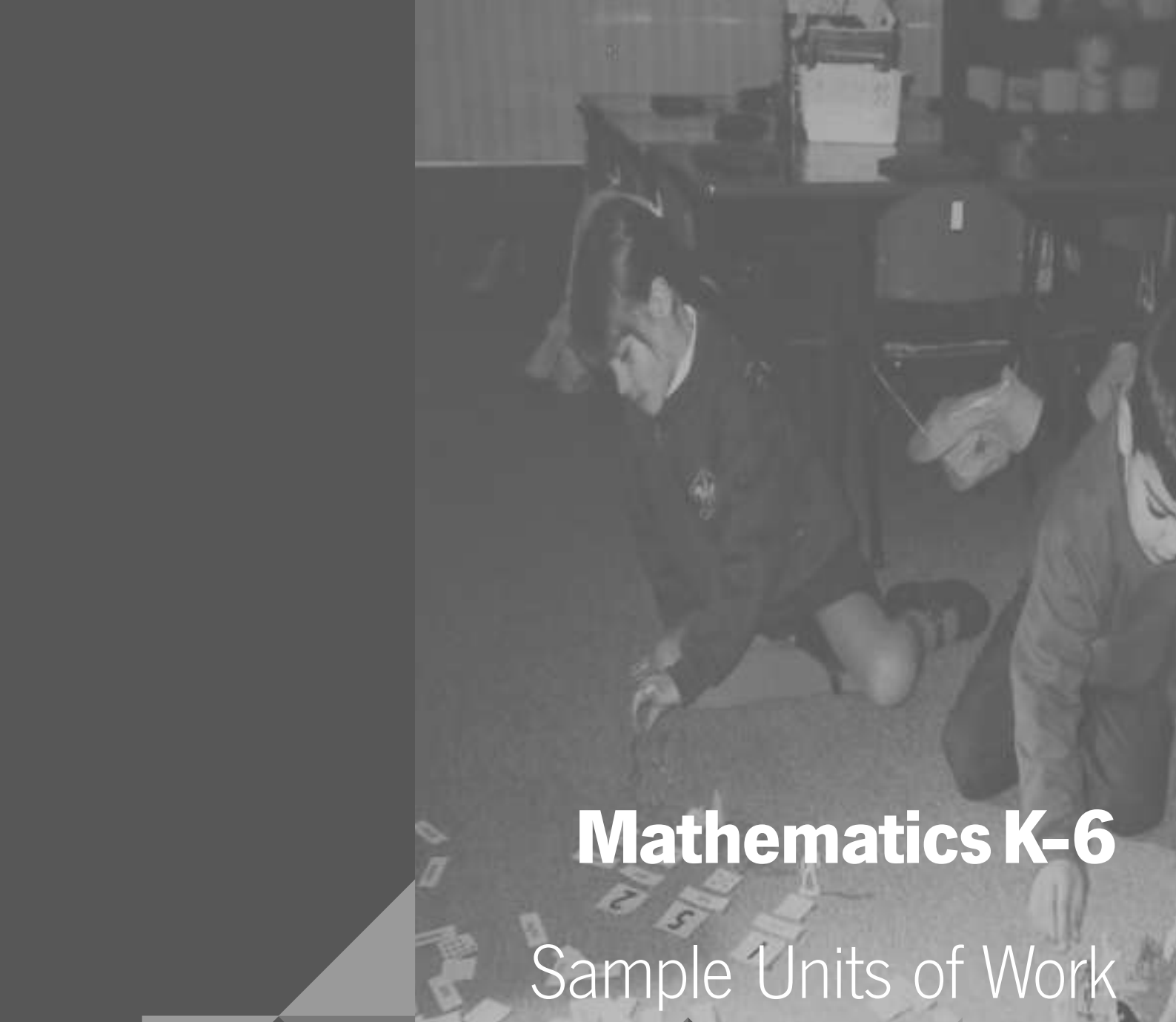

Mathematics K–6

Sample Units of Work

Acknowledgement

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Crawford Public School
Eastlakes Public School
Fairfield Public School
Jindabyne Public School
John Purchase Public School
King St Public School, Singleton
Kinross, Orange
Kyeemagh Infants School
Lane Cove West Public School
Lindfield Public School
Lithgow Public School
Lucas Heights Community School
Newington Preparatory School, Wyvern House, Stanmore
Numeralla Public School
Peakhurst West Public School
Pennant Hills Public School
Penshurst West Public School
Plumpton Public School
Redfern Public School
Roseville College
Sacred Heart Primary School, Mona Vale
St Catherine's School, Waverley
St Cecilia's Primary School, Balgowlah
St Edward's Primary School, South Tamworth
St Joseph's Primary School, Kempsey
St Kevin's Primary School, Dee Why
St Philomena's School, Moree
St Madeline's Primary School, Round Corner
St John the Baptist School, Harbord
St Rose School, Collaroy Plateau
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Contents

1 Introduction

This support document has been developed to assist teachers to use and understand key aspects of the *Mathematics K–6 Syllabus*. It contains a range of sample units of work that can be incorporated into teaching and learning programs. It shows how these programs should be underpinned by the principles of *assessment for learning* (*Mathematics K–6 Syllabus* p 138) that aim to support students in their learning.

Sample units of work have been prepared for each Stage from Early Stage 1 to Stage 3. They do not address all syllabus outcomes. They will assist teachers in initial planning for implementation of the new syllabus and provide a model for planning other units of work. The units include relevant outcomes, content and a variety of teaching and learning experiences. Assessment activities have been designed for and integrated into each unit. These sample units may be modified or amended to suit the needs, interests and abilities of students.

2 Advice on programming

2.1 Establishing a scope and sequence

The *Mathematics K–6 Syllabus* requires all Strands and Substrands to be taught in each year of primary schooling. Developing a scope and sequence will involve identifying the outcomes to be addressed, the strategies for gathering evidence of student learning, the content and learning experiences, and when and for how long the content will be studied. Essentially it involves mapping the syllabus outcomes and suggested Key Ideas for each Year and is probably best undertaken by teachers working together in Stage and Year groups. They will need to discuss and resolve issues relating to duplication, revision and progression. It should reflect, at a glance, how the requirements of the school plan are to be covered for that Year and Stage group.

The K–10 Mathematics Scope and Continuum (pp 27-37) could be used to assist with developing the scope and sequence as it provides a summary of the key concepts that should be developed from Early Stage 1 to Stage 5. In addition, Working Mathematically outcomes need to be explicit in the content taught and therefore should be built into units across the scope and sequence.

The standards described in the syllabus were developed on the understanding that students are engaged in mathematical learning for a minimum of four and a half hours per week. These indicative hours will provide the basis for programming decisions. In any particular Stage, some students may achieve the standard sooner than the majority of their cohort, while others may require additional time.

2.2 Assessment for learning

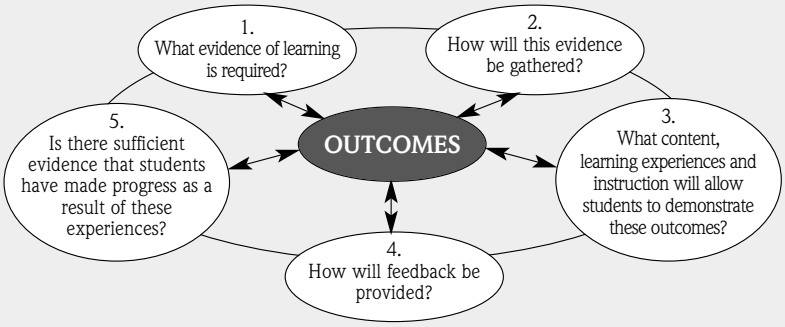
The syllabus promotes the concept of *assessment for learning* as integral to teaching and learning in a standards-referenced framework and is an essential component of good teaching. Assessment for learning involves teachers planning how and when they will gather evidence of learning at the same time that they plan the work that students will do. It recognises the importance of assessment and promotes the active involvement of students in their own learning.

Assessment for learning:

- is an essential and integrated part of teaching and learning
- reflects a belief that all students can improve
- involves setting learning goals with students
- helps students know and recognise the standards they are aiming for
- involves students in self-assessment and peer assessment
- provides feedback that helps students understand the next steps in learning
- involves teachers, students and parents reflecting on assessment data when planning the next steps in learning. Parents may also gauge their children's confidence and competence with mathematics through discussions and observing their children doing mathematical tasks.

The following diagram summarises a model for developing integrated assessment activities. It emphasises that outcomes are central to the decisions teachers make about the learning to be undertaken and the evidence of learning that needs to be collected. This evidence enables teachers to provide students with feedback on their learning and to determine how well students are achieving in relation to these outcomes.

Evidence of learning will assist teachers and students to decide whether they are ready for the next phase of learning or whether further learning experiences are needed to consolidate students' knowledge, skills and understanding.



2.3 Planning units of work for effective learning and assessment

The syllabus acknowledges that students learn in different ways and at different rates. Teachers therefore may need to incorporate a range of activities to accommodate the different ways students learn and to cater for the range of levels of students' current knowledge, skills and understanding in mathematics. In Year 3, for example, while there may be a majority of students working within Stage 2 content, other students may be working within Stage 1, or perhaps within Early Stage 1 or Stage 3.

The syllabus reflects the hierarchical nature of most learning in mathematics. New learning builds upon prior learning in the same, or a related, substrand from the syllabus. In this way, it is possible that students may have met content related to the unit of work previously. If the targeted outcomes have been partially achieved, the unit should focus on consolidating and extending the student's knowledge, skills and understanding.

Teachers can program for related topics from different Stages to be taught sequentially or concurrently in a particular Year. For a small school or multi-grade class, the teacher may decide to teach a unit on Two-dimensional Space using Polygons as the focus. The teacher may set up teaching/learning situations where each Stage would use shapes applicable to the content in their Stage. For example:

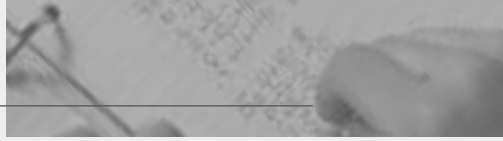
- Early Stage 1 students would look at squares, rectangles and triangles
- Stage 1 students would also look at hexagons, rhombuses and trapeziums
- Stage 2 students would also look at pentagons, octagons and parallelograms
- Stage 3 students would also look at isosceles, equilateral and scalene triangles.

The activities could include open-ended tasks such as students organising a presentation about their polygons, Barrier Games, constructing a picture using the shapes, and the use of computer drawing programs to draw their shapes and make pictures, patterns or tessellations.

Substrands from different strands may be integrated, for example, Chance and Data. Appropriate learning experiences could be:

- Stage 1 students might pose the question 'What rubbish will we find in the playground after lunch?' Students make predictions, and then visit the playground to collect data. The data can then be organised into a data display.
- Stage 2 students might conduct simple experiments with random generators such as coins, dice or spinners to inform discussion about the likelihood of outcomes. For example, students roll a die fifty times, keep a tally and graph the results.
- Stage 3 students might use samples to make predictions about a larger 'population' from which the sample comes eg predicting the proportion of cubes of each colour in a bag after taking out a sample of the cubes. Students could graph predictions and the results of the draw and compare.

The Patterns and Algebra and Number strands could be programmed together to enable students to make important links between number patterns and relationships and the four operations.



2.4 Using the sample units of work

The sample units of work contained in Sections 3 to 6 (pp 11-156) have been developed to demonstrate ways in which teachers can build a teaching/learning program containing units of work to ensure coverage of the syllabus.

The sample units illustrate how to:

- be explicit about the outcomes and content to be addressed
- be explicit about the evidence required to demonstrate student learning
- adapt teaching and learning programs to students' demonstrated needs
- modify future teaching and learning programs in the light of students' demonstrated needs.

Each unit includes the specific content outcome(s) that provide the main focus of the unit as well as the Key Ideas, knowledge and skills statements, and Working Mathematically statements from the syllabus. The page reference to the relevant content page in the syllabus is also provided.

WM Working Mathematically

The Working Mathematically outcomes are listed so that teachers consider the development and assessment of these outcomes as well as the content outcomes. Learning Experiences and Assessment Opportunities that provide opportunities for students to develop and demonstrate one or more of the five Working Mathematically processes (*Questioning, Applying Strategies, Communicating, Reasoning, Reflecting*) have been labelled with **WM**.

The units of work contain examples of the types of activities teachers might employ to cover the content in the *Mathematics K–6 Syllabus*. The units of work are not mandatory. It is expected that teachers and schools will adapt the units according to the needs of their students, the availability of or preference for particular resources and the nature of school policies and priorities. This might mean that teachers and schools:

- implement all of the units as outlined plus additional school-designed units to cover all syllabus requirements
- implement some of the units and develop school-designed units to complement them
- use the Outcomes and Content sections of the *Mathematics K–6 Syllabus* as the basis for planning, making use of their own units.

Features of the Sample Units of Work

The following sample page has been constructed to highlight the features included in the units of work.

Learning Experiences and Assessment Opportunities

Timetables

Students access timetables on the Internet or the teacher provides students with a variety of timetables eg bus, plane, train, ferry, theme parks, movies. Students describe any visible patterns eg 'Buses leave every 15 minutes on weekday mornings.' Students calculate the duration of different journeys or events using start and finish times. They develop an itinerary for a given time-frame eg 4 hours.

Students plan their 'ultimate' 24-hour itinerary. Students record their itinerary in 12-hour time using am and pm notation, and 24-hour time. Students discuss which timetables use 24-hour time and why it is important.

WM Stopwatches

Students read digital stopwatch displays showing time from left to right in minutes, seconds and hundredths of a second.

2:34:26

Students use stopwatches to time various events and order them according to the time taken. Students discuss cases where accurate timing is important eg athletics, swimming, television advertisements.

Extension: Students research the world records of different sports. They then record and order them.

Matching Times

In pairs, students are given two blank cards. They record the time in am or pm notation on one card and 24-hour time on the other. The teacher collects the cards, shuffles them and redistributes the cards to the class.

Each student has to find their partner by asking other students questions to identify the matching time.

Students can only answer 'yes' or 'no'.

Possible questions include:

- do you have an o'clock time?
- is your time ten minutes after 7:15 am?
- is your time 2130 in 24-hour time?

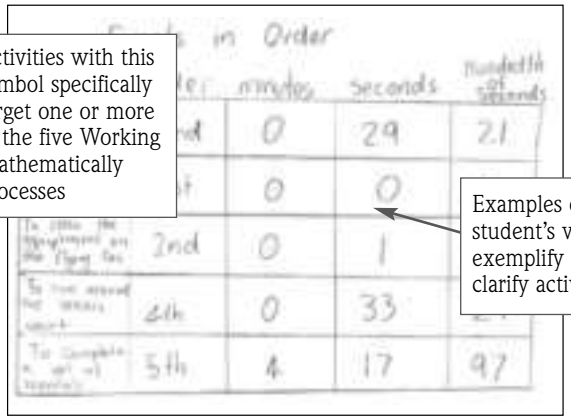
Students then group themselves into am and pm times. Each group then orders their cards.

Timing Experiments

Students estimate the amount of time selected events will take and then check by timing the events with a stopwatch eg

- the time for a ball dropped from the top floor of a building to reach the ground
- the time for a car seen in the distance to reach a chosen point.

Students record the times in a table and order the events.



WM A Day In My Life

Students list at least eight things they do on a particular day of the week with the time they do each activity.

They then record these times on a sheet of clock faces. Students convert the times to 24-hour time.

They use the 24-hour times and activities to draw a timeline using an appropriate scale.

Possible questions include:

- how could you order the events according to the time taken?

Reading a Timeline

The teacher displays a timeline related to real life or a literary text. Students write what they can interpret from the timeline.

Resources

atlases, class timetable, food packaging, copies of clock faces, stopwatches, television programs, blank cards, timetables (bus, plane, train, theme parks, movies)

Language

timetable, timeline, scale, time zones, daylight saving, 24-hour time, am and pm notation, duration of events, converting, arrive, depart, timetable, timeline, decade, century, millennium, latitude, longitude, elapsed time

Links

Position
Length
HSIE

Activities with this symbol specifically target one or more of the five Working Mathematically processes

Graphics clarify an aspect of the activity

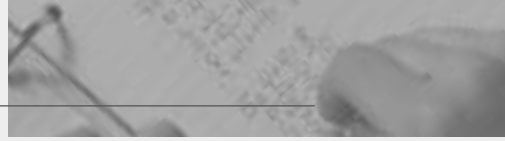
Examples of student's work exemplify and clarify activities

Assessment for learning activities are integrated into the teaching/ learning sequence

Resources that could be used in this unit are listed

Language expected to be used by students in this unit

Possible links to other KLAs and Mathematics K–6 substrands



The learning experiences provide suggestions to support teaching and learning of the substrand. Teachers are encouraged to choose experiences appropriate for their students, and to develop additional learning experiences when necessary. The assessment activities also provide suggestions for teachers to use where appropriate. Each unit will need to be adapted to meet the needs of particular students. The units suggest a preferred hierarchy of learning experiences, but allow for teachers to add to them or extend and revise where necessary.

Advice regarding the appropriate use of technology, links to other substrands and strands, suitable resources, and language and literacy considerations are also provided. The resources include suggested references to support the Learning Experiences.

Teachers will need to plan how to implement the units of work. The units of work provided will not cover all the content for the Stage. Teachers may need to develop further learning experiences for their students, based on the Key Ideas and content for each outcome in the Scope and Continuum.

The activities are organised in a hierarchical sequence of learning allowing for a range of achievement as students work towards the outcome. It is expected that schools and teachers will write further units of work based on the needs of their students.

The sample units of work have been developed by:

- identifying the outcomes that will be highlighted in the unit of work
- deciding on the subject matter or focus of the unit
- deciding on the evidence of learning required and how students will demonstrate this in relation to the outcomes, and how this evidence will be gathered and recorded
- selecting the relevant syllabus content or Key Ideas for the identified outcomes relating to the knowledge, skills and understanding that students will develop
- ensuring that the Working Mathematically processes are identified when developing new skills and concepts and also when applying existing knowledge
- planning learning experiences and identifying those that will provide evidence of learning
- ensuring a range of assessment strategies is used
- providing opportunities for the teacher to reflect on student progress and plan future learning experiences accordingly.

2.5 Designing effective learning and assessment

Effective learning experiences and the type of activity selected should allow evidence of learning to be gathered. Methods of gathering evidence of learning could include teacher observation, questioning, self-assessment and peer assessment as well as more formalised assessment activities. Assessment should be an integral part of the unit of work and support student learning.

Teachers should consider whether the assessment:

- has explicitly stated purposes and addresses the outcomes
- is integral to the teaching and learning program
- shows a clear relationship between the outcomes and content being assessed
- allows students to demonstrate the extent of their knowledge, skills and understanding
- focuses on what was taught in class and what students were informed would be assessed
- provides opportunities to gather information about what further teaching and learning is required for students to succeed
- provides valid and reliable evidence of student learning
- is fair
- encourages learners to reflect, question and plan for future learning.

2.6 Effective feedback to students

The aim of feedback is to communicate to students how well their knowledge, skills and understanding are developing in relation to the outcomes. Students are then given opportunities to improve and further develop their knowledge, skills and understanding. Feedback enables students to recognise their strengths and their areas for development, and to plan with their teacher the next steps in their learning.

Students should be provided with regular opportunities to reflect on their learning. Teacher feedback about student work in relation to outcomes is essential for students and is integral to the teaching and learning process. Student self-reflection and peer evaluation will also provide valuable feedback to students.

Feedback should:

- focus on the activity and what was expected
- be constructive
- provide meaningful information to students about their learning
- correct misunderstanding
- identify and reinforce students' strengths
- state clearly how students can improve.

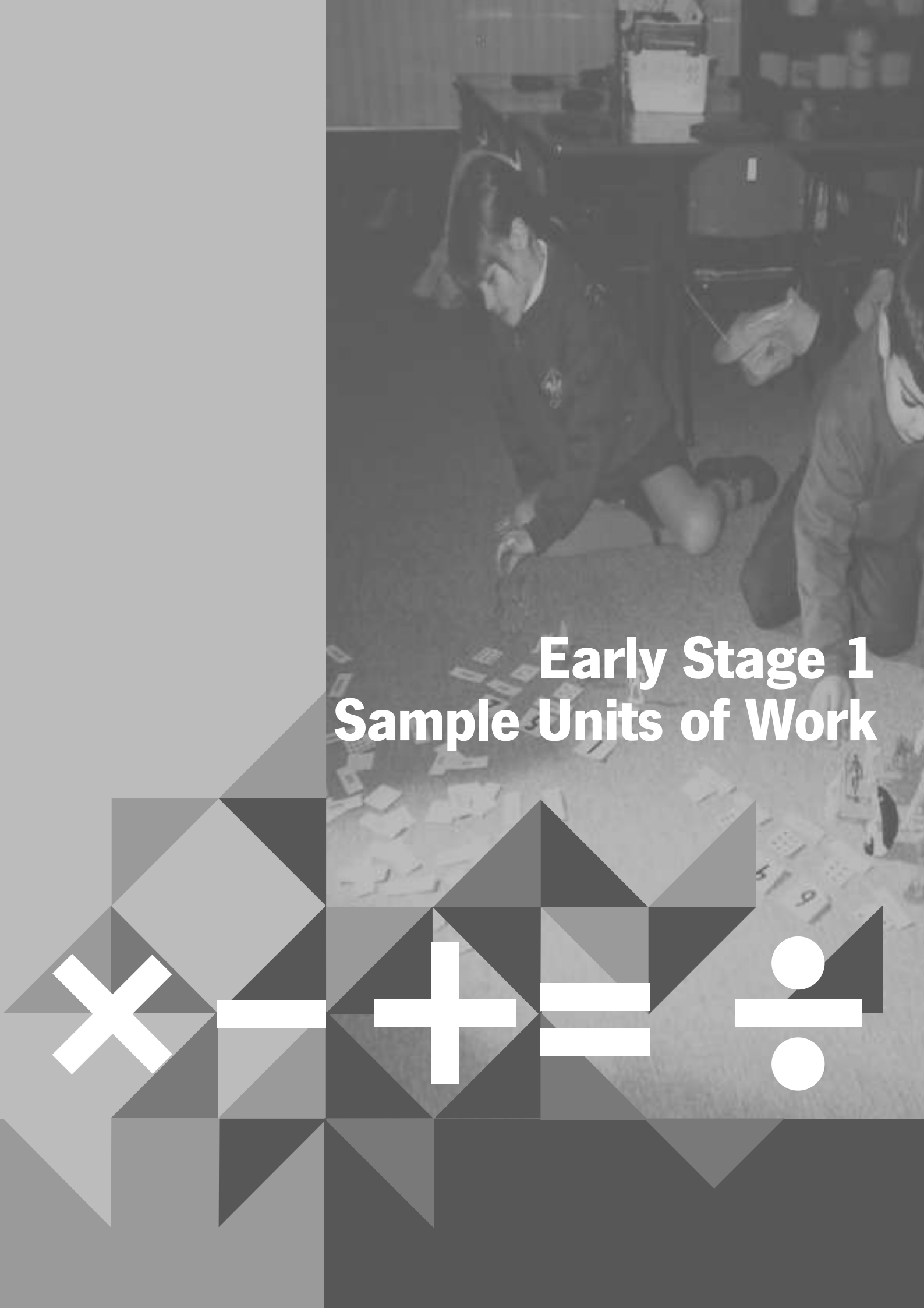
Forms of feedback include:

- discussion with the class, groups or individual students
- written annotations
- general comments to the class about those aspects of the activity in which students excelled and those aspects that still need addressing
- examples of good responses
- peer and self-evaluation.

2.7 Recording evidence for assessment

Recording student performance needs to be manageable. It need not occur after each assessment for learning activity. Teachers should make decisions about when student performance on an assessment activity should be recorded, which aspects to record and in what format. The teacher can use this information to ascertain where students are up to, what to teach next and at what level of detail, and to form a snapshot of student achievement at key points.

Record keeping should reflect the reporting processes of the school and may take the form of individual comments or notations for the tasks, marks, grades or visual representations.



Early Stage 1 Sample Units of Work

3.1 Whole Numbers

Strand – Number

Syllabus Content p 41

NES1.1

Counts to 30, and orders, reads and represents numbers in the range 0 to 20

Key Ideas

Count forwards to 30, from a given number

Count backwards from a given number, in the range 0 to 20

Compare, order, read and represent numbers to at least 20

Read and use the ordinal names to at least 'tenth'

Use the language of money

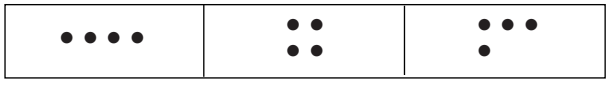
WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Early Stage 1 content	Uses objects, actions, imagery, technology and/or trial and error to explore mathematical problems	Describes mathematical situations using everyday language, actions, materials and informal recordings	Uses concrete materials and/or pictorial representations to support conclusions	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Early Stage 1 content

Knowledge and Skills

Students learn about

- counting forwards to 30, from a given number
- counting backwards from a given number, in the range 0 to 20
- identifying the number before and after a given number
- counting with one-to-one correspondence
- reading and writing numbers to at least 20, including zero
- recognising a dot pattern instantly for numbers up to seven (subitising)
- representing numbers to at least 20 using numerals, words, symbols and objects (including fingers)
- comparing and ordering numbers or groups of objects
- making and recognising different visual arrangements for the same number
  eg



- using 5 as a reference in forming numbers from 6 to 10 eg 'Six is one more than five'
- using 10 as a reference in forming numbers from 11 to 20 eg 'Thirteen is three more than ten'
- reading and using the ordinal names to at least 'tenth'
- recognising that there are different coins and notes in our monetary system
- using the language of money in everyday contexts eg coin, note, cents, dollars

Working Mathematically

Students learn to

- ask questions involving counting numbers to at least 20 eg 'How many pencils are in the tin?' (*Questioning*)
- apply counting strategies to solve simple everyday problems (*Applying Strategies*)
- communicate an understanding of number using everyday language, actions, materials and informal recordings (*Communicating*)
- justify answers by demonstrating the process used (*Applying Strategies, Reasoning*)
- recognise numbers in a variety of contexts, including on classroom charts, a calculator, shop cash register, computer keyboard and telephone (*Reflecting*)
- count rhythmically to identify number patterns eg stressing every second number (*Applying Strategies*)
- estimate the number of objects in a group of up to 20 objects, and count to check (*Reflecting, Applying Strategies*)
- exchange money for goods in a play situation (*Reflecting*)

Learning Experiences and Assessment Opportunities

WM Counting

Students should be given frequent opportunities to count forwards and backwards from various starting points.

Counting experiences could include:

- rhythmic counting eg 1 **2** 3 **4** 5 **6**... (where the bold numbers are said aloud)
- counting individually
- counting off. Students stand as they call their number and when counting backwards students sit.
- circle counting. Students sit in a circle and take turns to count particular groups of students eg the number of students in the class, the students with blue shirts.
- counting with body percussion to emphasise a pattern eg odd numbers hitting knees, even numbers with a clap.

Class Shop

The teacher sets up play situations to allow students to explore coins and notes, and use them in shopping contexts. A selection of items could be available with marked prices.

Students order the items for sale from least expensive to most expensive.

Students role-play buying items at the shop using coins and notes for whole amounts.

Students group the items they could buy with a given coin or note.

The class shop can vary to include businesses such as hairdresser, butcher, baker, trash and treasure, office, restaurant, or bookshop.

WM Wind Up Toy Race

The teacher sets up some toy races in groups of ten. Students race the toys and order them from first to tenth. They then label them with ordinal cards made by the teacher.

Possible questions include:

- who came first?
- who came last?
- what are the words we use to describe where we come in a race?

Peg Cards

In pairs, students are given a set of large numeral cards (eg 0 to 10). The cards are not in order.

Students take turns to read the numeral on each card to their partner and attach the corresponding number of pegs.

The cards are then ordered from 0 to 10 across the floor.

Extension: Students are asked to select two of the numbers from the floor and count from the smallest to the largest, or the largest to the smallest.

Rhymes, Songs and Stories

Students could listen to stories and sing songs and nursery rhymes to develop number concepts eg Three Bears, Five Little Ducks, Ten Little Indians, Ten Fat Sausages.

It is important to use rhymes that involve counting backwards as well as rhymes that involve counting forwards, and to use ordinal numbers.

Teachers could also use stories to teach ordinal names by asking questions such as 'What happened second in the story of the Three Little Pigs?'

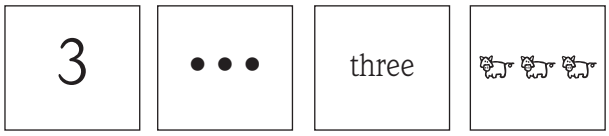
Address Books

Students collect numbers that relate to themselves and collate them into a booklet eg telephone numbers, addresses, birthdays, ages.

These books can be used for discussions about numbers and assessment of writing numerals.

WM Concentration

Students are given a set of cards with numbers represented by numerals, pictures, dots, or words
eg



Cards should be provided within an appropriate range eg 0 to 10, 10 to 20. In pairs or individually, students match the cards.

Using 5 as a Reference

Part A

Students are given an egg carton that has been cut to form two rows of five. Five chicks are placed in the top row and the students use this as a reference for counting numbers up to 10. Students are asked to count numbers up to 10 by placing some chicks in the bottom row of the egg carton. Students compare their arrangements of chicks.

Possible questions include:

- what is the number you have now?
- what is the next number?
- how did you count it?

Part B

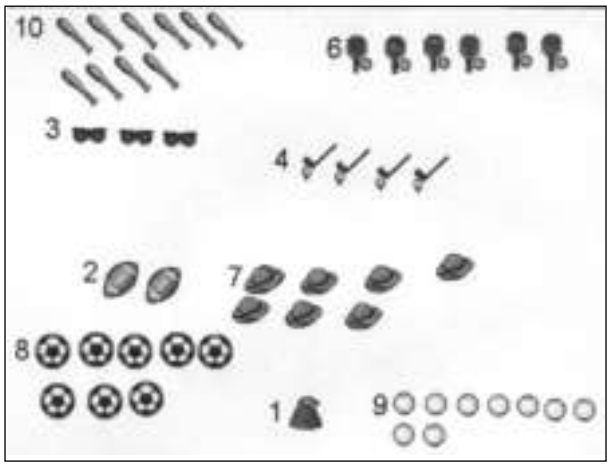
The teacher uses two joined egg cartons to create two rows of 10. Students count beads, buttons or shells into the egg cartons to show ten, ten and one, ten and two, etc. (Starting from 10 should be emphasised.)

Counting into Cups

In small groups, students are given containers such as paper cups, each labelled with a number 0 to 10, (then 0 to 20, 0 to 30). Students are asked to identify the number on the cup and count the corresponding number of popsticks in the cup, and place them in order.

Computer Numbers

In pairs, students use simple computer graphics to represent the numbers 0 to 20. Students are encouraged to discuss how best to arrange the graphics so that each number can be identified quickly.



Race to 10 or 20

In pairs, students are each given a set of consecutive number cards eg 0 to 10 or 0 to 20. They shuffle their cards and place them face down. On 'Go' students race to order their cards, placing them face up.

Variation: The cards are ordered backwards 10 to 0, then 20 to 10.

Possible questions include:

- can you read and order the numbers?
- from 12, can you count forwards to 30?
- can you count backwards from 19 to 0?
(Adapted from CMIT)

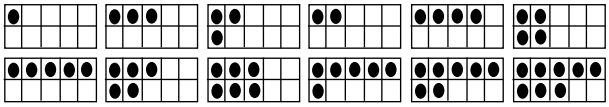
WM Calculator

In groups, students display a number eg 2 on their calculator. They use the 'Clear' button to clear the display. This is repeated for other numbers in the range 0 to 9. Students then make their displayed number from popsticks or similar materials and glue them onto the page. Students then order their popstick numbers with the other numbers made in the group.

Extension: Students display numbers in the range 10 to 19, 20 to 29.

How Many Dots?

The numbers 0 to 10, represented by dots on transparent ten-frames are required for this activity
eg



One frame is selected by the teacher and briefly displayed on an overhead projector.

The students determine and record how many dots are on the ten-frame.

The teacher asks the students 'How did you work out how many dots there were?'

Extension: Two ten-frames are placed on the overhead projector at a time. Students are asked to find the total number of dots and describe their strategies. (Adapted from CMIT)

WM Where's the Number?

Each student is provided with a strip of cardboard that represents a number line, with zero written at one end and ten written at the other.

Using a peg as a marker, the students are asked to locate a particular number on the number line and discuss its

0	10

placement in relation to 0 and 10.

The activity is repeated for other numbers between 0 and 10 eg move the peg to where the number 9 would be.

Extension: The activity could be extended using a 0 to 20 number line. (Adapted from CMIT)

Number Lines

Students write a numeral in a given range on a small square of paper. The teacher selects a student randomly to peg their number on a string hung across the room. Students discuss the placement.

A second student is selected to peg their number on the string considering its placement in relation to the first number.

This is repeated for all students, discussing where each number would go, before placement
eg

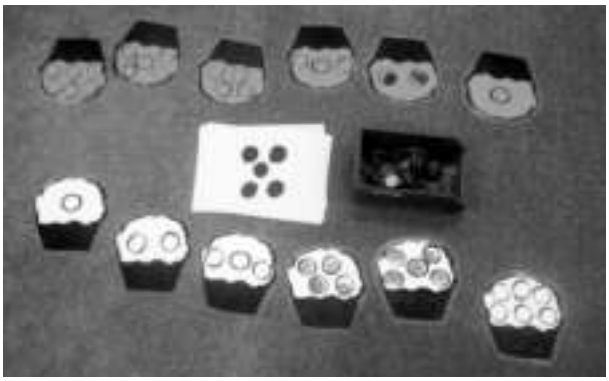
13	14		17

Possible questions include:

- what number comes before/after number 17?
- what numbers go between 14 and 17?
- where do you think number 11 will go?
(Adapted from CMIT)

WM Cup Cakes

The teacher makes 6 cup cakes for each participating student. Each cup cake has a different number of counters ('cherries') in the range of 1 to 6 drawn on it. Students roll a die in turn and are asked to match the number on the die to their cup cake. They put counters on the dot pattern to show they have rolled that number. As this is a subitising game, instant recognition of die patterns is required and the student should be encouraged to say the number immediately without counting. If the student needs to count the dots they do not put 'cherries' on their cupcakes for that turn.



Hidden Number

Students order numeral cards from 0 to 20. The numbers 1 to 19 are turned face down and the numbers 0 and 20 are left face up for students to see. One student is selected to stand on 0 and step forward to a card of their choice.

Possible questions include:

- which card is the student standing on?
- how do you know?

If I turned over the number before/after this number, what number should that be? (The student turns over the selected card for other students to check.)

Variation: The student stands on 20 and steps backwards to select a card. (Adapted from CMIT)

WM Teddy Bear Race

In pairs, students are given six teddy bear counters, a die and a playing board (as shown).

Home					
1	2	3	4	5	6

Students line up the plastic teddies at the start of the playing board, so that one teddy is on each numeral. Students take turns to roll a die and move a teddy one space each time its corresponding numeral is rolled. Play continues until all teddies reach 'home' on their playing board.

Extension: As each bear reaches home, students label each bear with its position in the race.

1st	2nd	3rd	4th	5th	6th

Possible questions include:

- which bear will win the race most of the time? Why?
- where did your teddy number one come in the race?
(Adapted from CMIT)

Resources

counters, posting box, calculators, egg cartons, plastic cutlery, cups, saucers, plates, Australian coins and notes, play money, numeral flashcards, string, pegs, pictures of clothing, dice, ordinal flashcards, ten-frames, paper squares, cash register, grocery boxes and containers, game boards, unifix cubes, playdough, cards with dot patterns, paint, glue, magazines, picture cards

Links

Patterns and Algebra

Addition and Subtraction

Language

count, counting, forwards, backwards, zero, one, two, …, twenty, first, …, tenth, money, coin, note, cents, dollars, smallest number, largest number, bundle, before, after, more, fewer, next, match, the same as

3.2 Addition and Subtraction

Strand – Number

Syllabus Content p 46

NES1.2

Combines, separates and compares collections of objects, describes using everyday language and records using informal methods

Key Ideas

Combine groups to model addition

Take part of a group away to model subtraction

Compare groups to determine 'how many more'

Record addition and subtraction informally

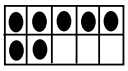
WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Early Stage 1 content	Uses objects, actions, imagery, technology and/or trial and error to explore mathematical problems	Describes mathematical situations using everyday language, actions, materials and informal recordings	Uses concrete materials and/or pictorial representations to support conclusions	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Early Stage 1 content

Knowledge and Skills

Students learn about

- combining two or more groups of objects to model addition
- separating and taking part of a group of objects away to model subtraction
- comparing two groups of objects to determine 'how many more'
- creating combinations for numbers to at least 10
  eg 'How many more make ten?'



- describing the action of combining, separating or comparing using everyday language eg makes, join, and, get, take away, how many more, altogether
- counting forwards by ones to add and backwards by ones to subtract
- recording addition and subtraction informally using drawings, numerals and words

Working Mathematically

Students learn to

- pose 'how many' questions that can be solved using addition and subtraction (*Questioning*)
- use concrete materials, including fingers, to model and solve simple addition and subtraction problems (*Applying Strategies*)
- solve simple everyday problems using problem-solving strategies that include 'acting it out' (*Applying Strategies*)
- use visualisation of numbers to assist with addition and subtraction (*Applying Strategies*)
- apply strategies that have been demonstrated by other students (*Applying Strategies, Reflecting*)
- use simple computer graphics to represent numbers and their combinations to at least 10 (*Applying Strategies*)
- explain or demonstrate how an answer was obtained (*Applying Strategies, Communicating, Reasoning*)
- describe what happened to a group when it was added to or subtracted from (*Communicating, Reflecting*)

Learning Experiences and Assessment Opportunities

Hand Prints

In small groups, students are given a die (numbered 1, 1, 2, 2, 3 and 3), a collection of counters, and a game board made up of two hand prints as shown.

The object of the game is to collect exactly ten counters.

In turn, students roll the die, collect that number of counters, and place them on the game board.

If the student cannot fit the number of counters on their game board, they must remove that number from those on the board.

For example, Paula's game board looks like this.

Paula needs to roll a 1 to finish the game. If she rolls a 3, she has to take 3 counters off the board, leaving her with 6 counters.

WM Rabbit Ears Plus

The teacher models making 'rabbit ears' by putting their fists at the sides of their head, saying a number less than 10 and raising that number of fingers.

Students are asked to:

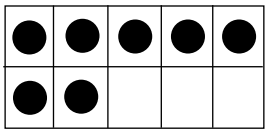
- raise two fingers on one hand and three fingers on the other hand. How many fingers are raised altogether?
- show six rabbit ears. How many fingers have been raised on each hand to make six altogether?
- raise two fingers on one hand. How many fingers need to be raised on the other hand to make four altogether?

Students should be encouraged to raise their fingers while their hands are still at the side of their heads. Then they can check if they have the correct number by looking at and counting their fingers.

Some students may be selected to model and explain their solution eg 'I made 6 with 5 fingers on one hand and 1 more.' (Adapted from CMIT)

WM Ten-frame Subtractions

Students are shown a ten-frame with some counters on it eg



Possible questions include:

- how many counters are on the ten-frame?
- how many squares are full/empty?

Students are asked to imagine three counters jumping off the ten-frame.

Possible questions include:

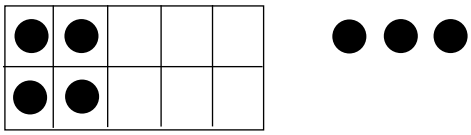
- how many counters are left on the ten-frame?
- how did you work that out?
- how many squares are full/empty?

The three counters are then moved off the ten-frame for students to check their answer.

This activity encourages students to visualise numbers. It should be repeated with other counter combinations. (Adapted from CMIT)

Ten-frame Additions

Students are shown a ten-frame with some counters positioned on it and others beside it
eg



Possible questions include:

- how many counters are on the ten-frame?
- how many counters are off the ten-frame?

Students are asked to imagine the three counters jumping onto the ten-frame.

Possible questions include:

- how many counters are there altogether?
- how did you work that out?
- how many squares are full/empty?

The three counters are then moved onto the ten-frame for students to check their answer. This activity encourages students to visualise numbers. It should be repeated with other counter combinations. (Adapted from CMIT)

WM Domino Count

Students are given a set of dominoes and are asked to count how many dots are on each side of a domino and then how many dots there are altogether. Students are encouraged to:

- work out how many dots there are on each side without counting one at a time
- discuss different strategies they could use to work out how many there are altogether.

The teacher could ask the students to imagine a domino with four dots on one side and one dot on the other. They then discuss with students how many dots there are and strategies that can be used to find out.

The teacher could also pose the problem:

'There are six dots altogether on my domino. How many dots could there be on each side?'

Students record and discuss the possible answers. Some students may require materials such as counters to assist them in solving the problem.

Possible questions include:

- is there a quicker way to find the answer than counting by ones from one?
- is there a quicker or easier way to add?
- is that the only possible answer?

Combinations to Ten

Students are given a container of 10 counters that are all one colour on one side and a different colour on the reverse.

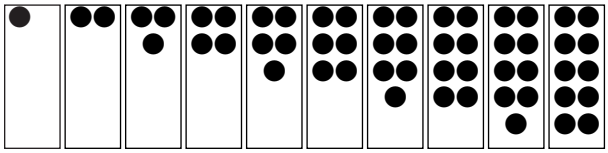
In pairs, students shake the container and roll the counters onto the floor. Students sort the counters into colour groups, depending on which side the counters land. Students should be encouraged to organise the groups so they can see 'how many' at a quick glance
eg

Students determine how many counters are, for example, red and how many are yellow.

Students use drawings and numerals to record their results.

Teen Numbers Plus

The teacher prepares a set of dot cards for the numbers 1 to 10 and a set of number cards from 11 to 19, as shown.



11	12	13	14	15
16	17	18	19	

All dot cards are turned face down, but kept in sequence.

In small groups, a student turns over two of the dot cards and states how many dots there are altogether. If the answer is one of the teen number cards, the student removes the number card and the dot cards are turned face down again.

Play continues in turn until all of the teen number cards have been collected.

WM Hidden Counters

Students are given a small number of counters to count.

The teacher picks up the counters with one hand, puts both hands behind their back, distributes the counters between their two hands and closes their fists.

Students are then shown the two closed fists. One hand is opened and the students see the number of counters in that hand. Students determine how many counters the teacher has in the other hand and explain how they worked it out.

The activity is repeated many times and the number of counters is varied.

Variation: Students play this as a game with a partner. (Adapted from CMIT)

Comparing Towers

In pairs, Student A rolls a die, collects the corresponding number of interlocking cubes and makes a tower. Student B then rolls the die, collects the corresponding number of interlocking cubes and makes a tower. The two students compare their towers and are asked to determine whose tower is taller.

Possible questions include:

- how do you know which tower is taller?
- how many cubes are in each tower?
- how many more cubes are in the taller tower?

The student with the taller tower removes the 'difference' and keeps it. The game continues until students have collected up to 30 cubes.

Students may also use two or three dice, or dice with numbers larger than 6. (Adapted from CMIT)

Addition Posting Box

Students silently count while the teacher drops a collection of blocks into a box one at a time. Students record the total number of blocks, compare and discuss their totals with others.

The teacher adds more blocks slowly (2 or 3). The students count silently and record the new total.

Possible questions include:

- how did you find the total number of blocks?

Students should be encouraged to hold the starting number in their head and count forwards from that number to determine the total. (Adapted from CMIT)

Taking-away Blocks

Students count out 10 objects. They roll a die and take away that number of objects. They determine how many objects are left and record what has been done. The game is repeated for a pre-determined number of throws.

WM Subtraction Posting Box

The teacher holds an opaque container of counters and presents the following scenario:

'There are ten counters in this container. I am going to take some of the counters out, one at a time. Then I want you to record how many counters are left in the container.'

The teacher removes some of the counters (eg four) and the students record the number of counters remaining. Students discuss their strategies.

Possible questions include:

- can you give another example using the same numbers? eg 'I had 10 and then I took away 6 and there are 4 left now.'
- how can you record what you have done? Can you record it in a different way? (Adapted from CMIT)

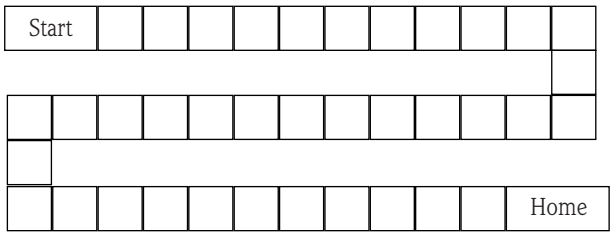
Nim

In pairs, students make a line of eleven blocks between them. In turn, each student chooses to remove one, two or three blocks, using strategies to attempt to make the other player remove the last block. The player who is forced to remove the last block loses.

Students repeat the game many times and could keep score eg the student who wins, takes a counter.

Racing Track Counting

The teacher prepares a game board like the one shown.



Students form pairs. Student A rolls two dice and adds the number of dots shown, moving their marker the corresponding number of places on the board. Student B does the same. Students must roll the exact number of places remaining to move to Home or they miss their turn.

Resources

variety of counters, dice, number cards, paper cups, beads, ten-frame, racing track game board, dot cards, handprints on cardboard, dominoes

Links

Whole Numbers

Length

Patterns and Algebra

Language

add, plus, altogether, makes, equals, is equal to, same as, more, less, fewer, and, join, take away, move them away, take out, leaves, enough, not enough, too many, get how many more, together, took, left, not as many, how many, cover them up.

'I put two marbles with Oliver's three marbles and got five.'

'I joined three blocks and five blocks together and made eight.'

'I took three pencils out of my pencil case and there are five left in my case.'

'I put the line of five red blocks beside the line of three blue blocks and there were two more red blocks.'

3.3 Multiplication and Division

Strand – Number

Syllabus Content p 52

NES1.3

Groups, shares and counts collections of objects, describes using everyday language and records using informal methods

Key Ideas

Model equal groups or rows

Group and share collections of objects equally

Record grouping and sharing informally

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Early Stage 1 content	Uses objects, actions, imagery, technology and/or trial and error to explore mathematical problems	Describes mathematical situations using everyday language, actions, materials and informal recordings	Uses concrete materials and/or pictorial representations to support conclusions	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Early Stage 1 content

Knowledge and Skills

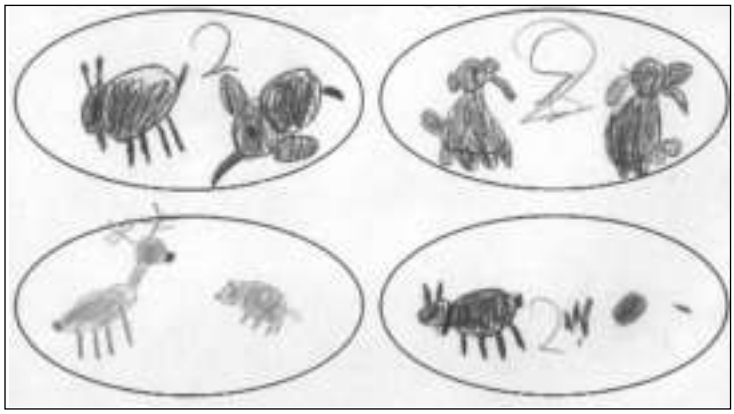
Students learn about

- using the term 'group' to describe a collection of objects
- using the term 'sharing' to describe the distribution of a collection of objects
- grouping and sharing using concrete materials
- modelling equal groups or equal rows
- recognising unequal groups or unequal rows
- labelling the number of objects in a group or row
- recording grouping and sharing informally using pictures, numerals and words

Working Mathematically

Students learn to

- pose problems that can be solved using grouping or sharing (*Questioning*)
- respond to grouping and sharing questions by drawing, making, acting, guessing and checking, and retelling (*Communicating, Applying Strategies*)
- describe grouping and sharing using everyday language, actions, materials and drawings (*Communicating*)
- explain or demonstrate how an answer was obtained (*Applying Strategies, Communicating, Reasoning*)



Learning Experiences and Assessment Opportunities

Groups of Children

Students skip within a given area eg a netball court. The teacher calls out a number and students make groups of that number.

Possible questions include:

- do all groups have the same number of students?
- how can we check this?

Each group checks the number of students in their group and a student is chosen to count the number of groups. Students line up in rows so the groups can be compared.

WM Sorting Objects

Students are given a collection of different-coloured objects to sort into groups. Possible questions include:

- do the groups have the same or a different number of objects?
- can you find a way to make each group equal in number?

Students use drawings and numerals to record their groups.

Groups and Number Cards

In groups of three or four, students sit in a circle. Multiple copies of the number cards 0 to 5 are placed in one pile, face down.

Student A turns over a number card and all players take that number of counters from a pile. Student A counts the total number of counters all players have for that turn. Other players say if they agree with that total number and record their answers. Play continues until all players have had a turn.

Sharing

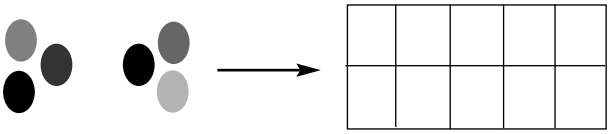
Students are shown a collection of up to 30 objects. They are asked to discuss what sharing means and to explain how they would share the objects.

In small groups, students are asked to select a bag of objects that has been prepared by the teacher. Each bag contains a different number of objects. Students are asked to share the objects between their groups equally and discuss whether it was possible.

Students record their solutions.

Ten-frames

Students make two groups of three counters. They are then asked to place the groups onto a ten-frame.



Possible questions include:

- is there the same number of counters in each group?
- how can you tell without counting?
- how many counters are there altogether?

This activity is repeated using two groups of other numbers up to five.

Variation: Two ten-frames could be joined together to make two groups of numbers up to ten or four groups of numbers up to five.

Students could be given a 5×5 grid and asked to make groups up to five groups of five. (Adapted from CMIT)

WM Rows

Students are given 12 small plastic animals or other small objects.

Possible questions include:

- can you arrange the animals/counters into equal rows?
- how many different ways can you arrange the animals/counters into equal rows?

Students record and share their solutions.

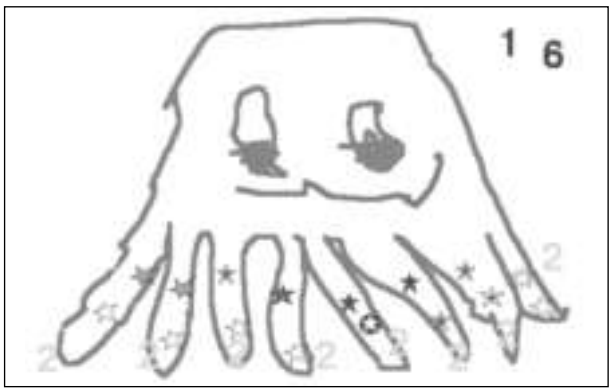
This activity could be repeated with smaller or larger collections of objects.

WM Spotty Henry

The teacher presents the following story:

'Henry is a spotted octopus with 8 legs. He has 2 spots on each leg. How many spots does Henry have?'

Materials are provided for students to work out a way to solve and record the problem.



Extension: Students create and illustrate their own story for others to solve.

Same Number of Groups

Students are asked to make four groups of two objects. It may help some students to have four pieces of paper or a large sheet marked with four squares.

Possible questions include:

- can you replace the four groups of two with four groups of another size?
- can you describe your new groups?

Students use drawings and numerals to record their groups.

An Even Number of Objects

The teacher gives a student an even number of objects and asks the student to share the objects with a friend so that each has the same amount.

Possible questions include:

- can you explain how the objects were shared?
- how did you check that you had the same amount?
- how did you work out which group has more/less?

The activity is repeated using different types of concrete materials and varying the number of objects in each problem.

Pasting Rows

Students cut and paste pictures or use a computer drawing program to create arrays. They are asked to describe their array and use numerals/words to label its features.

Possible questions include:

- is there a different way to make this group?
- what new groups can be made with the same objects?
- how could you check your answer?

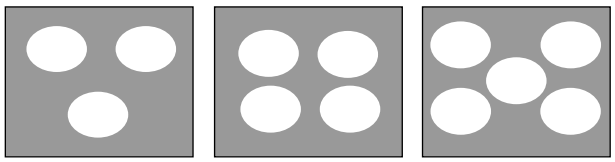
Number Problems

Teachers and students can use current topics of study as a setting for number problems.

For example, if the students are looking at the life cycle of lizards, the teacher might pose the question 'If four lizards each laid four eggs, how many eggs would there be?'

WM Farms

In groups, students are given a place mat with three, four or five ovals on it to represent paddocks. They are also given a collection of plastic animals.



Student A rolls a die and all the students place that number of animals in each paddock. Each student is asked to describe their farm and is encouraged to use numbers in their description. Students record their findings. (Adapted from CMIT)

Continuous Materials

The teacher can stress the concept of equal sharing when considering units in the Measurement strand
eg

- ask students to share out a bottle of water so that there is the same amount in each of a number of glasses
- ask students to cut a piece of paper ribbon so that two people get the same length
- consider the fair allocation of time for students to be in the play area
- ask students to divide a pile of sand into equal amounts.

Fair Share

The teacher shares out some objects unequally among a group of students and asks whether the objects have been shared equally.

In pairs, students are given an odd number of objects and are asked to share them. Students discuss what they can do with the leftover object.

WM Real Life

Students are given examples of sharing that are interesting and are part of their everyday lives
eg

- sharing 16 sandwiches at a party among four people
- sharing 8 marbles between two sisters
- sharing ten football cards among three friends.

The concept of a ' fair share' should be discussed and what to do with the leftovers.

Resources

collections of different objects up to 30, digit cards, array cards, ten-frames, counters, plastic teddy bears, pictures, computer drawing program, scissors, glue, cardboard with ovals on it.

Links

Whole Numbers

Addition and Subtraction

Language

group, row, share, equal, not equal, the same, not the same, more, less, needs more, altogether, fair share, give out, groups, how many, match, share one at a time, two threes, four fives.

'Their groups are the same.'

'Each group has five.'

'Everyone got the same so it was a fair share.'

3.4 Patterns and Algebra

Strand – Patterns and Algebra

Syllabus Content p 73

PAES1.1

Recognises, describes, creates and continues repeating patterns and number patterns that increase or decrease

Key Ideas

Recognise, describe, create and continue repeating patterns

Continue simple number patterns that increase or decrease

Use the term 'is the same as' to describe equality of groups

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Early Stage 1 content	Uses objects, actions, imagery, technology and/or trial and error to explore mathematical problems	Describes mathematical situations using everyday language, actions, materials and informal recordings	Uses concrete materials and/or pictorial representations to support conclusions	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Early Stage 1 content

Knowledge and Skills

Students learn about

Repeating Patterns and Number Patterns

- recognising, copying and continuing repeating patterns using sounds and/or actions
- recognising, copying, continuing and creating repeating patterns using shapes, objects or pictures

  eg ♦, ∇, ♦, ∇, ♦, ∇, …
- describing a repeating pattern made from shapes by referring to distinguishing features

  eg 'I have made my pattern from squares. The colours repeat. They go red, blue, red, blue, …'
- describing a repeating pattern in terms of a 'number' pattern

  eg ♦, O, ♦, O, ♦, O, … is a 'two' pattern

  Δ, ∇, O, Δ, ∇, O, … is a 'three' pattern

  B, B, X, B, B, X, … is a 'three' pattern
- recognising, copying and continuing simple number patterns that increase or decrease

  eg 1, 2, 3, 4, …

  20, 19, 18, 17, …

  2, 4, 6, 8, …

Number Relationships

- using the term 'is the same as' to express equality of groups

Working Mathematically

Students learn to

- ask questions about how repeating patterns are made and how they can be copied or continued (*Questioning*)
- check solutions to continuing a pattern by repeating the process (*Applying Strategies, Reasoning*)
- record patterns created by using the process of repeatedly adding the same number on a calculator (*Communicating*)
- create repeating patterns with the same 'number' pattern eg A, B, B, A, B, B, … is a 'three' pattern and so is o, Δ, Δ, o, Δ, Δ, ... (*Communicating, Applying Strategies*)
- recognise when an error occurs in a pattern and explain what is wrong (*Applying Strategies, Communicating, Reasoning*)
- make connections between counting and repeating patterns (*Reflecting*)
- create or continue a repeating pattern using simple computer graphics (*Applying Strategies*)
- determine whether two groups have the same number of objects and describe the equality eg 'The number of objects here is the same as the number there.' (*Applying Strategies, Communicating*)

Learning Experiences and Assessment Opportunities

Beginning to Make Repeating Patterns

Part A

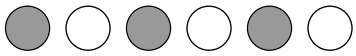
Students are given a set of counters containing two colours and are asked to put the counters in a row. Some students may create a repeating pattern, while others may not. The intention of the activity is to distinguish between those arrangements that are repeating patterns and those that are not.

Possible questions include:

- where do we see patterns?
- what comes next in this pattern? How do you know?
- which part of the pattern is repeated?
- can you describe how to make this pattern?

Part B

The teacher models putting a small collection of counters in a row, making sure that they make a repeating pattern
eg



Possible questions include:

- can you describe your row of counters?
- can you describe my row of counters?
- can you make a row of counters like mine?
- can you make another row of counters that has a pattern?

In pairs, students make new rows of counters, describe them to each other, and record their patterns.

At this early stage, it is preferable to use materials that have only one attribute (eg colour) before using materials with multiple attributes.

Describing Repeating Patterns using Numbers

The teacher makes a repeating pattern using multilink cubes
eg

This pattern is called a 'three' pattern because the pattern repeats after every third cube.

Possible questions include:

- how many cubes are in each group that repeats? (three)
- how many groups are in your pattern? (three)
- what is the total number of cubes in the pattern? (nine)

With teacher guidance, students record the pattern using drawings. They are encouraged to use numbers in their recording.

WM Making Repeating Patterns

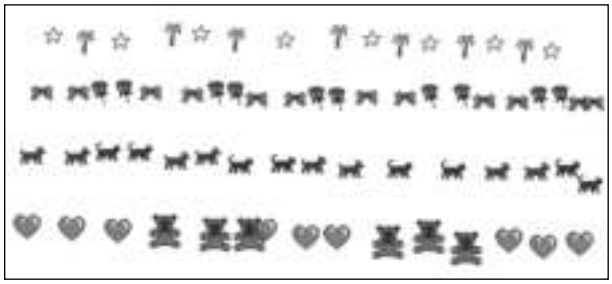
In pairs, students are given collections of materials such as coloured counters, unifix cubes or shells, and are asked to make a pattern that repeats.

Students then use drawings to show what they have done.

Possible questions include:

- can you describe your pattern?
- which parts repeat?
- how many pattern blocks are in each of the parts that repeat?

Students should be encouraged to record this information in their own way on their drawings.



'Two', 'Three' and 'Four' Patterns

Part A

In pairs, students make a 'two' pattern by placing two different-coloured counters/cubes beside each other and repeating these several times.

Students name the pattern as a 'two' pattern, as there are two elements that repeat.

Students are then asked to make a 'three' pattern by placing three different-coloured counters/cubes beside each other and repeating these several times.

Students name the pattern as a 'three' pattern, as there are three elements that repeat.

The students are then asked to make and name a 'four' pattern.

WM Part B

Students make other 'two', 'three' and 'four' patterns, describe what they have done, and record their patterns.

Possible questions include:

- can you create a pattern like this one?
- how many elements will 3 groups of your pattern make?

Pattern Counting in Twos

Students, as a whole class, count while tapping body parts in a pattern.

For example, a 'two' pattern might be to tap your head and then tap your shoulders. This pattern could be repeated with students saying 'one, two, one, two, …' leading to rhythmic counting in twos with an emphasis on every second number: 'one, **two**, three, **four**, five, **six**, …' (where the bold numbers are said aloud).

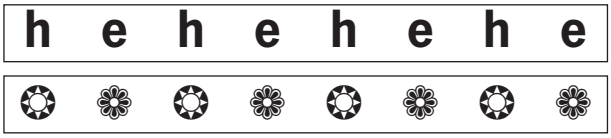
The teacher could stop students and ask what number they will say aloud next.

Students could be invited to make up another 'two' pattern for the students to follow as a whole class.

Creating Patterns with the Same 'Number' Pattern

Part A

The teacher prepares two pattern cards that have 'two' repeating elements.
eg



Students are shown the two cards and are asked to describe how the cards are the same.

WM Part B

In pairs, students are given collections of material such as coloured cubes, buttons, beads, shapes and shells.

They are asked to make other patterns that have two elements that repeat.

Variation: Part A and Part B are repeated with an emphasis on 'three' or 'four' repeating elements.

Different 'Three' Patterns

In pairs, students create 'three' patterns in a variety of ways that could include objects, pictures, sounds, letters, words or numbers
eg

- red, yellow, blue, red, yellow, blue, …
- 1, 2, 3, 1, 2, 3, 1, 2, 3, …
- O, O, Δ, O, O, Δ, …
- A, B, B, A, B, B, …
- snap fingers, clap, clap, snap fingers, clap, clap, …

Students could use simple computer graphics to create a 'three' pattern in a variety of ways.

WM Grouping Patterns

In small groups, students are given a set of repeating pattern cards.

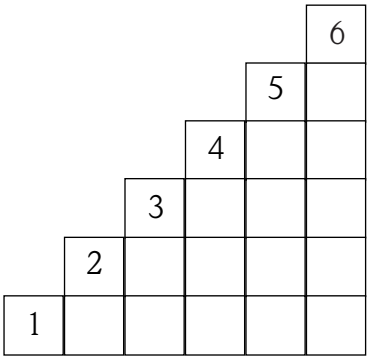
They sort the cards, and explain how they were sorted.

Students are asked to describe each group of cards in terms of a number pattern. Students use materials to create a new pattern for each group.

Staircases

Students build staircases using interlocking cubes eg unifix, multilink, lego or duplo bricks.

Students count aloud as they touch each stair.



Possible questions include:

- can you see a number pattern?
- what number comes next?
- can you continue the number pattern without making more stairs? (this is an increasing pattern)
- can you count backwards down the staircase? (this is a decreasing pattern)

Variation: Students count aloud every second number as they touch each stair (eg 2, 4, 6) and are asked questions similar to those above.

Calendars

Students count from 1 to 30 (31) on a calendar display for one month. They are then asked to discuss the pattern of days – Monday, Tuesday, Wednesday, etc.

Possible questions include:

- is there a pattern to the days?
- what dates will be Tuesdays?
- how many Mondays will there be in this month?

WM What's Wrong With this Pattern?

Students are presented with patterns where one of the elements (eg shapes, pictures, letters, numbers) has been misplaced.

eg 

Possible questions include:

- do you think this is a pattern?
- can you find what is wrong and can you correct the mistake?

Students should experience a variety of patterns with errors so that they can readily identify patterns that repeat and those that don't.

'Is the Same as'

Students are given collections of objects to sort and count in order to find groups that have the same number of objects.

Students describe and label the group using the term 'is the same as'.

eg 

Students could use drawings or simple computer graphics, and the term 'is the same as' to record their findings.

Connecting Repeating Patterns with Counting

This activity has been included as a bridge to Stage 1 content.

WM Part A

Students are shown a large strip of paper with the numbers from 1 to 30 written on it. The paper is placed on the floor.

Using materials, the teacher starts a repeating pattern with each new element of the pattern positioned above a number on the strip of paper.

eg

Δ	O	Δ	O	Δ	O	Δ		
1	2	3	4	5	6	7	8	9

Possible questions include:

- can you describe the pattern I have made?
- what part of the pattern repeats?
- what will the next shape be? How do you know?

Students are asked to imagine that the pattern continues and to consider the following questions:

- what shape will be above the number 10? How do you know?
- what shape will be above the number 15? How do you know?

Extension: Students could be asked:

- if we read out all of the numbers that have a circle above them, what do we know about these numbers?
- if we continue the pattern up to the number 20, how many triangles will there be?

Part B

In pairs, students are given a numeral strip and a collection of objects to create a repeating pattern and pose questions to be answered by their partner.

Resources

pattern blocks, unifix cubes, multilink cubes, coloured counters, lego or duplo bricks, a paper strip with numbers marked, calculators, calendar

Links

Whole Numbers

Addition and Subtraction

Multiplication and Division

Time

Language

pattern, repeat, copy, is the same as, group, increase, decrease, before, after, next, wrong, 'two' pattern, 'three' pattern, number, count forwards, count backwards

3.5 Area

Strand – Measurement

Syllabus Content p 96

MES1.2

Describes area using everyday language and compares areas using direct comparison

Key Ideas

Identify and describe the attribute of area

Estimate the larger of two areas and compare using direct comparison

Record comparisons informally

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Early Stage 1 content	Uses objects, actions, imagery, technology and/or trial and error to explore mathematical problems	Describes mathematical situations using everyday language, actions, materials and informal recordings	Uses concrete materials and/or pictorial representations to support conclusions	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Early Stage 1 content

Knowledge and Skills

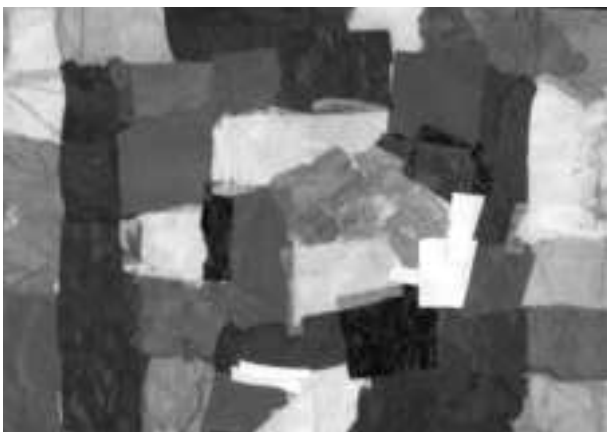
Students learn to

- identifying the attribute of area as the measure of the amount of surface
- covering surfaces completely with smaller shapes
- making closed shapes and describing the area of the shape
- using everyday language to describe area eg surface, inside, outside
- using comparative language to describe area eg bigger than, smaller than, the same as
- estimating the larger of two areas and comparing by direct comparison eg superimposing
- recording area comparisons informally by drawing, tracing or cutting and pasting

Working Mathematically

Students learn to

- ask questions about area in everyday situations eg 'Which book cover is bigger?'(*Questioning*)
- solve simple everyday problems using problem-solving strategies that include 'acting it out' (*Applying Strategies*)
- demonstrate how he/she determined which object has the biggest area (*Communicating, Reasoning*)
- explain why they think the area of one surface is bigger or smaller than another (*Communicating, Reasoning*)
- use computer software to draw a closed shape, colouring in the area (*Applying Strategies*)



Learning Experiences and Assessment Opportunities

Surfaces

Students gain an understanding of 'surface' by:

- touching and describing various surfaces in the classroom or school environment eg desk tops, tree trunks, skin, bricks, grass, fences and carpet and making rubbings.
- discussing floor, wall and roof coverings in different parts of the school and at home. Students could collect photos and pictures from magazines showing coverings and make statements about these.

The teacher supplies materials such as sandpaper or corrugated cardboard of different sizes. Students are blindfolded and feel the surfaces. They state which surface covers the most area. Students then superimpose the surfaces to test their predictions.

Covering a Paper Giant

The teacher draws a 'giant' on a large sheet of butchers' paper. In small groups, students are asked to cover a part of the giant (eg the pants) with small pieces of paper without leaving gaps.

Students discuss whether the entire giant is covered.

WM Match the Shape

Students are given four small pieces of paper, card or fabric. Two pieces are the same size and shape, and two are the same shape but different sizes.

Possible questions include:

- can you find two shapes that are the same?
- how do you know they are the same?
- can you describe how they are the same?

Extension: The activity could be repeated for a wider range of shapes in smaller gradations of size.

Cover Up

Students cover a shape with various tessellating and non-tessellating objects such as thin books, pieces of paper, sheets of newspaper, leaves or chip packets.

Possible questions include:

- is the entire shape covered?
- what other objects could you use so that the entire shape is covered?

Handprint Detective

The teacher presents the following story:

'This morning I found a handprint in the classroom. I have made copies of the handprint so that we can find who it belongs to.'

Possible questions include:

- can you work out if your hand is bigger, smaller or about the same area as the handprint?

Students superimpose their hand onto the handprint.

Students explain how they checked if their hand was a match, and if not, whether their hand is bigger or smaller than the handprint. (Adapted from CMIM)

WM Ordering Leaves

Students collect or are given a collection of leaves.

Possible questions include:

- which leaf is the biggest/smallest?
- how can you tell which leaf has the biggest/smallest area?
- can you show me a leaf that is smaller/bigger than this one?
- can you sort the leaves according to their size?

Students are shown an outline of a tree shape and are asked to identify the group of leaves they would use:

- if they had to cover the tree shape completely and explain why
- if they had to use as many leaves as possible
- if they weren't allowed to use many leaves.

Students are then given an outline of a tree shape and are asked to glue leaves onto the shape so it is completely covered.

Bag of Shapes

The teacher prepares several bags containing a variety of shapes.

The students are organised into small groups. Each group is given a bag of shapes.

In turns, each student randomly selects two of the shapes from the bag, estimates which one is bigger, and superimposes the shapes to test their prediction. They share their observations with the group.

Students are asked to describe how they worked out which shape was bigger and to record their comparisons.

Possible questions include:

- can you describe what you have done?
- how did you compare these two shapes?

WM Find a Bigger Area

In pairs, students draw a shape on paper and are asked to find three areas that are bigger, smaller or about the same size.

Students discuss how they compared the areas.

The teacher models comparing by superimposing one shape over another.

Students' responses are listed in a table.

Bigger	Smaller	About the same

(Adapted from CMIM)

Doll's Quilt

Students are given a piece of art paper and are asked to design a patchwork quilt by covering it with small coloured paper shapes. The small shapes can be made by tearing or cutting regular or irregular shapes.

Possible questions include:

- did you cover the whole quilt?
- which shape worked best?
- were there any overlaps or gaps? Why?

Let's Compare Shapes

In pairs, each student is given a piece of paper and asked to draw a large shape. They paint or colour the area of the shape and cut it out.

Students compare the size of their shape with their partner's shape by superimposing. Students glue their shape onto paper and write a statement comparing their shape with their partner's shape eg 'Hugo's shape is bigger than Alexandra's.'

Possible questions include:

- what is area?
- can you show me the area of this shape?
- how do I know which area is bigger? Can you show me? (Adapted from CMIM)

WM Closed and Open

Students are given a piece of ribbon. They make lines and then shapes with the ribbon. They then draw these. The whole class join several ribbons to make a large area. They measure the area by covering it with their bodies.

Variation: Students use computer software to draw closed and open shapes, and colour them in using the paint tool. (Adapted from CMIM)

Cat and Mouse

Students play a variation of the game Cat and Mouse. One student is outside the circle and one student is inside the circle.

When the teacher/student calls 'open' the cat and mouse can move inside or outside to chase each other. When the teacher/student calls 'closed' the students hold hands to 'close' the circle and stop the cat chasing the mouse. The teacher/student chooses when to say 'open' or 'closed' by whether the cat and mouse are inside or outside the circle.

Resources

paper, scissors, pencils, copied handprint, paint, crayons, different enlargements of shapes, leaves, pieces of cloth, glue, wall paper, string, ribbon

Links

Two-dimensional Space

Length

Visual Arts

Human Society and its Environment

Language

the same as, nearly the same as, almost, about the same as, bigger, much bigger than, larger, smaller, much smaller than, surface, area, overlap, on top of, gaps, covers, fits, on top, space

'I covered all my shape without leaving any gaps.'

'The tea towel fits on the beach towel and doesn't hang over.'

'When I put it on top I know the square is bigger than the triangle because there is some space around it.'

3.6 Volume and Capacity

Strand – Measurement

Syllabus Content p 102

MES1.3

Compares the capacities of containers and the volumes of objects or substances using direct comparison

Key Ideas

Identify and describe the attributes of volume and capacity

Compare the capacities of two containers using direct comparison

Compare the volumes of two objects by direct observation

Record comparisons informally

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Early Stage 1 content	Uses objects, actions, imagery, technology and/or trial and error to explore mathematical problems	Describes mathematical situations using everyday language, actions, materials and informal recordings	Uses concrete materials and/or pictorial representations to support conclusions	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Early Stage 1 content

Knowledge and Skills

Students learn about

- identifying the attribute of the volume of an object or substance as the amount of space it occupies
- identifying the attribute of the capacity of a container as the amount it can hold
- filling and emptying containers using materials such as water, sand, marbles and blocks
- using the terms 'full', 'empty' and 'about half-full'
- using comparative language to describe volume and capacity eg has more, has less, will hold more, will hold less
- stacking and packing blocks into defined spaces eg boxes, cylindrical cans
- comparing the capacities of two containers directly by
  - filling one and pouring into the other
  - packing materials from one container into the other
- comparing the volumes of two piles of material by filling two identical containers
- comparing the volumes of two objects by directly observing the amount of space each occupies eg a garbage truck takes up more space than a car
- using drawings, numerals and words to record volume and capacity comparisons informally

Working Mathematically

Students learn to

- recognise when a container is nearly full, half-full or empty (*Applying Strategies*)
- recognise and explain which three-dimensional objects pack and stack easily (*Communicating, Reflecting*)
- question and predict whether an object or collection of objects will fit inside a defined space such as a box or cupboard (*Questioning, Applying Strategies, Reflecting*)
- solve simple everyday problems using problem-solving strategies that include 'acting it out' (*Applying Strategies*)
- predict which container has the greater capacity (*Applying Strategies*)

Learning Experiences and Assessment Opportunities

Volume and Capacity Through Play

Students develop an understanding of volume and capacity during free and directed play. Experiences could include:

- packing away materials
- filling a variety of containers using handfuls, cups, sieves, spoons and scoops
- filling containers with materials such as sand, water, gravel or pasta
- filling containers to the brim
- filling one container and pouring the contents into another
- filling boxes with smaller objects such as unifix cubes
- packing and unpacking toys.

WM Stacking

Students are asked to select a number of the same objects (eg cans, boxes, balls or blocks) to build a wall. Students explain why they selected a particular object. They then build another wall using a different object.

Possible questions include:

- how did you create your wall?
- are there other ways of stacking the objects you used?
- which object was the easiest to stack?
- which wall is the biggest? How do you know?
- what were you measuring?

Variations: Students could be asked to build vehicles, buildings or animals by stacking various junk materials and gluing them together.

Sand Moulds

Students make sand models using suitable containers as moulds eg buckets or yoghurt cups. Students make sand castles using damp, wet or dry sand.

Students then compare their sand castles to the original mould and with the sand castles made from the same mould by other students.

Full or Empty

The teacher provides a set of labels with the terms 'full', 'empty' and 'about half-full'.

In pairs, students use a variety of containers and substances (eg water, sand, beans, marbles, small blocks) to represent each of the labels.

Students record the activity using drawings and words.

Pouring and Packing

In small groups, students are given a collection of different-sized containers.

Student A selects one of the containers and fills it with material such as pasta or blocks. The group is then asked to find containers in the collection that hold more or less than the chosen container.

Each student checks their prediction by pouring the pasta or packing the blocks from the first container into the selected container.

Students record their results. Students discuss:

- how could you tell if the second container holds more or less than the first container?
- how did you predict whether the second container would hold more or less than the first container?
- would you get different results if a different material was used?

WM Holds More Holds Less

Students find containers that have larger or smaller capacity than a given container eg students check by filling containers with blocks or by pouring sand from one container to another. Students record their results in a table.

Holds more	Holds less	Holds about the same

Who Can Hold The Most?

In pairs, students are given a bucket of beans and two identical clear containers.

Students investigate who can hold the most beans in their two hands (cupped together). Each student places the beans into one of the clear containers and compares the containers to determine who can hold the most beans in their hands.

Students use drawings or numerals to record the results.

Variation: The activity could be repeated using different materials eg blocks. (Adapted from CMIM)

Towers

Students work in a group to build a tower. They choose from a range of materials, such as building blocks, cans, interlocking cubes, cuisenaire rods, cylinders or wood off-cuts. Students discuss their towers.

Possible questions include:

- who made the tallest tower?
- who made the widest tower?
- which tower takes up the most space?
- how can we check this?
- is there an easier way to check?
- why are the towers different?

Variation: The activity could be repeated with each group using equal-sized blocks.

WM Containers with the Same Capacity

Students select a pair of containers that they think will have the same capacity from a large collection of containers. Students test their prediction by filling one container with water, sand, grain, beads, marbles or other appropriate material, and transferring the contents to the other container.

Students demonstrate and explain to others how they compared their two containers. They describe one container as 'holding more' and the other as 'holding less'.

Possible questions include:

- how do you know when a container is full?
- what does it mean when all of the water from one container does not fit into another container?
- are marbles good for measuring? Why or why not?

WM Packing

Students are presented with a variety of objects such as cubes, cuisenaire rods, marbles or buttons.

Students predict whether or not a collection of particular objects will fill a box. They discuss the result obtained in packing different objects.

Students select a group of objects, predict if they will pack into the box, and pack the objects to check.

Possible questions include:

- if I use blocks to measure capacity, what is the best way to pack them?
- how will you know how many blocks you used? Can you draw how you work this out?
- is there a quick way to work it out?

Resources

sand, water, containers, beans, pasta, blocks, felt pens, marbles, peas, sieves, cups, spoons, funnels, colanders, sugar, buckets, teapots, tubes, plastic boxes, scoops

Links

Three-dimensional Space

Science and Technology

Language

pile, stack, contain, hold, takes up more room, space, takes up the least/most space, size, big, bigger, small, smaller, fit, same, the same as, different, difference, wide, narrow, thick, thin, tall, short, deep, shallow, round, fill, loose, flowing over, even level, level with, enough, not enough, too much, full, half full, nearly full, full to the brim, full to the top, overflow, empty, nearly empty, spill, more, less, pack, pour, will hold more/less, has more, has less

'This container is half full.'

'This container has nothing in it.'

'If it's full to the brim, it spills easily.'

'A grain of rice is so small it hardly takes up any room.'

3.7 Mass

Strand – Measurement

Syllabus Content p 108

MES1.4

Compares the masses of two objects and describes mass using everyday language

Key Ideas

Identify and describe the attribute of mass

Compare the masses of two objects by pushing, pulling or hefting or using an equal arm balance

Record comparisons informally

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Early Stage 1 content	Uses objects, actions, imagery, technology and/or trial and error to explore mathematical problems.	Describes mathematical situations using everyday language, actions, materials and informal recordings	Uses concrete materials and/or pictorial representations to support their conclusions	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Early Stage 1 content

Knowledge and Skills

Students learn about

- identifying the attribute of mass as the amount of matter in an object
- describing objects in terms of their mass
  eg heavy, light, hard to push, hard to pull
- using comparative language to describe mass
  eg heavier, lighter, heaviest, lightest
- comparing and describing two masses by pushing or pulling
- comparing two masses directly by hefting
  eg 'This toy feels heavier than that one.'
- sorting objects on the basis of their mass
- using an equal arm balance to compare the masses of two objects
- identifying materials that are light or heavy
- using drawings and words to record mass comparisons informally

Working Mathematically

Students learn to

- ask questions about why they can or cannot lift an object (*Questioning*)
- predict which object would be heavier than, lighter than or have about the same mass as another object (*Applying Strategies*)
- give reasons why they think one object will be heavier than another (*Reasoning*)
- check a prediction about the masses of two objects by using an equal arm balance (*Applying Strategies*)
- discuss the action of an equal arm balance when a heavy object is placed in one pan and a lighter object in the other pan (*Communicating*)

Learning Experiences and Assessment Opportunities

Pushing, Pulling and Lifting

Students are encouraged to hold, push, pull, and lift objects, especially those that are of clearly different mass.

Students throw balls of different mass and compare how far they are able to throw them.

Students discuss the idea of splitting a heavy load into several lighter loads, or using a trolley or wheelbarrow to transfer materials.

Free Play with an Equal Arm Balance

In small groups, students are given the opportunity to experiment with an equal arm balance and a variety of materials. Students work with a minimum of direction and record their findings. Students discuss and compare their results and note any findings about balance.

Possible questions include:

- what are the words we use to talk about mass?
- by looking at these two objects, which one do you think is heavier?
- show me how you know which mass is heavier?

WM Mystery Boxes

Students are shown two identical boxes, but one is empty and the other contains objects. Students are asked to describe how the two boxes are the same and how they are different.

Students may attempt to lift the boxes but are told that the boxes are too large to lift safely. Students investigate another way of finding out how heavy the boxes are.

Students are encouraged to pull or push the boxes and asked whether they can tell which box is lighter.

Collectively, students create a list of items that are too heavy to lift and so should be pushed or pulled.

Mystery Bags

Students are each given two opaque shopping bags and are asked to place objects in them so that one bag is heavier than the other. These bags are shared with others to lift and describe.

Possible questions include:

- what words did you use to describe how the bags felt?
- could you work out which bag was heavier by just looking at them?
- what could you use to help you to work out which bag is heavier?

WM Guessing Game

In pairs, students are given an ice-cream container and a collection of objects, each of different mass eg ping-pong ball, lump of plasticine and chalkboard duster.

Student A selects one of the objects and places it in the ice-cream container, and puts the lid on without the other students seeing which object has been chosen.

By handling the container, and without referring to the original group of objects, Student B is asked to determine which object has been placed in the container.

Students should be encouraged to ask each other why they think a particular object is in the container.

WM Hefting

Students use hefting to compare and order two masses.

Students are asked to describe which is heavier and which is lighter. The teacher should include objects that are light or heavy for their size eg feather, beach ball, sinker. Students draw their objects and attach them to a class chart.

Heavier	Lighter

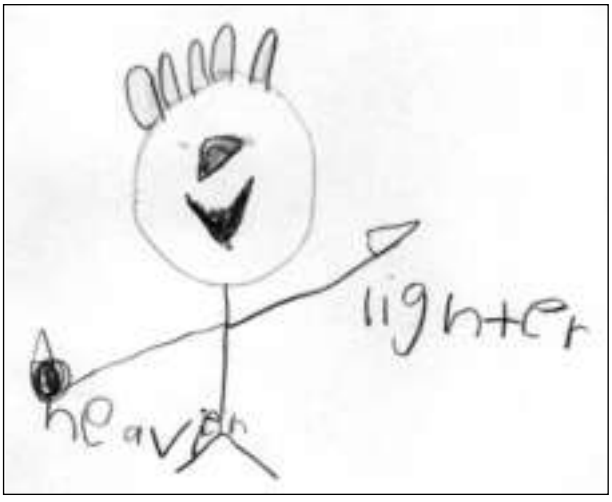
Everyone Can Balance

Students stand with their arms outstretched to simulate an equal arm balance.

The teacher holds an object in each hand and asks students to predict and demonstrate what would happen to their arms if the objects were placed in their hands.

Students are then given the objects to explain their actions and check their predictions.

Students record their results by drawing and labelling a picture. (Adapted from CMIM)



WM Sorting

Students are given a selection of obviously light and obviously heavy objects to sort into groups. A variety of everyday objects can be used eg paper clip, rock, tile, drink bottle. The teacher then discusses with students the reasons for putting objects into different groups.

Variation: As students get better at determining mass they could be given objects which have less obvious variations in weight.

Blindfold

Students take turns to be blindfolded. The teacher or another student places an object or container in each hand of the blindfolded student. The student is asked to state which hand is holding the heavier object or container. Students who are observing are asked to make an estimate of which one is the heavier object, giving reasons for their choice. (Adapted from CMIM)

Twin

Students are each given a bag, and work in small groups to find a partner who has a bag with about the same mass. The teacher prepares bags or invites students to fill the bags, providing them with a choice of objects or materials. Students discuss how they determined their twin and give reasons for their findings. Students record their results. (Adapted from CMIM)

WM Equal Arm Balance and Hefting

Students heft to decide which is the heavier of two objects.

They then predict which pan will drop (and which will rise) when the objects are placed in the balance pans of an equal arm balance.

The objects are then placed in the pans and the students confirm which object is heavier.

Possible questions include:

- why do we measure mass?
- can you draw a picture that shows which object is heavier?

WM Is your Bag Heavier?

Students work in pairs and are seated back to back. The teacher provides each student with a variety of everyday objects of varying weights and sizes, a plastic or paper bag, and a die. Students roll the die and place the corresponding number of objects into their bag. When both students have placed the correct number of objects in their bag they face each other and determine whose bag is heavier by hefting. The student with the heavier bag wins a counter. The activity is repeated until one student wins five counters.

Possible questions include:

- how did you choose which objects to put into your bag?
- how could you change the weight of your bag?
- does the size of the object chosen change the weight of the bag?
- how did you test to see whose bag was heavier?

Variation: Students win a counter for the lighter bag.

Resources

string, telephone book, large cereal boxes, match boxes, bean bags, balls, shot puts, toys, hoops, polystyrene, bricks, rocks, stones, foam, ping-pong balls, washers, macaroni, corks, sand, buckets, students' school bags, equal arm balance, balls of various sizes, boxes of similar sizes, bags

Links

Volume and Capacity

Language

light, heavy, small, large, hard to lift, easy to lift, easy to push, not heavy, not light, equal arm balance, lopsided, as heavy as, lighter than, heavier than, weight, smaller than, larger than, mass, less mass, more mass, greater mass, not as heavy, not as light, harder to push, harder to lift

3.8 Two-dimensional and Three-dimensional Space

Strand – Space and Geometry

Syllabus Content pp 124 & 118

Outcomes

SGES1.1

Manipulates, sorts and represents three-dimensional objects and describes them using everyday language

SGES1.2

Manipulates, sorts and describes representations of two-dimensional shapes using everyday language

Key Ideas

Manipulate and sort three-dimensional objects found in the environment

Describe features of three-dimensional objects using everyday language

Use informal names for three-dimensional objects

Manipulate, sort and describe two-dimensional shapes

Identify and name circles, squares, triangles and rectangles in pictures and the environment, and presented in different orientations

Represent two-dimensional shapes using a variety of materials

Identify and draw straight and curved lines

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Early Stage 1 content	Uses objects, actions, imagery, technology and/or trial and error to explore mathematical problems	Describes mathematical situations using everyday language, actions, materials and informal recordings	Uses concrete materials and/or pictorial representations to support conclusions	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Early Stage 1 content

Knowledge and Skills

Students learn about

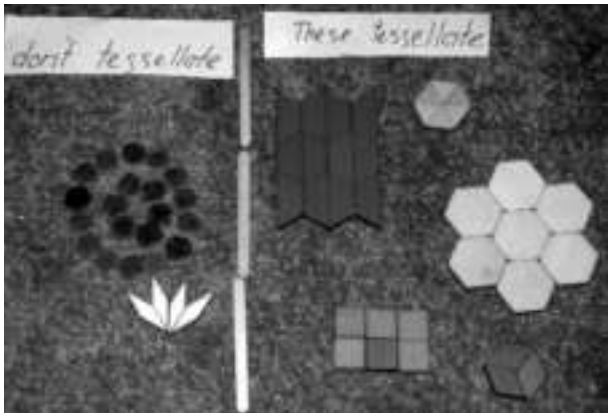
Three-dimensional Space

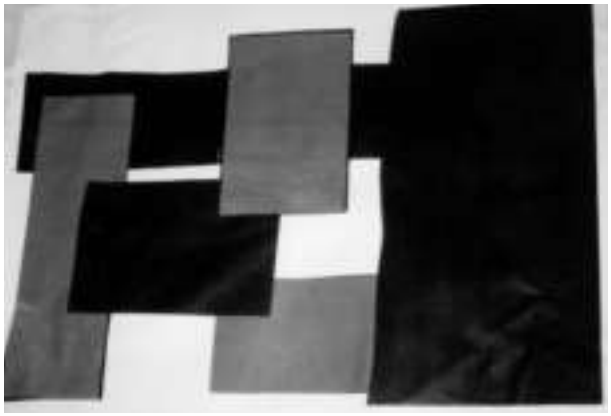
- manipulating and describing a variety of objects found in the environment
- describing the features of common three-dimensional objects using everyday language eg flat, round, curved
- sorting three-dimensional objects and explaining the attribute used eg colour, size, shape, function
- predicting and describing the movement of objects eg 'This will roll because it is round.'
- making models using a variety of three-dimensional objects and describing the models
- recognising and using informal names for three-dimensional objects eg box, ball

Working Mathematically

Students learn to

- manipulate and describe a hidden object using everyday language eg describe an object hidden in a 'mystery bag' (*Applying Strategies, Communicating*)
- use everyday language to describe the sorting of objects (*Communicating*)
- recognise and explain how a group of objects has been sorted eg 'These objects are all pointy.' (*Applying Strategies, Reasoning, Communicating*)
- predict the building and stacking capabilities of three-dimensional objects (*Applying Strategies*)
- use a plank or board to find out which objects roll and which objects slide (*Applying Strategies*)
- describe the difference between three-dimensional objects and two-dimensional shapes using everyday language (*Communicating, Reflecting*)



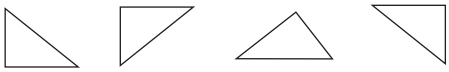


Knowledge and Skills

Students learn about

Two-dimensional Space

- identifying and drawing straight and curved lines
- comparing and describing closed shapes and open lines
- manipulating circles, squares, triangles and rectangles, and describing features using everyday language
- sorting two-dimensional shapes according to features, including size and shape
- identifying, representing and naming circles, squares, triangles and rectangles presented in different orientations eg



- identifying circles, squares, triangles and rectangles in pictures and the environment
- making representations of two-dimensional shapes using a variety of materials, including paints, paper, body movements and computer drawing tools
- drawing a two-dimensional shape by tracing around one face of a three-dimensional object

Working Mathematically

Students learn to

- ask and respond to questions that help identify a particular shape (*Questioning, Communicating*)
- recognise and explain how a group of two-dimensional shapes has been sorted (*Communicating, Reasoning, Applying Strategies*)
- ask and respond to questions that help identify a given shape (*Questioning, Communicating*)
- make pictures and designs using a selection of shapes eg a house from a square and a triangle (*Applying Strategies*)
- create a shape using computer paint, draw and graphics tools (*Applying Strategies*)
- turn two-dimensional shapes to fit into or match a given space (*Applying Strategies*)
- predict the results of putting together or separating two-dimensional shapes (*Applying Strategies*)

Learning Experiences and Assessment Opportunities

WM Free Play (Three-dimensional Space)

In groups, students participate in free play using a wide variety of collectable and commercial materials on a regular basis eg Lego, Duplo, boxes, everyday three-dimensional objects.

Free play sessions may also be used to practise teacher-directed activities.

Possible questions include:

- can you sort the three-dimensional objects?
- can you describe your sorting?
- can you describe the features of each three-dimensional object?

Shape Walk (Two- and Three-dimensional Space)

Students walk around the school and describe the various shapes they see eg 'These leaves look round.'

Students are asked to use drawings to show what they found. These are collated and placed in a class book for others to share.

Tracing Objects (Two- and Three-dimensional Space)

In pairs, students make a design or picture by tracing around the faces of various objects eg make a picture of a robot by tracing a variety of objects.

Students share and describe their pictures and are asked to:

- explain the position of particular shapes
- discuss the ways different students used a particular shape, and
- identify any shape used in different orientations.

Print It (Two- and Three-dimensional Space)

Students select an object from a collection of environmental and commercial materials such as fruit, stones, boxes and pattern blocks.

They are asked to investigate the different parts of the object that can be painted and printed onto paper. Students share and discuss the printed shapes and the ways they were able to create particular shapes.

Variation: The teacher could cut some of the objects and ask the students to predict the shape/s that could be made if the cut surface was printed. Students test their predictions by painting and printing.

Lines (Two-dimensional Space)

Students are given a piece of string and are asked to make a straight line, a curved line or a closed shape. They are asked to describe their line or shape, and draw what they create.

Variation: Students could use computer software to draw a variety of closed shapes and open lines.

WM Making Shape Pictures (Two-dimensional Space)

Students make a picture using different-sized paper shapes, including circles, squares, triangles and rectangles. As students are working, the teacher asks the students to name the shapes they are using.

Students glue their picture onto paper, add additional features, and describe their picture in sentences to be scribed.

Variation: Students could use a computer drawing program to create a shape picture.

Pipe Cleaner Shapes
(Two- and Three-dimensional Space)

Students investigate the shapes or figures that can be made by bending and joining pipe cleaners. Students describe their shape and use drawings to record what they have made. Alternatively, the teacher may take photos.

Variation: Students could use connecting straws or other appropriate material.

Sorting Attribute Blocks (Two-dimensional Space)

Part A

Students are shown a set of attribute blocks and, in turn, are asked to select two of the blocks and state how they are alike and how they are different eg 'These two shapes are both triangles but one is thick and one is thin.'

Part B

The teacher then sorts the attribute blocks into two groups and the students determine how the shapes were sorted.

Part C

In small groups, a student randomly selects one of three cards and displays the card for the others to see.

The group then sorts the attribute blocks according to the feature indicated on the card.

Sorting and Classifying
(Two- and Three- dimensional Space)

The teacher prepares a variety of regular and irregular paper shapes and collects a variety of objects (some with similar features).

Part A

Students are asked to sort the shapes and objects into groups eg rough or smooth, colour, size, shape. Students are asked to explain their grouping.

Students then sort the shapes and objects in a different way. For example, if the students sort them according to their colour the teacher could ask 'If these shapes and objects were all red, how would you sort them?'

Part B

In small groups, students take turns to sort the shapes and objects for others to determine and explain how they have been sorted.

Possible questions include:

- how many different ways can you sort the shapes?
- is this shape a square, a rectangle or a triangle? How do we know?
- how are these shapes (two rectangles) the same or different?
- can you name each shape?

Cutting Up Triangles
(Two-dimensional Space)

The teacher provides copies of several different drawings of large triangles. Each student selects a triangle and cuts it out. They begin cutting off triangles. As students work, they describe the kind of cuts that have been made eg 'I snipped off a corner.'

Possible questions include:

- do you know the name of this shape?
- can you find two triangles that are the same or similar and one very different triangle?
- are all of these shapes triangles? How do you know?

Predicting Movement
(Three-dimensional Space)

Students are asked to sort a collection of objects into those they predict will roll and those that will slide.

Using a variety of materials, students make a device that will help them to test their predictions.

Students explain why some objects roll and some objects slide and reflect on their predictions.

Students use drawings and labels to show how the objects were sorted.

Extension: Students investigate and describe the effect of varying the steepness of a ramp.

WM Drawing and Describing Shapes
(Two-dimensional Space)

Students are asked to draw a particular shape eg a circle.

They are then asked to draw a different shape eg a rectangle.

Possible questions include:

- how did you draw the circle?
- what was different about the way you drew the rectangle?
- can you draw another rectangle that looks different? How is it different?
- are there other shapes that can be drawn using curved/straight lines? Can you draw some?

WM Geoboards (Two-dimensional Space)

Students construct a large triangle on a geoboard, using an elastic band.

Possible questions include:

- how many smaller triangles could you make inside your triangle?
- how many different triangles can you make on your geoboard?
- can you make two triangles that are the same?
- can they fit better if we put them another way?

Students share their responses and describe how each triangle is different.

Variation: This activity could be varied using a square or rectangle.

Shape and Line Hunt (Two-dimensional Space)

The teacher prepares a chart on butchers' paper with columns labelled 'circles', 'squares', 'triangles' and 'rectangles'.

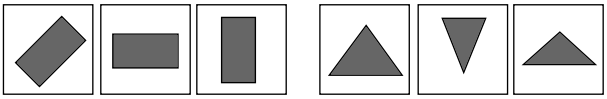
The students are asked to find pictures in magazines that are similar to the shapes, cut them out, and paste them in the correct column.

Students then view the class chart and discuss the pictures and shapes that were found and comment on which shapes were more difficult to find.

Variation: Students are asked to find examples of curved or straight lines in magazines.

WM Shapes in Different Orientations (Two-dimensional Space)

In small groups, students are given a bag, two hoops and two sets of cards (each set representing a particular shape in different orientations).
eg



All cards are shuffled and placed in the bag, and the two hoops are labelled 'Triangles' and 'Rectangles'. Students take turns to randomly select a card from their bag and place it in the appropriate hoop.

Variation: The activity could be varied using different shapes or more than two sets of cards (and hoops).

WM Barrier Shapes (Two-dimensional Space)

In pairs, each student is given an identical set of two-dimensional shapes eg 1 circle, 1 square, 3 triangles, and 2 rectangles.

Student A creates a flat design using the shapes and conceals it. They describe it to Student B who attempts to produce the same design. Students compare designs, swap roles and repeat the activity.

Possible questions include:

- could your partner follow your instructions?
- what shapes did you make and how did you do it?

Resources

geoboards, sponge shapes, elastic bands, pattern blocks, paint, crayons, pencils, chalk, textas, fruit and vegetables, cardboard shapes, plastic shapes, envelopes, leaves, sticks, buttons, fabric, wool, string, ribbon, felt, shells, wrapping paper, newspapers, magazines

Links

Creative and Practical Arts

HSIE

Language

large, larger, small, smaller, curved, straight, round, square, circle, triangle, rectangle, compare, same as, almost the same as, not the same as, sort, match, order, straight, trace, outline, edge, different, pointy

'I tore a big circle out and tore a little circle out for his head.'

'It's a triangle because it goes up to a kind of point.'

Stage 1
Sample Units of Work

4.1 Addition and Subtraction

Strand – Number

Syllabus Content p 47

NS1.2

Uses a range of mental strategies and informal recording methods for addition and subtraction involving one- and two-digit numbers

Key Ideas

Model addition and subtraction using concrete materials

Develop a range of mental strategies and informal recording methods for addition and subtraction

Record number sentences using drawings, numerals, symbols and words

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 1 content	Uses objects, diagrams, imagery and technology to explore mathematical problems	Describes mathematical situations and methods using everyday and some mathematical language, actions, materials, diagrams and symbols	Supports conclusions by explaining or demonstrating how answers were obtained	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 1 content

Knowledge and Skills

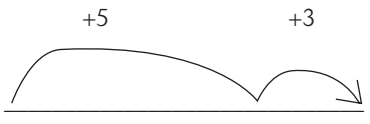
Students learn about

- representing subtraction as the difference between two numbers
- using the terms 'add', 'plus', 'equals', 'is equal to', 'take away', 'minus' and 'the difference between'
- recognising and using the symbols +, – and =
- recording number sentences using drawings, numerals, symbols and words
- using a range of mental strategies and recording strategies for addition and subtraction, including
  - counting on from the larger number to find the total of two numbers
  - counting back from a number to find the number remaining
  - counting on or back to find the difference between two numbers
  - using doubles and near doubles
    eg 5 + 7: double 5 and add 2 more
  - combining numbers that add to 10
    eg 4 + 7 + 8 + 6 + 3 + 1: group 4 and 6, 7 and 3 first
  - bridging to ten
    eg 17 + 5: 17 and 3 is 20 and add 2 more
- using related addition and subtraction number facts to at least 20 eg 15 + 3 = 18, so 18 – 15 = 3
- using concrete materials to model addition and subtraction problems involving one- and two-digit numbers
- using bundling of objects to model addition and subtraction with trading
- using a range of strategies for addition and subtraction of two-digit numbers, including
  - split strategy
  - jump strategy (as recorded on an empty number line)
- performing simple calculations with money including finding change and rounding to the nearest 5c

Working Mathematically

Students learn to

- recall addition and subtraction facts for numbers to at least 20 (*Applying Strategies*)
- use simple computer graphics to represent numbers and their combinations to at least 20 (*Applying Strategies*)
- pose problems that can be solved using addition and subtraction, including those involving money (*Questioning*)
- select and use a variety of strategies to solve addition and subtraction problems (*Applying Strategies*)
- check solutions using a different strategy (*Applying Strategies, Reasoning*)
- recognise which strategy worked and which did not work (*Reasoning, Reflecting*)
- explain why addition and subtraction are inverse (opposite) operations (*Communicating, Reasoning*)
- explain or demonstrate how an answer was obtained for addition and subtraction problems
  eg showing how the answer to 15+8 was obtained using a jump strategy on an empty number line



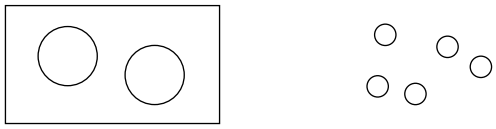
(*Communicating, Reasoning*)

- use a variety of own recording strategies (*Applying Strategies, Communicating*)
- recognise equivalent amounts of money using different denominations eg 50c can be made up of two 20c coins and a 10c coin (*Reflecting, Applying Strategies*)
- calculate mentally to give change (*Applying Strategies*)

Learning Experiences and Assessment Opportunities

Adding Counters

Students are given five counters and a work mat marked with two large circles.



Students are asked to place some of the counters in one circle and some in the other.

Possible questions include:

- how many counters did you put into each circle?
- how many counters are there altogether?

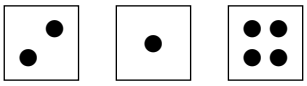
As students give their answers, the teacher models recording this as a number sentence. Students are asked to make as many different combinations to 5 as they can.

The activity is repeated using a different number of counters eg 10, 20. Students practise recording number sentences

WM Toss and Add

Students toss three standard dice and race to see who can state the total number of dots first.

Students are asked to share and explain their strategies.

eg 

For this example, student strategies could include:

- counting all of the dots
- starting with the highest number and counting on the other dice one-by-one ie 4, 5, 6, 7
- starting with the known sum of two dice and counting on the third eg '4+1=5 and 2 more.'
- using visual imagery eg 'I took the one dot and pretended it jumped onto the 'four' dice to make 5 dots, and then I added 2 more.'

Possible questions include:

- can you find a quicker way to add?
- can you add five more?
- how many do you have altogether?
- how did you get your answer?

Variation: Students could repeat the activity using numbered dice or dice with larger numbers.

Take-away Box

Part A

Students count aloud while the teacher drops a number of cubes into a box. Students are asked to state the total number of cubes in the box.

The teacher then removes and displays some of the cubes.

Possible questions include:

- how many cubes are left in the box?
- how do you know?

Students are encouraged to explain or demonstrate how the answer was obtained.

The teacher empties the remaining cubes from the box and students check their answer.

Students record the process as a number sentence.

The activity is repeated using a different number of counters.

Part B

In pairs, students repeat Part A and are asked to record their actions and solutions using drawings, words and/or numerals. (Adapted from CMIT)

Blocks on the Bowl

In pairs, students are given a collection of cubes (up to 10) and a bowl. The bowl is turned upside down on the desk.

Student A places the blocks on top of the bowl and Student B counts the blocks.

While Student B looks away, Student A removes some of the blocks and places them under the bowl. Student A asks Student B 'How many blocks are under the bowl?'

Student B records their answer. They check the actual number of blocks altogether.

Students swap roles and repeat the activity using a different number of blocks.

Extension: When the students are confident with combinations up to 10, the activity could be extended to include numbers greater than 10.

Possible questions include:

- how many are left?
- what does ten take away five equal?
- I am thinking of a question where the answer is 5. What could the question be?
- how many altogether?
- six plus what equals nine? (Adapted from CMIT)

WM Make Your Calculator Count

Students are shown how to use the process of repeatedly adding the same number on a calculator to count

eg [1] [+] [+] [=]

In pairs, students use the calculator to count from one by repeatedly pressing the '=' button and record the counting numbers on a paper strip.

This process can be repeated by constantly adding other numbers.

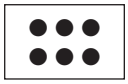
Counting-on Cards

Part A

The teacher prepares a set of number cards (a selection of numbers ranging from 20 to 50) and a set of dot cards (1 to 10). Each set is shuffled and placed face down in separate piles.

In small groups, one student turns over the top card in each pile

eg



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Students add the numbers represented on the cards together, and state the answer. The first student to give the correct answer turns over the next two cards.

Variation: Students are asked to subtract the number on the dot card from the number on the number card.

Part B

Students discuss the strategies used in Part A. The teacher models recording strategies on an empty number line

eg

Students are given the cards from Part A and are asked to turn over the top card in each pile and record their strategies using their own empty number line. Students share their strategies.

Doubles Bingo

Students are given a blank 2 × 3 grid and six counters. Students are asked to record a number in each square that is 'double any number' on a standard die

eg

12	2	8
6	2	6

The teacher rolls the die and states the number shown. Students 'double the number' on the die and place a counter on the corresponding answer on their grid.

The teacher continues to roll the die until one student has covered all numbers on their grid.

Variation: Students are asked to record numbers in each square that are 'double plus one' or 'double take away one'. A die marked with numbers other than 1 to 6 could be used.

(Adapted from CMIT)

Teddy Bear Take-away

In pairs, students each count out 20 teddy bear counters and line them up in two rows of 10.

In turn, students roll a die and take away the corresponding number of bears from their collection. Students should be encouraged to remove all counters from one line before taking them from the other.

Students use their own methods to record the process

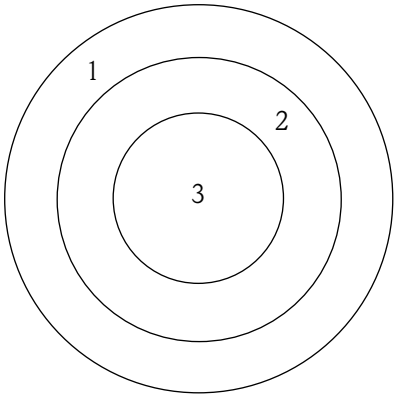
eg

Students continue the activity, taking turns to remove the bears until a student has no bears remaining.

Extension: Students could subtract larger numbers by rolling 2 or 3 dice. (Adapted from CMIT)

WM Dart Board Additions

Students are shown this 'dart board'. They are told that a zero is scored when a dart misses the board.



Possible questions include:

- what is the largest possible score that can be made with 3 darts?
- which numbers from 0 to 9 can be scored using 3 darts? How?
- can you change the numbers so that we can still get all the counting numbers from 1 as scores, but also get a bigger score than 9?

Students use a calculator to test and check possible solutions and record their solutions.

Make 100

The teacher removes the picture cards (Kings, Queens, Jacks) from a standard pack of playing cards. The Ace is used to represent one.

In small groups, each student is dealt six cards.

The aim of the activity is to add all six card numbers together to make the closest total to 100 (but no greater than 100). Each student can nominate one of their cards to be a 'tens' card.

For example, if the student was dealt

6	2	3	7	8	4

they could nominate the 7 card to have the value 70 and add the remaining cards for a total of 93.

Students could use a calculator to assist. They should be encouraged to record their calculations.

Add or Take away

The teacher removes the picture cards (Kings, Queens, Jacks) from a standard pack of playing cards. The Ace is used to represent one.

In small groups, each student is dealt four cards. The top card of the pack is then turned over to become the 'target card'.

Students attempt to make an addition or subtraction number sentence, using any of their four cards, so that the answer equals the number shown on the 'target card'. Students who can do this collect a counter.

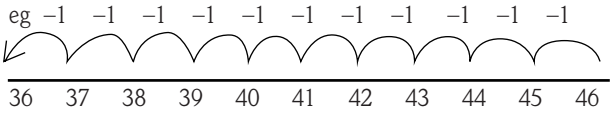
The cards are returned to the pack, shuffled and the activity is repeated. Play continues until one student has collected ten counters.

WM Take-away Popsticks

In pairs, each student counts a particular number of popsticks up to 100, into a paper bag, in bundles of tens and ones.

In turn, students roll two standard dice and add together the two numbers obtained. They take that number of popsticks out of the bag and count how many are left.

Students record the activity using an empty number line



Variation: Students could throw the dice and use the numbers obtained to represent a two-digit number (eg a 3 and a 2 could be 32 or 23) to be added to or subtracted from the number of popsticks in the bag.

Two Bags of Popsticks

Students are given two paper bags, each containing more than ten popsticks. Students count the number of popsticks in each bag and record the amount on the bag. Some students may choose to bundle 10 popsticks together using an elastic band.

Students are asked to determine the total number of popsticks in both bags. They record, share and discuss the strategies they used to calculate the total. A variety of strategies is possible.

Variation: The activity could be repeated, varying the number of popsticks to suit student performance on the task. Different materials, such as interlocking cubes, could be used.

Possible questions include:

- how can you make 37 with popsticks?
- what other strategy could be used to combine the two numbers?

Students compare recording methods with a partner and determine the quickest strategy.

WM Broken Keys

Students are given a calculator and are told to pretend some of the keys are broken. Students are asked to make the calculator display show the number 1 using only the 3, 4, +, – and = keys. Students record their responses.

Students are then asked to make the calculator display the number 2, then 3, then 4, then 5…then 20 using only these keys.

Variation: The activity could be varied by asking students to use only the 4, 5, +, – and = keys.

Race to and from 100

In pairs, students roll a die and collect that number of popsticks. These are placed on a place value board in the 'Ones' column.
eg

Hundreds	Tens	Ones

The student continues to roll the die, collect popsticks and place them in the Ones column.

The total number of popsticks in the 'Ones' column is checked and bundled into groups of ten, when ten or more popsticks have been counted.

The bundles of ten are then placed in the 'Tens' column. When there are ten tens, they are bundled to make one hundred and the game is finished.

After the idea of trading is established, students could record the total number of popsticks on the place value board after each roll.

Variation: Students start with 100 popsticks in the 'Hundreds' column. As the die is rolled, the number of popsticks is removed from the place value board by decomposing groups of ten. The game is finished when the student reaches zero.

Money Matters

WM Part A

Students are given a collection of coins. They demonstrate different ways to make 10c, 20c and 50c (and then $1 and $2) using the coins. Students record their findings.

Possible questions include:

- how many different ways can you represent 50c?
- what counting strategy did you use to determine the amount of money you had?

WM Part B

The teacher creates shopping situations where one student is given an amount of money to spend. They purchase a list of items. The shopkeeper totals the items and calculates the change. Students discuss strategies used to determine the cost of the list of items and the change to be given.

Resources

pack of cards, calculators, drawn dart board, paper bags, popsticks, counters, circles, teddy bear counters, numbered dice, dot dice, interlocking cubes, elastic bands, blank 2 × 3 grids

Links

Whole Numbers

Multiplication and Division

Patterns and Algebra

Language

add, plus, equals, is equal to, take away, minus, difference between, counting on, counting back, double, double and one more, number sentence, number line, addition, subtraction, trading, estimate, combinations, patterns, difference, altogether, subtract, sign, estimate, digit, combine, bundle

'I have fourteen red counters and six yellow counters; I have twenty altogether.'

'Eleven is two and nine more.'

'Five and five is ten and two more is twelve.'

'Sixteen take away seven is equal to nine.'

'The difference between seventeen and twenty-six is nine.'

'Fifty take away thirty is twenty.'

4.2 Multiplication and Division

Strand – Number

Syllabus Content p 53

NS1.3

Uses a range of mental strategies and concrete materials for multiplication and division

Key Ideas

Rhythmic and skip count by ones, twos, fives and tens

Model and use strategies for multiplication including arrays, equal groups and repeated addition

Model and use strategies for division including sharing, arrays and repeated subtraction

Record using drawings, numerals, symbols and words

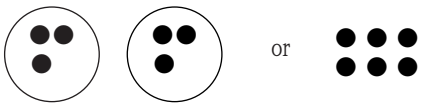
WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 1 content	Uses objects, diagrams, imagery and technology to explore mathematical problems	Describes mathematical situations and methods using everyday and some mathematical language, actions, materials, diagrams and symbols	Supports conclusions by explaining or demonstrating how answers were obtained	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 1 content

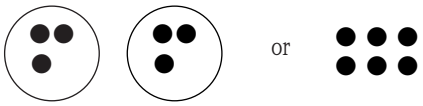
Knowledge and Skills

Students learn about

- counting by ones, twos, fives and tens using rhythmic or skip counting
- describing collections of objects as 'rows of' and 'groups of'
- modelling multiplication as equal groups or as an array of equal rows eg two groups of three



- finding the total number of objects using
  - rhythmic or skip counting
  - repeated addition
    eg '5 groups of 4 is the same as 4 + 4 + 4 + 4 + 4.'
- modelling the commutative property of multiplication eg '3 groups of 2 is the same as 2 groups of 3.'
- modelling division by sharing a collection of objects into equal groups or as equal rows in an array
  eg six objects shared between two friends



- modelling division as repeated subtraction
- recognising odd and even numbers by grouping objects into two rows
- recognising the symbols ×, ÷ and =
- recording multiplication and division problems using drawings, numerals, symbols and words

Working Mathematically

Students learn to

- pose simple multiplication and division problems, including those involving money (*Questioning, Reflecting*)
- answer mathematical problems using objects, diagrams, imagery, actions or trial-and-error (*Applying Strategies*)
- use a number line or hundreds chart to solve multiplication and division problems (*Applying Strategies)*
- use estimation to check that the answers to multiplication and division problems are reasonable (*Applying Strategies, Reasoning*)
- use patterns to assist counting by twos, fives or tens (*Reflecting, Applying Strategies*)
- describe the pattern created by modelling odd and even numbers (*Communicating*)
- explain multiplication and division strategies using language, actions, materials and drawings (*Communicating, Applying Strategies*)
- support answers to multiplication and division problems by explaining or demonstrating how the answer was obtained (*Reasoning*)
- recognise which strategy worked and which did not work (*Reasoning, Reflecting*)

Learning Experiences and Assessment Opportunities

Rhythmic Counting

Students practise rhythmic counting by using body percussion. For example, students count 1, **2**, 3, **4**, 5, **6**,…(where the bold numbers are emphasised) as they tap their knees and then clap their hands. (Adapted from CMIT)

Skip Counting in a Circle

Students at this Stage need to practise skip counting by twos, fives and tens.

Students sit in a circle and skip count around the circle in a variety of ways.

For example, students could skip count by:

- twos by putting both arms into the circle as each student says their number in the sequence (2, 4, 6, …)
- fives by holding up one hand and wiggling their fingers as each student says their number in the sequence (5, 10, 15, …)
- tens by holding up both hands and wiggling all fingers as each student says their number in the sequence (10, 20, 30, …).

Linking Counting to Multiplication

Students practise rhythmic counting using body percussion. For example, to count by threes students pat their knees, clap their hands, then click their fingers. They whisper as they count, stating aloud the number said on the 'click'.

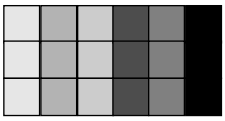
In small groups, students are given a supply of interlocking cubes. Each student makes a group of three cubes and places the cubes in front of them. A student is selected to 'whisper' count their group of cubes eg 'one, two, THREE'. The next student continues to count 'four, five, SIX' and this continues until all students have counted.

The group joins their sets of cubes, and states the number of groups and the total number of cubes.

eg

'*6 groups of three is 18*'

Students are then asked to form an array using the cubes.
eg



The activity is repeated for other numbers.

WM Making Groups to Count

In small groups, students are given a large collection of interlocking cubes. They are asked to estimate and then count the cubes.

Students share their methods for counting the cubes and discuss more efficient strategies for counting. The teacher may need to suggest to the students that they connect the cubes in groups and skip count to determine the total.

Possible questions include:

- how did you estimate the total number of cubes?
- how did you count the cubes?
- did you change your original estimate after counting to 10?
- can you group the cubes to help you count them quickly?

Pegging Clothes

In groups of six, each student is given four pegs to attach to the edge of their clothing.

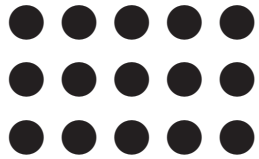
Students are asked to count the total number of pegs in their group. They are encouraged to do this by counting each peg quietly and counting the last peg on each piece of clothing aloud.

Students are then asked to record the numbers spoken aloud.

Variation: The number of students in the group or the number of pegs to be attached to each piece of clothing could be varied.

Arrays

Students are briefly shown a collection of counters arranged as an array on an overhead projector.
eg



Possible questions include:

- can you use counters to make what you saw?
- how many counters were there altogether?
- how did you work it out?

Variation: In small groups, one student is given a set of cards presenting a range of numbers arranged as arrays. The student briefly displays one card at a time for others to determine the total number of dots.

Car Parks

This activity can be used to model division as sharing and division as grouping.

In a group of five, each student is given a piece of paper to represent a car park. The teacher poses the following questions:

Sharing: How many cars will be in each car park if twenty toy cars are to be shared among the five car parks (ie the five pieces of paper)?

Possible questions include:

- how many cars are there to be shared?
- how many cars are in each car park?

The teacher models recording the activity.

eg 20 shared between 5 is 4, or $20 \div 5 = 4$.

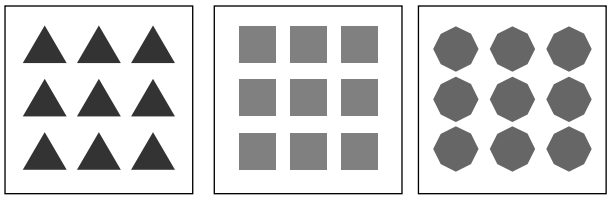
Grouping: How many car parks will be required for 10 cars if there are only to be 2 cars in each car park?

The teacher models recording the activity.

eg $10 - 2 - 2 - 2 - 2 - 2 = 0$, or $10 \div 2 = 5$

WM Arranging Desks

The teacher prepares multiple copies of the following cards.



Each student is given a collection of teddy bear counters.

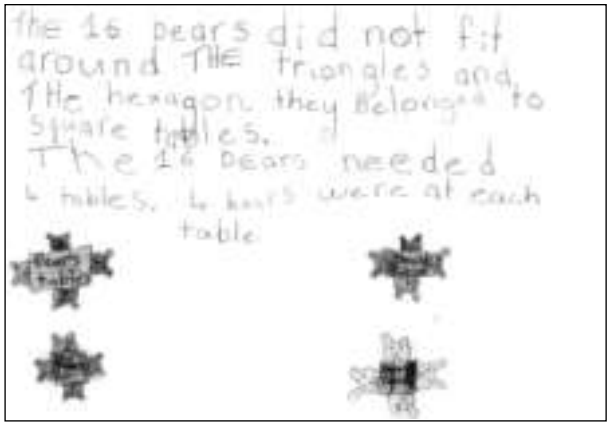
The teacher presents the following scenario:

'There are 16 bears in a class. The teacher can choose to sit three bears at each of the triangular tables, four bears at each of the square tables or six bears at each of the hexagonal tables.'

Students investigate which table shape the teacher could use so that the correct number of bears is sitting at each table.

Possible questions include:

- which shapes did you try?
- can you describe what you did?
- how many square tables were needed?
- what table shape could the teacher use if there were 12 bears…21 bears…30 bears?

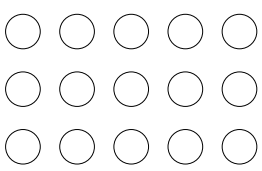


WM Concert Time

In small groups, students arrange a given number of chairs in equal rows for students to watch a concert.

Students draw the array using symbols to represent the chairs. Students are encouraged to use numbers on their array. Students are asked to find another way to arrange them.

eg



$5 + 5 + 5 = 15$

Possible questions include:

- which would be the best array for a concert for 12 students?
- how many different arrays did you find?

Handful of Money

Part A

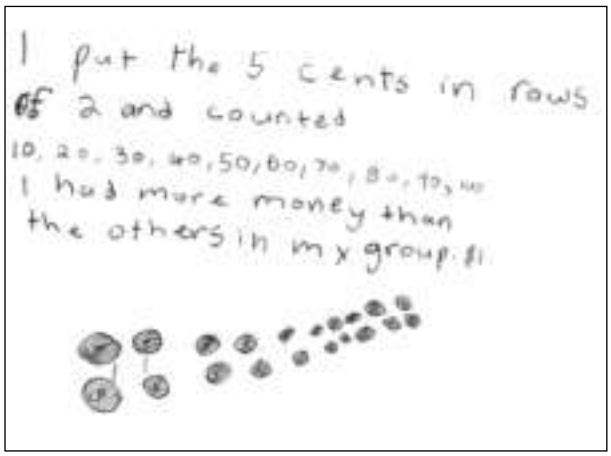
Students are given a bucket of 5c coins. They take a handful of coins from the bucket and are asked to use skip counting to determine the total.

The teacher models recording the activity using repeated addition eg 5c + 5c + 5c + 5c + 5c + 5c = 30c. Students are encouraged to record their actions in a similar way.

Part B

Students are asked to remove the coins one at a time and count backwards by fives. Students are then asked to record their actions using repeated subtraction
eg 30c – 5c – 5c – 5c – 5c – 5c – 5c = 0.

Variation: The activity can be repeated using a bucket of 10c coins.



WM Hidden Groups

In small groups, students sit in a circle, with a pile of number cards (0 to 5) and a collection of counters in the centre.

Student A reveals a card and each of the other students takes the corresponding number of counters and hides them under their hand. Student A then answers the questions:

- what is the total number of counters hidden under all the hands?
- how did you work it out?

Students share and discuss their strategies and repeat the activity.

Variation: Different number cards could be used.

Lots of Legs

Students are given problems such as:

- there are 20 legs. How many animals?
- there are 21 legs. How many stools?
- there are 16 legs. How many aliens?

Students share and discuss the variety of possible responses.

WM Number Problems

The teacher poses a variety of number problems involving multiplication or division for students to solve. Students should be encouraged to pose their own problems for others to solve.

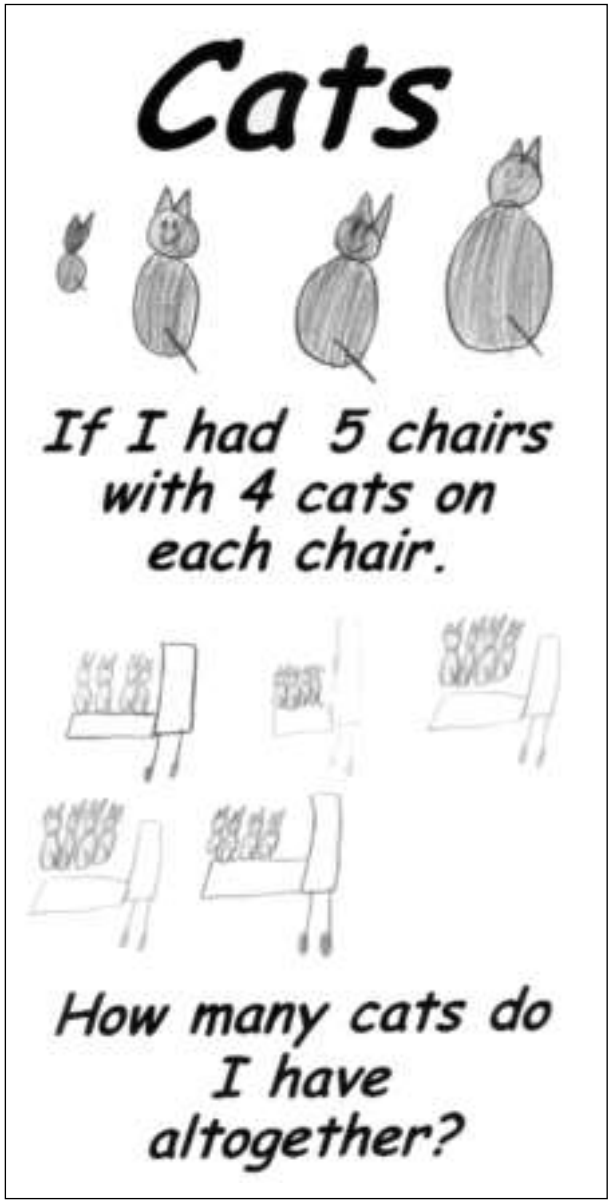
As a prompt, students could be asked to write problems about 20 biscuits, 30 oranges or 40 tennis balls.

Students should be given access to a variety of materials to model and solve the problems.

Possible questions include:

- what strategy did you use to solve this multiplication problem?
- can you record how you solved it?
- did your strategy work better than your friend's? Why?

Variation: Problems can be produced on the computer and made into booklets.



WM Popsticks in Cups

In pairs, students place five cups on a table and put an equal number of popsticks in each cup.

Possible questions include:

- how many cups are there?
- how many popsticks are in each cup?
- how many popsticks did you use altogether? How did you work it out?
- can you estimate the answer to the multiplication or division problem?
- is it reasonable?
- how can you check your estimation?

Students share and discuss their strategies for determining the total number of popsticks eg students may use rhythmic or skip counting strategies.

Students are asked to record their strategies using drawings, numerals, symbols and/or words. The teacher may need to model some methods of recording to students.

Variation: Students are given a different number of cups and repeat the activity. (Adapted from CMIT)

Leftovers

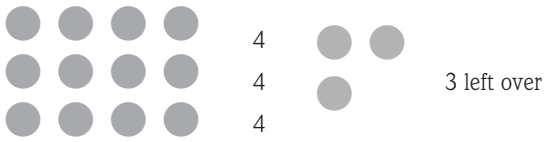
Students are each given a particular number of blocks or counters. The teacher calls out a smaller number for students to make groups or rows of that number.

For example, if students are given 15 counters and are asked to make groups of 4, there would be 3 groups of 4 and 3 left over.

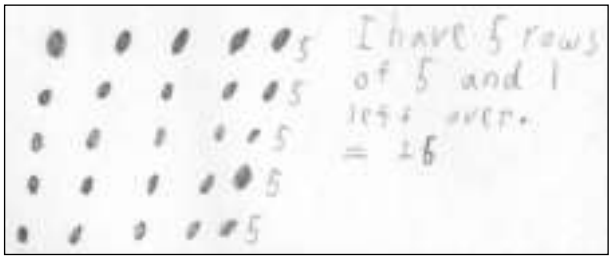
Students describe their actions and discuss whether it was possible to make equal groups or rows.

Students record their findings in their own way using drawings, numerals, symbols and/or words.

eg 'I made 3 groups of 4 but there were 3 left over.'



The activity is repeated for other numbers eg making groups of 5 out of the 15 blocks or counters.



Resources

paper, matchbox cars, plastic cups, popsticks, plastic money, Lego, digit cards, counters, pegs, straws, pencils, paper plates, counters, blocks, dice, hundreds chart, interlocking cubes, cups

Links

Whole Numbers

Addition and Subtraction

Patterns and Algebra

Language

multiplication, division, ones, twos, fives, tens, collection of objects, groups of, rows of, equal groups, symbols, equal rows, shared between, hundreds chart, number line, altogether, array, the same as, shared among, share, group, divide, double, repeated addition, repeated subtraction, row, how many fives, twice as many, pattern, share fairly

'There are three rows of five chairs.'

'There are three fives.'

'I have to make three groups of four to match this label.'

'I've got four groups of two. That's two and two more is four, five, six, seven. Eight altogether.'

'I made four rows of six pegs. That's twenty-four pegs.'

'I shared my pencils between my friends and they got two each.'

'Everyone got the same so it was a fair share.'

4.3 Fractions and Decimals

Strand – Number

Syllabus Content p 61

NS1.4

Describes and models halves and quarters, of objects and collections, occurring in everyday situations

Key Ideas

Model and describe a half or a quarter of a whole object

Model and describe a half or a quarter of a collection of objects

Use fraction notation $\frac{1}{2}$ and $\frac{1}{4}$

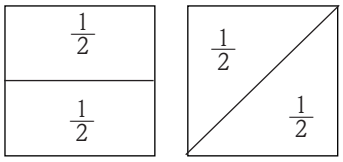
WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 1 content	Uses objects, diagrams, imagery and technology to explore mathematical problems	Describes mathematical situations and methods using everyday and some mathematical language, actions, materials, diagrams and symbols	Supports conclusions by explaining or demonstrating how answers were obtained	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 1 content

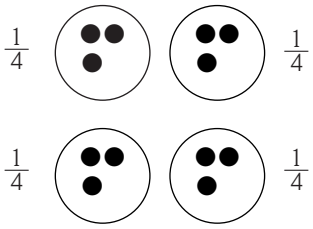
Knowledge and Skills

Students learn about

- modelling and describing a half or a quarter of a whole object
- modelling and describing a half or a quarter of a collection of objects
- describing equal parts of a whole object or collection of objects
- describing parts of an object or collection of objects as 'about a half', 'more than a half ' or 'less than a half'
- using fraction notation for half ($\frac{1}{2}$) and quarter ($\frac{1}{4}$)
- recording equal parts of a whole, and the relationship of the groups to the whole using pictures and fraction notation eg



- identifying quarters of the same unit as being the same eg



Working Mathematically

Students learn to

- question if parts of a whole object, or collection of objects, are equal (*Questioning*)
- explain why the parts are equal (*Communicating, Reasoning*)
- use fraction language in a variety of everyday contexts eg the half-hour, one-quarter of the class (*Communicating*)
- recognise the use of fractions in everyday contexts eg half-hour television programs (*Communicating, Reflecting*)
- visualise fractions that are equal parts of a whole eg imagine where you would cut the cake before cutting it (*Applying Strategies*)

Learning Experiences and Assessment Opportunities

Sharing the Whole

Part A

In pairs (or groups of four), students share a slice of bread so that each person gets the same amount of bread with none left over. Students discuss and record their strategies.

Part B

The teacher demonstrates cutting a piece of fruit into two or four pieces. Students:

- count the pieces
- describe how the pieces are alike
- describe the pieces as 'halves' or 'quarters'.

In small groups, students attempt to cut paper shapes into two or four equal parts. They discuss whether the parts are equal and share the pieces.

Find the Matching Half/Quarter

The teacher cuts shapes into halves/quarters for students to match in order to recreate the shape.

Students discuss the number of parts needed to create each shape and use the term 'halves' or 'quarters' to describe what they did.

WM Halve/Quarter Different Objects

Students investigate a variety of objects eg length of string, ball of plasticine, fruit, cup of water, muesli bar and symmetrical pictures. They discuss:

- how they would divide each object into halves/quarters
- how they would check if the two/four parts are equal.

Students manipulate each object, attempt to divide them into two/four equal parts, check the size of the halves/quarters and describe the parts.

Students reflect on whether their method of checking that the halves/quarters were equal was different for each of the objects eg checking the two halves of a length of string compared to checking the two halves of a ball of plasticine.

WM Halve/Quarter the Paper

Students discuss the two important things about creating halves/quarters:

- creating two/four parts
- checking whether they are the same size.

Using a paper square, students discuss:

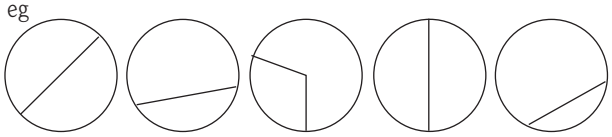
- how they would cut it into halves/quarters
- how they would check if the two/four parts are equal
- whether there is more than one way they could do it.

Students cut a variety of paper shapes into halves/quarters, describe the parts and compare their responses with others.

Are They Halves/Quarters?

Students are shown a collection of shapes eg circles. The collection should include some that show two equal parts and some that show two unequal parts.

eg



Possible questions include:

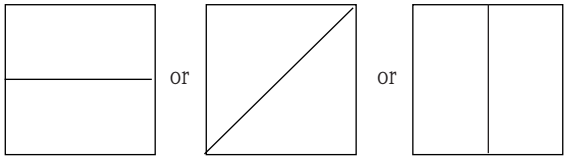
- do these circles show two equal parts?
- how do you know?

The activity should be repeated for quarters.

WM How Many in Each Half?

Students are given a paper square to represent a farm. They are asked to fold the paper in half to create two equal-sized paddocks.

eg



Students are given a collection of animal counters and are asked to count out ten for their farm. They put the animals on the farm so there are an equal number of animals in each paddock.

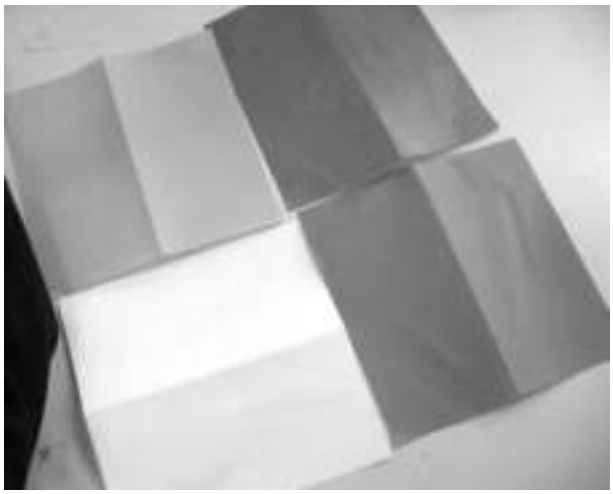
Possible questions include:

- how many animals do you think will be in each paddock?
- could you have worked out the number of animals in each paddock without sharing them out one-by-one?

Students share and discuss their strategies and solutions.

Variation: This activity could be varied by:

- changing the number of animals on the farm
- creating four equal-sized paddocks
- using a different context eg flowers in a garden, chocolate chips on a biscuit, candles on a cake, peas on a plate.



Sharing Collections

Halves

The teacher displays eight cubes and says 'I am going to share these eight cubes between two people.'

Two students are selected to hold out their hands for the teacher to share the cubes, one at a time.

Possible questions include:

- did each student get an equal amount?
- how many cubes did each student get?

The teacher says 'We have shared the eight cubes into two equal amounts. Each is one-half of eight.'

Quarters

The activity is repeated using the scenario 'I am going to share the eight cubes among four people.'

Students predict how many each student will receive and four students are selected to hold out their hands for the teacher to share the cubes.

The teacher says 'We have shared the eight cubes into four equal amounts. Each is one-quarter of eight.'

Possible questions include:

- why did each student get less this time?
- how could you check if the two/four parts are equal?

Estimating Halves

In pairs or small groups, students are provided with a collection of small similar objects in containers eg centicubes, counters, beads. They empty the contents and create two groups of objects that they estimate will be about half of the collection.

Possible questions include:

- what strategies did you use to help with your estimation?
- what could you do to improve your estimation?
- how did you check your results?

The activity should be repeated using different objects.

Extension: Students estimate and create four groups that are about equal using similar objects and strategies.

Comparing Halves and Quarters

Part A

Students are given two identical paper circles.
They are asked to fold one of the circles in half, label each part and cut along the fold. They are then asked to fold the other circle into quarters, label each part and cut along the folds.

Students compare the halves/quarters.

Possible questions include:

- which parts are the same?
- which parts are different? How are they different?

WM Part B

Students are given two different-sized paper circles.

They are asked to fold both circles in half, label the parts and cut along the folds.

Students compare the halves.

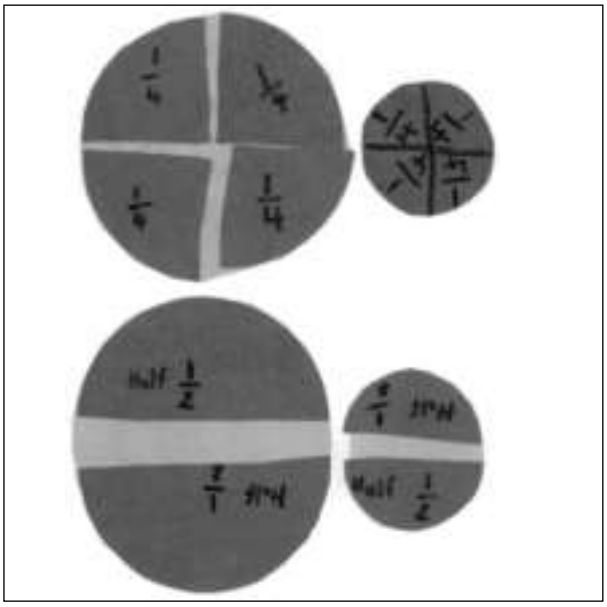
Possible questions include:

- which parts are the same? Why are they the same?
- which parts are different? How are they different?
- what is each piece called?

Students discuss that halves of different wholes can be different sizes.

Labelling Equal Parts

Students are given a paper square and are asked to fold the square into four equal parts. They are asked to name the parts and encouraged to use fraction notation and/or words to label the equal parts.



Students cut along the folds and describe the parts in relation to the whole.

Possible questions include:

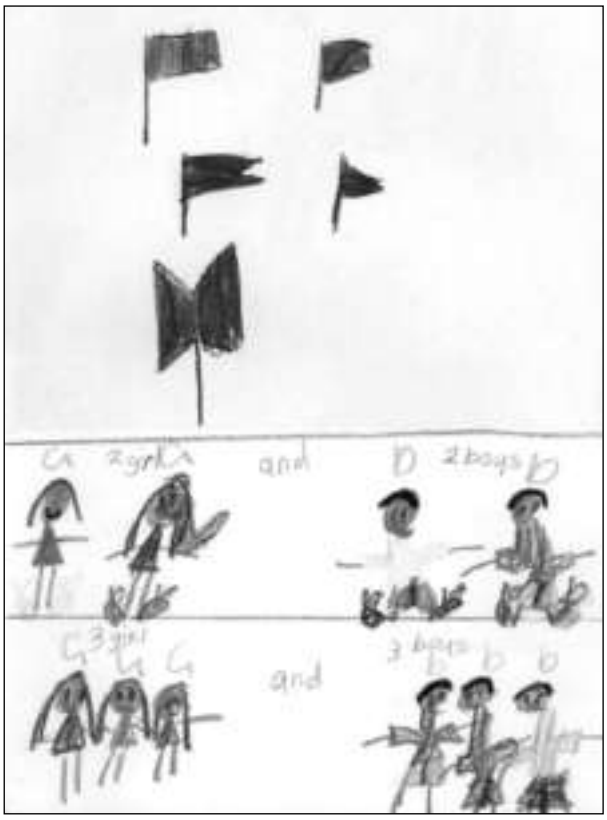
- what is a half/quarter?
- what does a half/quarter look like?
- how could you check if the two/four parts are equal?

Fraction Problems

Students are presented with problems that require a knowledge of fractions to solve.

Possible problems include:

- half of the children in the family are boys. Draw what the family could look like.
- if you cut a ball of plasticine in half, how could you check if the parts are equal?
- one half of a flag is red and the other half is blue. Draw what the flag might look like.



Extension: 'Emily bought six pizzas. Some were cut into halves and some were cut into quarters. There was the same number of halves as quarters. How many halves and how many quarters were there?'

Students are encouraged to use their own strategies to solve the problems, and record their solutions.

Find Half of a Collection

Students are given a die with faces numbered 2, 4, 6, 8, 10, 12. In small groups or pairs, students take turns to roll the die. They collect counters to match half the amount rolled and record their roll and the counters taken eg 10 is rolled and the student collects 5 counters. Students have a predetermined number of rolls eg 20. The winner is the student who has the most counters.

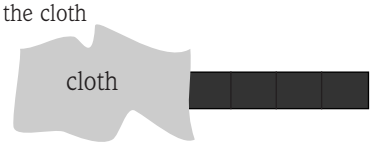
Variation: The numbers on the die could be any even number.

Hidden Half

The teacher displays a list of numbers that are divisible by two (in the range 2 to 20). In pairs, students are given a collection of objects eg cubes, beads, and a piece of cloth.

Student A turns away.

Student B selects a number from the list, collects that number of blocks and joins them together. They cover one-half of the blocks with the cloth
eg



Student A is asked to determine:

- how many blocks are under the cloth?
- how many blocks are there altogether?
- if you were allowed to take one-quarter of the collection, how many would you take?

Student B checks Student A's responses.

Students repeat the activity using similar objects and strategies.

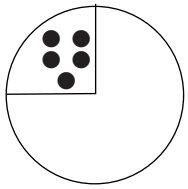
Variation: Students collect an even number of cubes. They put half the number of cubes into a bag and display the other half in their hand. Students pose the question:

'If half is in my hand, how many blocks are there altogether?'

This could be played in small groups with a point system used to determine a winner.

WM Hidden Quarters

The teacher displays a diagram of a cake on an overhead projector. A small number of 'choc buds' (counters) are placed in one of the quarters
eg



The students are presented with the following story:

'Judy cut her cake into quarters to share. She made sure everyone got the same number of choc buds on their piece of cake. Three people have taken their piece and Judy's piece is left on the plate.'

Possible questions include:

- how many pieces was the cake cut into?
- what is each piece called?
- how many choc buds (counters) can you see?
- how many choc buds were there altogether on the cake?
- how did you work it out?
- is there another way to cut the cake into halves/quarters?

Student share, discuss, and record their strategies.

Resources

paper shapes, counters, interlocking cubes, cloth, plasticine, fruit, bread

Links

Whole Numbers

Addition and Subtraction

Multiplication and Division

Length

Language

group, divide, quarters, part, part of, other part, equal, equal parts, about a half, more than a half, less than a half, one part out of two, two equal parts, one half, one part out of four, four equal parts, one quarter

4.4 Chance

Strand – Number

Syllabus Content p 68

NS1.5

Recognises and describes the element of chance in everyday events

Key Ideas

Recognise the element of chance in familiar daily activities

Use familiar language to describe the element of chance

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 1 content	Uses objects, diagrams, imagery and technology to explore mathematical problems	Describes mathematical situations and methods using everyday and some mathematical language, actions, materials, diagrams and symbols	Supports conclusions by explaining or demonstrating how answers were obtained	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 1 content

Knowledge and Skills

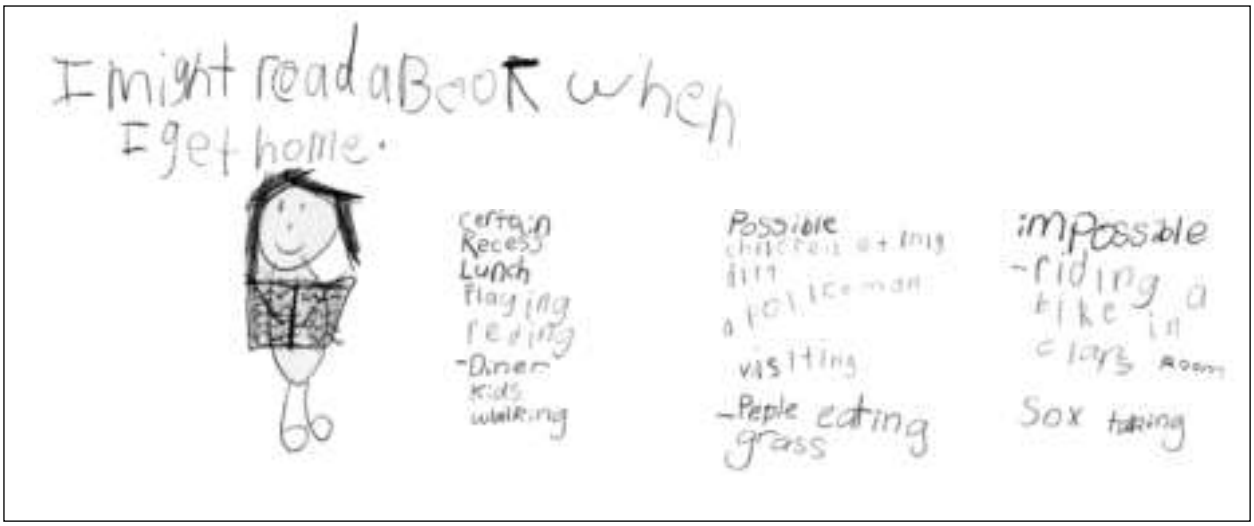
Students learn about

- using familiar language to describe chance events eg might, certain, probably, likely, unlikely
- recognising and describing the element of chance in familiar activities
  eg 'I might play with my friend after school.'
- distinguishing between possible and impossible events
- comparing familiar events and describing them as being more or less likely to happen

Working Mathematically

Students learn to

- describe familiar events as being possible or impossible (*Communicating*)
- describe possible outcomes in everyday situations eg deciding what might occur in a story before the ending of a book (*Communicating, Reflecting*)
- predict what might occur during the next lesson in class or in the near future eg predict 'How many people might come to your party?', 'How likely is it to rain soon if we have a cloudless blue sky?' (*Reflecting*)



Learning Experiences and Assessment Opportunities

Questioning

Students are encouraged to ask questions about the likelihood of events happening eg 'Is Mr Benton coming up to visit our class?', 'Is Stan's mum going to have a baby boy or girl?'

Extension: Students write questions using the terms 'likely' and 'unlikely'.

WM What might happen?

The teacher reads a picture book to the class and stops before the end of the book. Students are asked to predict what might happen next in the story.

Students discuss how likely or unlikely their predictions are eg 'Do you think she will fall onto a haystack?'

Extension: Each student draws and writes a statement about their prediction.

Never-ever Book

Students are asked to contribute a page to a book about the things that never ever happen eg 'It never ever rains cats and dogs.' Students share their page with a friend.

WM Weather

In the playground, students observe the weather. They discuss how sunny, cloudy, cold or hot it is.

From these observations students are asked:

- do you think it is likely or unlikely to rain?
- do you think it is likely to be very hot tomorrow?

Daily predictions of the next day's weather are recorded on a weather chart or calendar. They are then compared to observations on the day.

What might you see?

Students are divided into four groups.

Each group is given a picture depicting a particular environment eg snow, forest, outback, coastline. The groups are asked to imagine they are in a house in their 'environment' and to list the things they would see in their yard.

In turn, each group states an item on their list. Other students discuss the chance of finding the same item in their 'environment'.

WM Will it happen tomorrow?

Students are shown pictures of children doing a variety of activities eg eating lunch, playing in the rain, using a calculator, visiting the zoo.

Students discuss whether the activity 'might happen', 'will probably happen', or 'is unlikely to happen' tomorrow. Students are encouraged to discuss any differences in opinion.

Likely or not?

The teacher prepares cards with 'always', 'likely', 'unlikely' and 'never' on them and orders them on the floor. They pose the question:

'How likely is it that someone in another class has a vegemite sandwich today?'

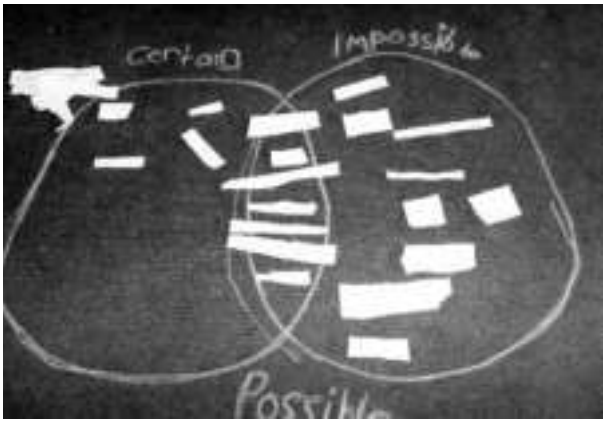
Students stand behind the chance card that they think is the best answer to the question and explain their reasons. Students survey one or more classes and find out whether their prediction was accurate.

Possible/Impossible

Students discuss and record things that they consider:

- possible eg being cloudy the next day
- impossible eg raining cows.

Students share their ideas, discuss any differences in opinion and form a display under the headings 'possible' and 'impossible'.



Die Games

Students are asked:

- which number is the hardest to get when a die is rolled?
- how could you find out if you are right?
- what is the chance of getting a 6?

Students are given a die to test their theory, and then record their findings for a given number of rolls eg 30.

Variation: The teacher poses the scenario: 'If I put 6 number cards in a hat and picked them out one at a time, recorded the number and put it back in the hat, would there be an equal chance of each number being picked?'

Students discuss their predictions and then test by doing the activity.

Is the Game Fair?

In pairs, each student rolls a die in turn and moves a marker along a number line marked from 1 to 50. One student follows the rule 'Double the number shown on the die'. The other student follows the rule 'Add 4 to the number shown on the die'. The winner is the first student to reach 50.

Students discuss the fairness of the game.

Is it fair?

Students write their names on a small sheet of paper. The names are placed in a hat to choose who will be the leader of the line. The teacher draws out one name and the students are asked to discuss if this is fair and whether everyone has the same chance. Names are put back after each draw. This activity is continued over a week and students test predictions, record and discuss.

What chance?

Students are invited to express their opinions about the chance of finding various items in the playground at lunchtime eg a chip packet, a shopping trolley, a relative.

Students discuss any differences in opinion. For example, Ellen might say it would be 'impossible' to see her mother in the playground at lunchtime. Another student could challenge this thinking by stating that Ellen's mother could arrive as a surprise.

Variation: Students sit in a circle. One student, holding a ball or beanbag, begins by making a statement such as 'The principal will visit the class today'. The ball or beanbag is passed to the next student and this indicates it is now their turn to talk. This student agrees or disagrees with the statement eg 'No, the principal won't visit today. I saw her walking to another room.' The next student in the circle is passed the ball or beanbag and contributes a statement that agrees or disagrees eg 'The principal could visit our room after she has visited the other room.'

WM Knock Knock

Students brainstorm a list of possible people who could knock at the classroom door eg the principal, a teacher, a primary child, an infants child, a mother, a father, a grandmother, a grandfather. Students write the names on cards. As a class, students discuss and rate people from 'least likely to knock' to 'most likely to knock'. During the day the students record who comes to the door. At the end of the day, students discuss the findings.

Variation: In small groups, students discuss and rate the people from 'least likely to knock' to 'most likely to knock'. The students report back to the class, justifying their choices.

Resources

dice, paper, picture books, hat, number line, counters, weather stamps, weather chart, calendar, environment pictures, activity pictures

Links

Whole Numbers

Addition and Subtraction

Data

Language

might, certain, probably, likely, unlikely, possible, impossible, predict, maybe, might not, will happen, will not happen, can happen, cannot happen, good chance, poor chance, fair, not fair, could happen, never

'I don't think that will ever happen.'

'It could possibly rain tomorrow.'

'It might happen.'

4.5 Patterns and Algebra

Strand – Patterns and Algebra

Syllabus Content p 74

PAS1.1

Creates, represents and continues a variety of number patterns, supplies missing elements in a pattern and builds number relationships

Key Ideas

Create, represent and continue a variety of number patterns and supply missing elements

Use the equals sign to record equivalent number relationships

Build number relationships by relating addition and subtraction facts to at least 20

Make generalisations about number relationships

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Early Stage 1 content	Uses objects, diagrams, imagery and technology to explore mathematical problems	Describes mathematical situations and methods using everyday and some mathematical language, actions, materials, diagrams and symbols	Supports conclusions by explaining or demonstrating how answers were obtained	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 1 content

Knowledge and Skills

Students learn about

Number Patterns

- identifying and describing patterns when counting forwards or backwards by ones, twos, fives, or tens
- continuing, creating and describing number patterns that increase or decrease
- representing number patterns on a number line or hundreds chart
- determining a missing element in a number pattern eg 3, 7, 11, ?, 19, 23, 27
- modelling and describing odd and even numbers using counters paired in two rows

Number Relationships

- using the equals sign to record equivalent number relationships and to mean 'is the same as' rather than as an indication to perform an operation eg 5 + 2 = 4 + 3
- building addition facts to at least 20 by recognising patterns or applying the commutative property eg 4 + 5 = 5 + 4
- relating addition and subtraction facts for numbers to at least 20 eg 5 + 3 = 8; so 8 – 3 = 5 and 8 – 5 = 3
- modelling and recording patterns for individual numbers by making all possible whole number combinations

  eg 0 + 4 = 4
  1 + 3 = 4
  2 + 2 = 4
  3 + 1 = 4
  4 + 0 = 4

- finding and making generalisations about number relationships eg adding zero does not change the number, as in 6+0 = 6

Working Mathematically

Students learn to

- pose and solve problems based on number patterns (*Questioning, Applying Strategies*)
- ask questions about how number patterns are made and how they can be copied or continued (*Questioning*)
- describe how the missing element in a number pattern was determined (*Communicating, Reflecting*)
- check solutions to missing elements in patterns by repeating the process (*Reasoning*)
- generate number patterns using the process of repeatedly adding the same number on a calculator (*Communicating*)
- represent number patterns using diagrams, words or symbols (*Communicating*)
- describe what has been learnt from creating patterns, making connections with addition and related subtraction facts (*Reflecting*)
- recognise patterns created by adding combinations of odd and even numbers
  eg odd + odd = even, odd + even = odd (*Reflecting*)
- check number sentences to determine if they are true or false, and if false, describe why
  eg Is 7 + 5 = 8 + 5 true? If not, why not?
  (*Communicating, Reasoning*)

Learning Experiences and Assessment Opportunities

WM Counting Patterns

The students are divided into two groups. A hundreds chart is displayed.

The class counts by fives (to 100), referring to the hundreds chart. As they count, the groups take turns to name the next number in the sequence eg 5, **10**, 15, **20**, 25, **30** (where Group B says the bold numbers and Group A says the numbers in between).

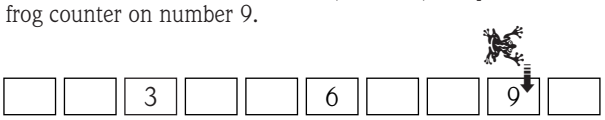
Possible questions include:

- what do you notice about the numbers we are saying?
- what do you notice about the numbers your group is saying?
- look at all of the numbers we are saying on the hundreds chart. What pattern do you notice?
- did we count number 35, …51, …85? How do you know?

Variation: Students count by other multiples eg tens, twos.

WM Frog Jumps

A set of number cards are placed face down in order from 1 to 30. The teacher turns over cards 3, 6 and 9, and places the frog counter on number 9.



The teacher explains that Freddie the frog has jumped on some of the cards to make a number pattern.

Students are asked:

- what numbers can you see?
- how many numbers is Freddie jumping over each time?
- what numbers has Freddie jumped over? How do you know?
- what number will Freddie jump on next? How do you know?
- will Freddie jump on number 14? How do you know?

Variation: The activity could be varied by:

- repeating for other number patterns
- placing the cards in descending order
- removing the first few number cards to create a pattern that begins from a number other than 1.

Relating Repeating Patterns to Number Patterns

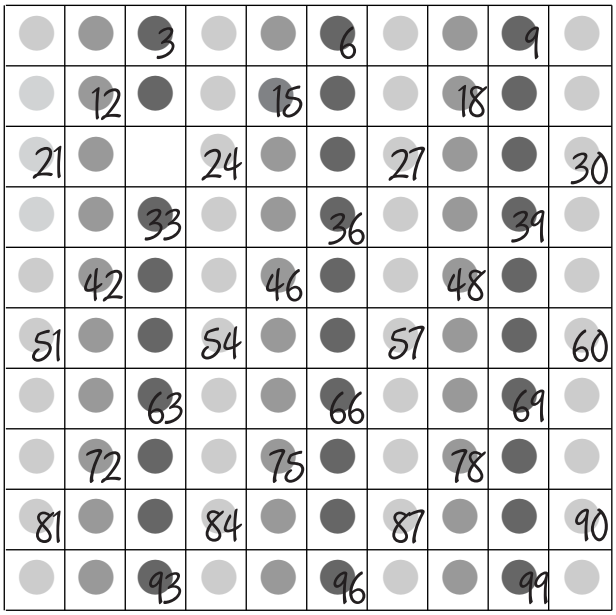
Part A

Students are asked to choose three different-coloured counters and create a 'repeating pattern'. They are asked to assign a counting number to the last counter in each group and discuss. eg

Students create a repeated pattern with two, four or five different-coloured counters. They assign counting numbers, record their patterns and discuss their results.

WM Part B

Students are asked to record their 'repeating pattern' (from Part A) on a 10 × 10 grid. They continue their pattern to complete the grid. Students assign a number to the last counter in each group.



Possible questions include:

- look at the colours, what pattern do you see?
- can you tell me about the numbers you have recorded?
- who can see a pattern in the numbers? What is the pattern?
- what is the fourth number you have recorded?
- when you count by threes, do you say the number 25?…36?….30?….100?
- can you show me the number that is the answer to 3 + 3 + 3?… and 3 + 3 + 3 + 3 + 3?

Make a Number Pattern

Students are asked to make a number pattern that increases, or a number pattern that decreases.

They are asked to:

- describe their number pattern in words and record these words
- continue their number pattern
- explain why a particular number is/is not used in their number pattern
- create another number pattern that has a particular number in it eg 'create a number pattern with the number 10 in it'.

Making the Calculator Count

Part A

In pairs, students are given a calculator and are shown how to make it count by repeatedly adding the same number.

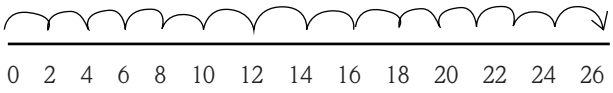
For example, on some calculators students enter

+	2	=	=

or

+	+	2	=	=

Students read the numbers displayed on the screen and record on an empty number line.



0 2 4 6 8 10 12 14 16 18 20 22 24 26

Possible questions include:

- what pattern do you see on the number line?
- how many numbers did you land on? How many numbers did you jump over?
- what would happen if you made your calculator count by fours?

Part B

In pairs, students are asked to start from a number other than zero.

For example students enter

3	+	2	=	=

Students predict the next number in the sequence, press the appropriate keys and record the numbers pressed.

Possible questions include:

- what do you notice about these numbers?
- why are the numbers different from those in Part A?
- what would happen if you started from the number 10?

Variation: The activity could be repeated for counting backwards by repeatedly subtracting the same number.

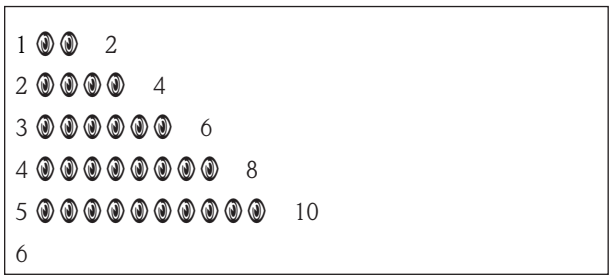
WM Counting Monsters

Students are shown a drawing of a monster with two eyes and are asked 'How many eyes does this monster have?' The number of eyes is recorded as follows.

Students are then asked:

- how many eyes are on two monsters? How did you work it out?
- how many eyes are on three monsters? ….four monsters?…five monsters?…. How did you work it out?

After each question, the new information is added to the chart.



Possible questions include:

- what pattern do you notice in the pictures?
- what pattern do you notice in the numbers?
- can you use these patterns to work out how many eyes are on 6 monsters?…9 monsters?

Variation: The activity could be varied by:

- beginning with 10 monsters at a party and recording the total number of eyes. One monster (at a time) goes home and the question is posed: 'How many eyes are left at the party?'
- changing the context to: the number of tricycle wheels, the number of cats' legs.

Finding a Partner

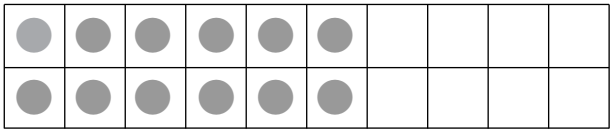
Students line up in twos to investigate whether every student in the class will have a partner. As a whole class, they count the rows of students: 2, 4, 6, 8, …. The teacher explains that these are even numbers.

WM Exploring Odd and Even

In pairs, students are given twenty counters and a 10 × 2 grid.

The teacher chooses a number (in the range 1 to 20) and asks the students to collect that number of counters and place them on the grid, paired in two rows.

eg 'Collect 12 counters and pair them in two rows on the grid.'

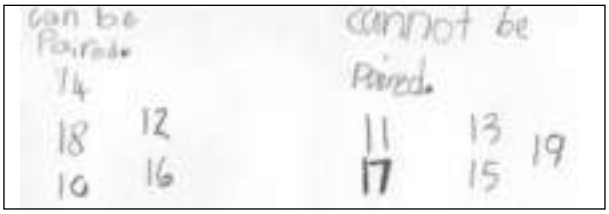


Students are asked to keep a record of which numbers of counters cannot, and which numbers can, be paired.

The teacher continues to choose other numbers for students to explore and uses the terms 'odd' and 'even' to describe the two groups of numbers.

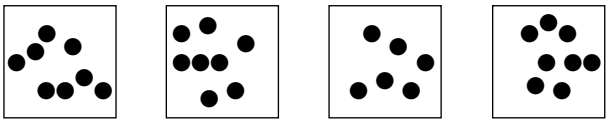
Possible questions include:

- what do you notice about all the numbers of counters that can be paired?
- when the number of counters cannot be paired, what do you notice about the number of counters left over?
- would you be able to pair 28 counters? 31 counters?
- can you name other even numbers? odd numbers?



Odd or Even Dots

The teacher prepares a set of dot cards, where the dots on each card are arranged randomly to represent numbers.
eg



The teacher displays a card and asks students to determine whether there is an even or odd number of dots. Students explain their strategies.

Human Calculator

Three students are selected to work together as a 'human calculator' (Group A).

The teacher whispers an instruction to the 'calculator' eg 'Add ten'.

In turn, the remaining students (Group B) say a number in the range 0 to 20. The 'calculator' performs the operation on the number and states the answer.

For example, if Group B says 21, the 'calculator' states the answer 31.

Students record the activity on paper.

eg

7 → 17

13 → 23

5 → 15

Possible questions to the students in Group B include:

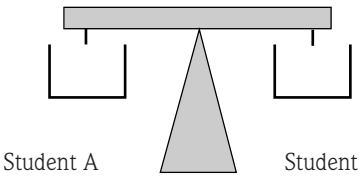
- what is the 'calculator' doing to your numbers to get the answer?
- how did you work it out?

Students should be encouraged to describe the relationship between their number and the 'calculator's' response.

Variation: The 'calculator' could be asked to add zero, double the number, subtract 1, multiply by 1, or add 100. Group B could be asked to name any number in the range 10 to 30 and the 'calculator' could subtract 10.

Balancing Numbers

Students discuss how to balance an equal arm balance. Students are encouraged to use the terms 'equal' and 'the same'.



In pairs, students share an activity board (as above) and each student is given 10 red blocks and 10 blue blocks.

Student A places any combination of red and blue blocks on their side of the board eg 3 red blocks and 5 blue blocks, making a total of 8.

Student B places a different combination of red and blue blocks on their side of the board so that both buckets have the same total eg 2 red blocks and 6 blue blocks.

Both students record their findings using drawings, numerals, symbols and/or words.

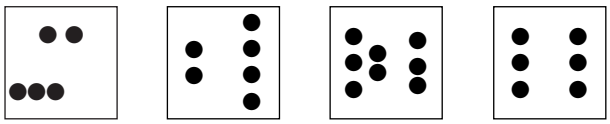
eg 3 + 5 = 2 + 6 or

3 + 5 is the same as 2 + 6

Generalisations about Odds and Evens

The teacher prepares a set of dot cards, where the dots on each card are arranged in two distinct groups. Students are given a collection of counters.

eg



The teacher displays a card briefly and asks students to use their counters to recreate what they saw.

Possible questions include:

- what did you see?
- is there an odd or even number of dots in each group?
- how many dots are there altogether?
- is the total an odd or even number?

Students are encouraged to make generalisations about adding combinations of odd and even numbers. Students record their generalisations.

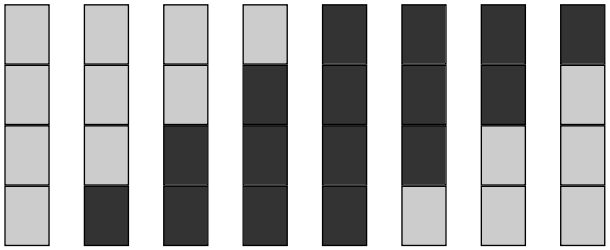
Making Coloured Towers

In pairs, students are given a collection of green and yellow interlocking cubes (or any two colours).

The teacher presents the following scenario:

'I would like you to build some towers. They are to be 4 cubes high. You can use one or both colours in your design. However, the green cubes must be together and the yellow cubes must be together.'

Students investigate the possible combinations
eg



Possible questions include:

- have you built all possible combinations?
- did you find an easy way of finding all possible combinations?
- what patterns do you notice in your towers?
- can you use numbers to describe your towers?
- who can see a pattern in the numbers? What is that pattern?
- how are the towers the same?
- which towers are similar? How are they similar?

Students are encouraged to recognise the commutative property eg 3+1 = 4 and 1+3 = 4.

Variation: The activity could be repeated for other numbers.

Spot the Mistake

In pairs, students are given a set of number cards representing a particular number pattern where

- one number is missing eg 2, 4, 6, 8, 12, 14, or
- a mistake has been made eg 2, 4, 6, 9, 10, 12, 14.

Students are asked to sequence the numbers on the cards and identify the missing number (or mistake).

Possible questions include:

- where is the mistake in the pattern?
- what did you do to find the answer? Did someone else do it another way?

Variation: Students create their own set of number cards for their partners to sequence.

WM Relating Arrays

In pairs, students cut and stick together sections of egg cartons to make different-sized arrays. Students place a block or counter in each egg recess.

Possible questions include:

- how many rows are there?
- can you count how many blocks/counters there are without counting each one?
- can you describe your array?

Students are asked to rotate their array.

Possible questions include:

- can you describe your array now?
- how has your array changed? eg 'I had 3 rows of 2 blocks but now I have 2 rows of 3 blocks.'
- has the total number of blocks/counters changed?

Students use drawings to record both arrays. The teacher models writing descriptions of the arrays

eg

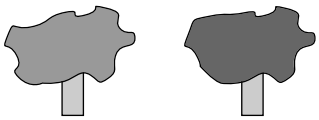
3 rows of 2 is 6

2 rows of 3 is 6

or $3 \times 2 = 6$ $2 \times 3 = 6$

Apple Combinations

Students are given ten counters and a work mat depicting two trees.



Students are presented with the following scenario:

'Mrs Day had two apple trees in her backyard. On Monday she picked three apples. How many apples did she pick from each tree?'

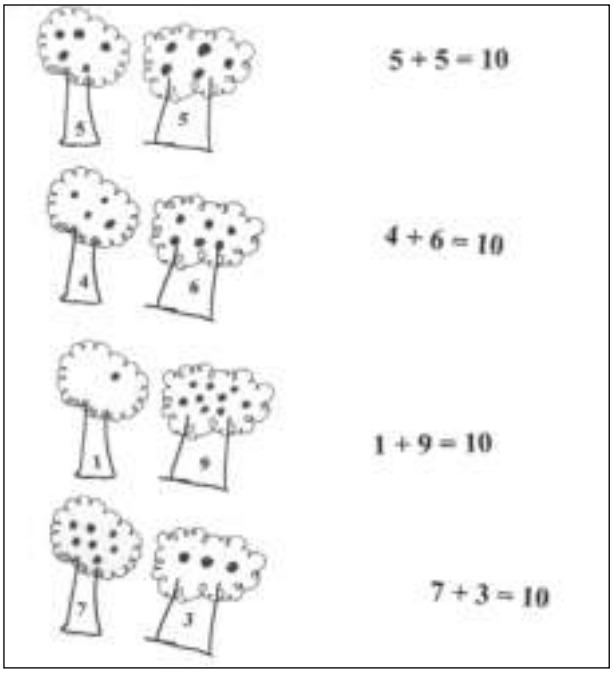
The teacher models the possible combinations for this problem:

- three apples from the left tree
- three apples from the right tree
- two apples from the left, one from the right, or
- two apples from the right, one from the left.

Students are asked to record the possible combinations if Mrs Day picked ten apples. Students are encouraged to use drawings, numerals and/or words in their recording.

Students then discuss solutions and are asked:

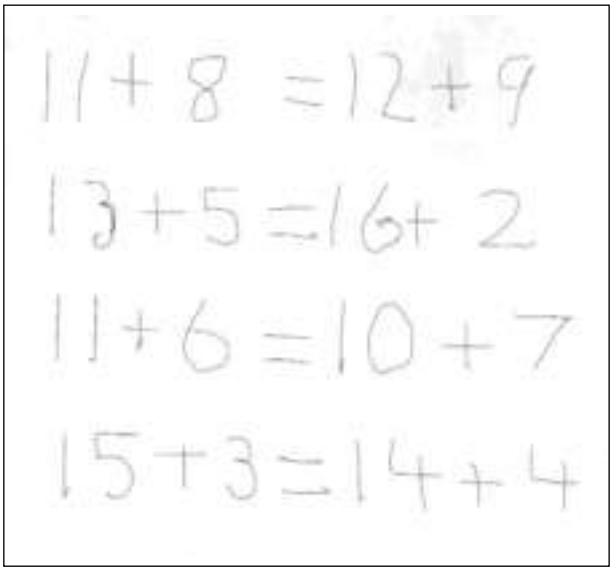
- have you recorded all possible combinations?
- did you find an easy way of finding all combinations?
- can you record the combinations as number sentences?
- what do you notice about the combinations you have found?



Checking Number Sentences

Students are presented with number sentences that may be true or false eg 12 + 3 = 11 + 4, 12 + 3 = 10 + 6

They discuss whether they are true or false, explain what is wrong, and correct the sentences where necessary.



WM Symbols

Students are presented with the following problem and answers:

'Can you write a variety of number sentences using the numbers 8, 3 and 11 and the symbols +, – and = ?'

Answers: 8 + 3 = 11
3 + 8 = 11
11 – 8 = 3
11 – 3 = 8

Possible questions include:

- what do you notice about the numbers?
- does this pattern work for a different set of three numbers?
- are you sure you have all possible combinations? How do you know?

Students select and investigate other numbers.

Resources

hundreds chart, egg cartons, counters, 10 × 10 grid, calculators, number cards (1 to 30), interlocking cubes, butchers' paper

Links

Whole Numbers

Addition and Subtraction

Multiplication and Division

Language

number pattern, counting forwards by, counting backwards by, odd, even, increase, decrease, missing, combination, is the same as, true, false, changes, doesn't change, repeating pattern, add, multiply, divide, subtract, complete, next number

'The number pattern 2, 4, 6, 8, 10 and 12 is like counting by twos.'

'The numbers in this pattern all end in five or zero.'

'When I add zero to the number, the number doesn't change.'

4.6 Length

Strand – Measurement

Syllabus Content p 93

MS1.1

Estimates, measures, compares and records lengths and distances using informal units, metres and centimetres

Key Ideas

Use informal units to estimate and measure length and distance by placing informal units end-to-end without gaps or overlaps

Record measurements by referring to the number and type of informal or formal units used

Recognise the need for metres and centimetres, and use them to estimate and measure length and distance

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 1 content	Uses objects, diagrams, imagery and technology to explore mathematical problems	Describes mathematical situations and methods using everyday and some mathematical language, actions, materials, diagrams and symbols	Supports conclusions by explaining or demonstrating how answers were obtained	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 1 content

Knowledge and Skills

Students learn to

- using informal units to measure lengths or distances, placing the units end-to-end without gaps or overlaps
- counting informal units to measure lengths or distances, and describing the part left over
- comparing and ordering two or more lengths or distances using informal units
- estimating and measuring linear dimensions and curves using informal units
- recording lengths or distances by referring to the number and type of unit used
- describing why the length remains constant when units are rearranged
- making and using a tape measure calibrated in informal units eg calibrating a paper strip using footprints as a repeated unit
- recognising the need for a formal unit to measure lengths or distances
- using the metre as a unit to measure lengths or distances
- recording lengths and distances using the abbreviation for metre (m)
- measuring lengths and distances to the nearest metre or half-metre
- recognising the need for a smaller unit than the metre
- recognising that one hundred centimetres equal one metre
- using a 10 cm length, with 1cm markings as a device to measure lengths
- measuring lengths or distances to the nearest centimetre
- recording lengths and distances using the abbreviation for centimetre (cm)

Working Mathematically

Students learn to

- select and use appropriate informal units to measure lengths or distances eg using paper clips instead of popsticks to measure a pencil (*Applying Strategies*)
- explain the appropriateness of a selected informal unit (*Communicating, Reflecting*)
- use informal units to compare the lengths of two objects that cannot be moved or aligned (*Applying Strategies*)
- use computer software to draw a line and use a simple graphic as an informal unit to measure its length (*Applying Strategies*)
- explain the relationship between the size of a unit and the number of units needed
  eg more paper clips than popsticks will be needed to measure the length of the desk
  (*Communicating, Reflecting*)
- discuss strategies used to estimate length eg visualising the repeated unit (*Communicating, Reflecting*)
- explain that a metre length can be arranged in a variety of ways eg straight line, curved line (*Communicating*)

Learning Experiences and Assessment Opportunities

How Big is Your Foot?

Students draw an outline of their shoe and mark the length to be measured by using markers such as a green dot at the start, and a red dot at the end.

Students then select an informal unit to measure the length of their shoe print.

Students repeat this process using a different informal unit and discuss why different results were obtained. They then record the results.

WM Measuring Cartoon Characters

In pairs, students are given large pictures of cartoon characters. They select and measure the length of different parts of the cartoon character eg the length of the leg.

Students identify and mark the starting point of each length with a green dot and the finishing point with a red dot.

Students select informal units such as toothpicks, popsticks and paper clips to measure, find a total by counting, and record their work.

Students then choose a different informal unit to measure the same length and compare the result to that obtained using their first unit.

Possible questions include:

- why did you get a different total for popsticks and paper clips?
- which informal unit was the most appropriate to measure the length of the leg?
- how will you record what you have found?

Ordering Lengths

Students guess which is the widest of three objects of similar width that cannot be easily moved eg the teacher's desk, the window, the cupboard. Students predict the order of the objects in terms of their width and check their prediction by measuring. Students use drawings, numerals and words to record their method and results.

Longer Than but Shorter Than

Students are asked to find as many objects as they can that are longer than three popsticks but shorter than four popsticks. The teacher observes students' methods. Students record their methods and findings.

Possible questions include:

- can you show me how long you think the object will be?
- can you make something that will help you to measure the objects quickly?

Curves

Students use chalk to draw a variety of curves on the ground. They measure the length of each curve using student-selected informal units. Students record and compare results.

Possible questions include:

- what can you use to measure the length of these curves?
- why did you choose that unit?
- which was the best unit to measure with and why?
- did you have any part left over when you measured the length?
- how would you describe the part left over?

Body Parts

In small groups, students use body parts as units of length. They record the results in a table and compare different students' measures of the same dimension.
eg

	Piero	Jane	Samir
width of table in foot lengths			
height of book case in hand spans			

Possible questions include:

- were your measurements the same? Why not?
- what could you use to measure more accurately?

How Many Hands?

In small groups, students make a tape measure that is calibrated using a handprint as a repeated unit.

This is done by tracing the hand of one group member. The teacher uses a photocopier to make multiple copies of the print for students to lay end-to-end and glue onto a long strip of paper.

Students use this tape to measure objects in the room eg a desk, the window, a chair, the bookcase.

Students record measurements on a large class chart.

As a whole class, students discuss their findings and explain:

- why different groups obtained different measurements for the same object
- their method for measuring
- how measurements were determined if the length of the object involved fractional parts eg $4\frac{1}{2}$ handprints.

Class Standard

Students discuss units that are more uniform than body measurements. Students select a uniform unit such as a chalkboard duster. In groups of four or five, students are provided with a duster and long strip of paper to make a tape calibrated with the informal unit. Students decide on a name for this unit. Students could use their tape to measure various objects and compare results with other groups.

WM Computer Lines

In pairs, students use Kidpix to draw lines of various lengths. They then use the stamp to measure the length of the line by repeated stamping along the line. Students compare and discuss their work.

Snakes Alive

Students make snakes from plasticine or playdough and measure them to the nearest centimetre using a tape measure. A partner then checks their measurement. Students compare results.

Variation: Students select a length and use estimation to make a snake of this length. Students check by measuring with a tape measure and record their results.

Possible questions include:

- was there a difference in length when your partner measured your snake? Why?
- how close was your estimation to the actual length?
- how did you estimate your length?

Hopping

Students work in groups of five. They use centimetres to measure the length of one hop for each student. Students record and compare measurements and repeat for other types of jumps. Students discuss their results.

Possible questions include:

- who can jump the furthest?
- does the tallest student jump the furthest?
- how accurate does your measuring need to be?
- how did you record your results to make comparison easy?

WM How Many in a Metre?

Students find the number of their hand spans in one metre. Students find the number of their foot lengths in one metre.

Students record their results in a table and discuss variations among students.

Half a metre

In pairs, one student folds their metre strip in half. Students use the half-metre strip to find objects that are less than half a metre, more than half a metre and about half a metre.

Lolly Wrappers

Students attempt to make the longest lolly wrapper strip by tearing the wrapper into a continuous strip. Students measure their strips to the nearest centimetre. Students compare results.

Variation: Apple peel could be used instead of a lolly wrapper.

How many ways can you make a metre?

Students are given a bag of streamers measuring from 10 cm to 1 metre, and a metre rule.

Students find streamers that together make 1 metre.

One Metre

Students each cut a strip of tape that is one metre long. Students use these to determine whether objects are more than one metre, less than one metre or about one metre in height, length or width. Students record results in a table.

The activity should be repeated for distances between objects.

less than 1 m	about 1 m	more than 1 m

Students discuss: 'Is a metre always a straight line?'

Possible questions include:

- can you estimate and then measure the length of these same objects using metres and centimetres?
- how did you check your estimations?

Resources

strips of paper, blocks, boxes, Base 10 tens, two teddy bears, plasticine, playdough, lolly wrappers, streamers, red and green dots, school shoes, toothpicks, popsticks, paper clips, chalk, glue, unifix cubes, computer

Links

Whole Numbers

Addition and Subtraction

Fractions and Decimals

Language

estimate, measure, metre, centimetre, length, distance, half-metre, end-to-end without gaps or overlaps, comparison, tallest, as tall as, not as tall as, shortest, shorter than, longest, longer than, straighter, widest, wider

'What's the difference between the length of the book and the pencil?'

'It looks like half a metre.'

'The door is two and a half metres tall.'

4.7 Area

Strand – Measurement

Syllabus Content p 97

MS1.2

Estimates, measures, compares and records areas using informal units

Key Ideas

Use appropriate informal units to estimate and measure area

Compare and order two or more areas

Record measurements by referring to the number and type of informal units used

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 1 content	Uses objects, diagrams, imagery and technology to explore mathematical problems	Describes mathematical situations and methods using everyday and some mathematical language, actions, materials, diagrams and symbols	Supports conclusions by explaining or demonstrating how answers were obtained	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 1 content

Knowledge and Skills

Students learn about

- comparing the areas of two surfaces that cannot be moved or superimposed eg by cutting paper to cover one surface and superimposing the paper over the second surface
- comparing the areas of two similar shapes by cutting and covering
- measuring area by placing identical informal units in rows or columns without gaps or overlaps
- counting informal units to measure area and describing the part left over
- estimating, comparing and ordering two or more areas using informal units
- drawing the spatial structure (grid) of the repeated units
- describing why the area remains constant when units are rearranged
- recording area by referring to the number and type of units used eg the area of this surface is 20 tiles

Working Mathematically

Students learn to

- select and use appropriate informal units to measure area (*Applying Strategies*)
- use computer software to create a shape and use a simple graphic as an informal unit to measure its area (*Applying Strategies*)
- explain why tessellating shapes are best for measuring area (*Communicating, Reasoning*)
- explain the structure of the unit tessellation in terms of rows and columns (*Communicating*)
- explain the relationship between the size of a unit and the number of units needed to measure area
  eg more tiles than workbooks will be needed to measure the area of the desktop (*Communicating, Reflecting*)
- discuss strategies used to estimate area eg visualising the repeated unit (*Communicating, Reflecting*)

Learning Experiences and Assessment Opportunities

WM Cover and Count

Students select one type of object to cover a given shape or area eg envelopes, lids, leaves, tiles, sheets of newspaper. They estimate, then count, the number of objects used.

Possible questions include:

- why are some objects better than others for covering?
- what can we do about the gaps?
- what can we do with the part left over?

This activity is repeated using areas of various sizes eg drink coasters, pin boards, desktops, the classroom floor.

WM Estimate and Check

Students draw a shape and colour the inside, to indicate the area of the shape. They then estimate and measure the area, stating the number and type of informal units used. Students discuss if another unit would be more suitable.

Students investigate and record findings using other units.

Possible questions include:

- which informal unit did you find more appropriate to estimate and measure the area of your shape? Why?
- what would you use to measure the area of your desktop? Why? How would you do it?
- can you record your findings?

Variation: Students could use Kidpix or other drawing applications to draw their shape and use stamps to fill the area.

Rugs

The teacher shows the students a collection of 4 or 5 small rugs. The teacher then poses the problem:

'I want to use one of these rugs for my pet dog/cat. Which one will give my pet the largest area to lie on?'

Students estimate which rug has the largest area.

In small groups, students select materials to cover the rugs to measure which one has the largest area.

Hands and Feet

The teacher poses the question: 'Which has the bigger area- your foot or your hand?' Students trace around one of their feet and one of their hands and use grid overlays (same shape) to find the area of each part. Students then compare their results to determine who has the biggest hand and/or foot in the class.

Possible questions include:

- does the person with the biggest foot have the biggest hand?
- how much bigger is your foot than your hand?

Table Tops

In small groups, students select an informal unit and calculate the area of the top of the desk.

Students are provided with a variety of materials to use as informal units eg paper plates, sheets of paper/cardboard, tiles.

The teacher takes digital photographs of student methods, particularly where students are overlapping units, leaving gaps, or not starting or finishing at the edge of the desk.

Photographs are displayed for discussion.

Possible questions include:

- what interesting things do you notice about the way groups measured the top of the desk?
- did each group measure the whole area?
- if two groups used the same item to cover the desk, why might they have different answers?

What can it be?

The teacher poses the problem: 'I measured an item from our room and found that it had an area of 10 tiles. What could it be?'

Students brainstorm items that it might be and then, in pairs, use tiles to measure the area of the items.

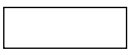
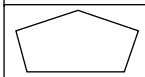
A class list of items with an area of 10 tiles is compiled. Students discuss how they chose which items to measure.

Possible questions include:

- can you compare how you measured the area of the book and the desk?
- which was easier? Why?
- which unit have you found to be more accurate? Why?

Estimation

Students select a shape or tile to use as a unit to compare the area of different shapes. They estimate the number of units required to completely cover a shape, check and record their results in a table.
eg

Shape	Unit	Number of Units	
		Estimate	Measurement
	□		
	□		

Possible questions include:

- did you have any parts left over?
- what would you call these parts?
- were these parts included in your count?
- how could you make sure that these parts are included next time?

Shadows

Students work in groups of three or four to trace the outline of each other's shadow on the playground using chalk. The teacher provides students with different-sized lids. Each group selects a lid to trace around. Students are asked to cover each shadow with outlines of their lid to find the area.

eg 'The area of my shadow is about 14 ice cream lids.'

Students compare the area of their shadow with those of others and discuss whose shadow has the biggest/smallest area.

Possible questions include:

- did your lid-shape leave gaps?
- is there a shape that would have been better to use? Why?

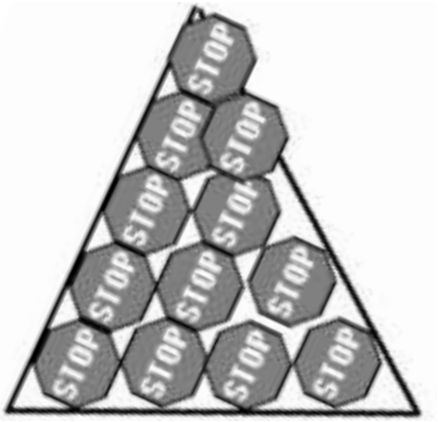
WM Stamping

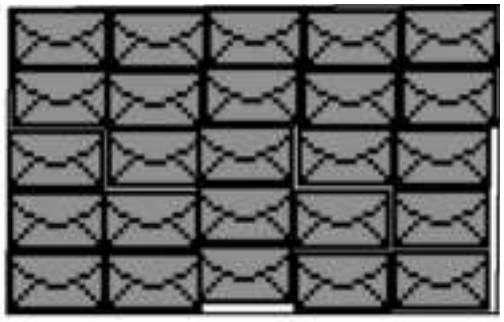
Using a computer drawing package, students are asked to draw a large shape (A). They then select a smaller shape or picture to use as a 'stamp'. Students 'stamp' the smaller shape inside the larger one, without gaps or overlaps.

Possible questions include:

- how many of the smaller shapes did you fit in your larger shape?
- can you work this out without counting each shape one-by-one?

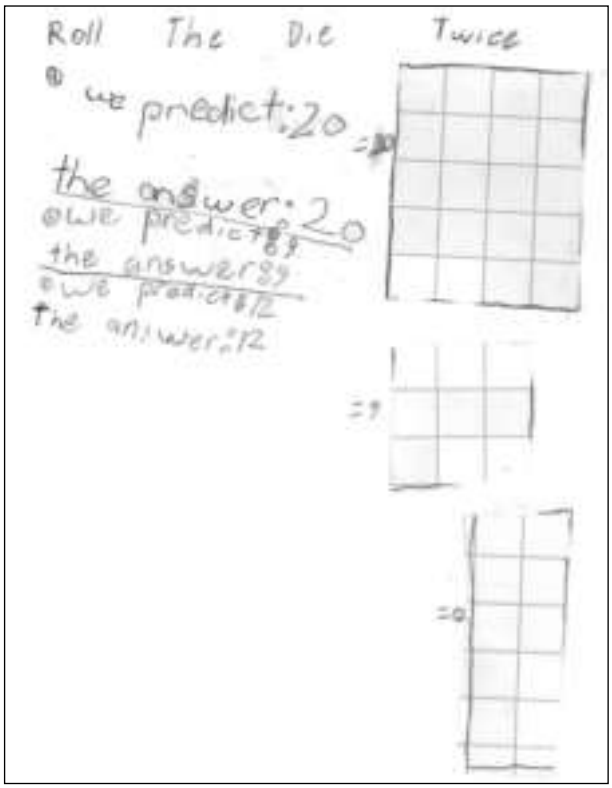
Students repeat this activity by creating a second large shape (B). They then compare the shapes A and B and determine which is larger. They discuss their method of comparison. Some students may have compared the number of 'stamps' on each shape, but if they used different 'stamps' they need to reflect on the importance of using the same 'stamp' to compare.





WM Roll the Die Twice

Student A rolls a die to find out how many square tiles to put along the top row of an array. Student B rolls the die to find how many rows to make. The teacher encourages students to predict how many tiles will be needed to complete the array after the second row. Students make the array and draw the pattern on grid paper. Students repeat the game at least twice more. Students cut out arrays drawn on grid paper and order them.



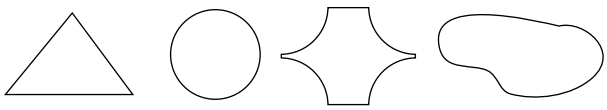
Grid Overlays

Students measure the area of a handprint using a grid overlay made from an overhead transparency. They then record the type of grid and the measurement in a table. Students repeat the activity using different grids
eg

Grid Unit	Estimate	Area of Handprint
Small square		
Triangle		
Hexagon		

Students discuss which type of grid was the best and why.

Students use a similar table to record measurements of the areas of other shapes eg



Rectangles

Students are given 12 square tiles. They create a rectangle with an area of 12 tiles.

Students draw their rectangles on grid paper then rearrange the tiles to create as many different shapes as they can, with the area remaining unchanged. They record them on grid paper. Students discuss strategies used to create their shapes.

Extension: Students create further shapes, selecting different units to measure area, and record them on grid paper eg Δ = 1 unit, $\square$ = 1 unit. Students are asked about the number of units needed to cover their shapes.

Patchwork Quilts

The teacher poses the problem: 'Emma made a patchwork quilt with 24 rectangles and Trent made one with 12 squares. Which quilt was bigger?'

The teacher provides students with copies of rectangles so that 1 square = 2 rectangles. Students discuss their predictions with a partner. One person makes Emma's quilt and the other makes Trent's quilt. Students compare their quilts.

Possible questions include:

- what if 2 squares = 1 rectangle?
  (Adapted from CMIM)

Conservation

Students are provided with two identical shapes. One shape could be mounted on cardboard and covered with plastic. The students are asked to cut the other shape into two, three or four pieces.

Students predict whether the pieces will fit on top of the first shape and explain why they think so. It is important that the students are not corrected if they believe the shape will not fit, but rather allowed time for investigation.

Students test their prediction by covering the cardboard shape.

Students could put their puzzle pieces in an envelope for others to try.

WM Class Notice Board

Students estimate how many student paintings (of the same size) would fit on a notice board/display area in the classroom. The teacher selects students to hang their paintings without gaps or overlaps. Students count paintings displayed.

Possible questions include:

- how many paintings could we fit on the notice board/display area?
- are there any paintings that hang over? If so, how can we count them?
- is there a way we could count all of the paintings without counting each painting one-by-one?

Resources

rectangle printed on paper or cardboard, shapes copied on opposite sides of paper, grid overlays (different shapes), various-sized tables, dice, tiles, rectangle/square cut-outs, tracing paper, paper plates, A4 sheets of paper, chalk, various-sized rugs, different-shaped or different-sized tiles, envelopes, lids, leaves, tiles, newspapers, drink coasters, pin board, shapes, camera

Links

Fractions and Decimals

Length

Whole Numbers

Addition and Subtraction

Multiplication and Division

Language

area, shape, inside, outside, open, closed, bigger, smaller, pattern, grid, array, same, superimposed, surface area, estimate, measure, cover, overlap, surface, area, side-by-side without gaps or overlaps, tessellating shapes

'There are some gaps between these shapes.'

'The shapes don't leave any gaps.'

'I used twelve rectangles to measure this book.'

'There are some gaps between these shapes.'

'I think triangles would be best to cover this area because they can fit in the corners.'

'The pieces went over the edge.'

4.8 Volume and Capacity

Strand – Measurement

Syllabus Content p 103

MS1.3

Estimates, measures, compares and records volumes and capacities using informal units

Key Ideas

Use appropriate informal units to estimate and measure volume and capacity

Compare and order the capacities of two or more containers and the volumes of two or more models or objects

Record measurements by referring to the number and type of informal units used

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 1 content	Uses objects, diagrams, imagery and technology to explore mathematical problems	Describes mathematical situations and methods using everyday and some mathematical language, actions, materials, diagrams and symbols	Supports conclusions by explaining or demonstrating how answers were obtained	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 1 content

Knowledge and Skills

Students learn about

- estimating volume or capacity using appropriate informal units
- measuring the capacity of a container by:
  - counting the number of times a smaller container can be filled and emptied into the container
  - filling the container with informal units (eg cubes) and counting the number of units used
- comparing and ordering the capacities of two or more containers by:
  - filling one container and pouring the contents into another
  - pouring the contents of each of two containers into a third container and marking each level
  - measuring each container with informal units and comparing the number of units needed to fill each container
- calibrating a large container using informal units eg filling a bottle by adding cups of water and marking the new level as each cup is added
- packing cubic units (eg blocks) into rectangular containers so there are no gaps
- estimating the volume of a pile of material and checking by measuring
- comparing and ordering the volumes of two or more models by counting the number of blocks used in each model
- comparing and ordering the volumes of two or more objects by marking the change in water level when each is submerged
- recording volume or capacity by referring to the number and type of informal units used

Working Mathematically

Students learn to

- explain a strategy used for estimating capacity or volume (*Communicating*)
- select an appropriate informal unit to measure and compare the capacities of two containers eg using cups rather than teaspoons to fill a bucket (*Applying Strategies*)
- explain that if a smaller unit is used then more units are needed to measure eg more cups than ice cream containers are needed to fill a bucket (*Communicating, Reasoning*)
- solve simple everyday problems using problem-solving strategies including trial and error (*Applying Strategies*)
- devise and explain strategies for packing and counting units to fill a box eg packing in layers and ensuring there are no gaps between units (*Communicating, Applying Strategies*)
- recognise that cubes pack and stack better than other shapes (*Reflecting*)
- recognise that containers of different shapes may have the same capacity (*Reflecting*)
- recognise that models with different appearances may have the same volume (*Reflecting*)
- recognise that changing the shape of an object does not change the amount of water it displaces (*Reflecting*)

Learning Experiences and Assessment Opportunities

Macaroni Match

Students are asked to pack three or more different containers with macaroni, and then order the capacities of the containers by:

- packing the contents of each container into another container separately
- swapping the contents of each container.

The activity can be repeated using other items eg by packing lunch boxes into cartons, marbles into cups, or cubes into boxes.

Is it full?

Students fill a container with marbles, peas or beads and discuss whether it is full or not full, and whether there are any spaces. Students discuss that some materials fill or pack without gaps.

Students select an appropriate type of object and predict if it will fill a container without leaving spaces. They are then asked to explain why they think this.

Dump or Pack?

In small groups, students fill an ice cream container with plastic cubes by each of two methods:

- picking up the cubes in handfuls and dumping them into the container
- packing the cubes into the container by placing them neatly next to each other and building up the layers.

Students record the number of cubes used for each method.

Possible questions include:

- which method of filling gives you more items?
- what products do you buy at the supermarket that are packed/loosely bagged?
- which shaped item gives you more product if it is packed?

To the Mark

Students pour water into clear plastic containers up to a particular level marked with a felt pen. Students repeat with different filling material.

Students discuss actions and results, describing how they ensured that the material was level with the mark.

Tower Twist

In small groups, students build two towers using the same number of interlocking plastic cubes. Groups then exchange towers and remake the tower by moving cubes to change the shape. The towers can be passed through a number of groups, each making changes. Towers are displayed next to each other. Students compare the towers and describe how they are different. Students draw their construction and record the number of cubes used for each of the towers.

WM Pour and Order

Students are asked to compare and order the capacities of containers eg a cup, a jug and a pan.

Students are encouraged to use their own methods. Students may fill one container and pour the contents into another container, or pour the contents of each of the containers into a third larger container and mark each level.

Possible questions include:

- how did you estimate the capacity?
- what can you use to measure and compare the capacities of two containers?
- can you order the capacities?

Different Cups

The teacher collects cups of different shapes and sizes and ice-cream containers of the same size. Each pair of students has a different cup and an ice cream container. Students are asked to fill the ice cream container with water using repeated cupfuls and record how many cups it took to fill the container.

Possible questions include:

- why did we all get different numbers of cups?
- whose cup needed the most cupfuls to fill the container ?
- whose cup needed the least cupfuls to fill the container?
- can you explain and record your findings?
- does this container have the same capacity as that one?

Students record the activity on a picture graph showing the different types of cups.

Filling with Prisms and Spheres

In small groups, students fill containers with rectangular prisms eg blocks, boxes and cubes. Students then fill containers with spheres eg marbles, golf balls and tennis balls. Students record the results for each material and discuss the difficulties they had in packing spheres. The teacher could suggest containers that would be suitable for packing spheres.

Possible questions include:

- how can you fill this box? What will you use? Why?
- which shapes will pack and stack without leaving spaces?

Calibrating Bottles

Students use a cup or similar measuring device to calibrate a larger container. Each time a cup of filling material is poured into the container, the student marks the level with a felt marker. Students discuss actions and results, describing the difference that the filling material made to the level eg compare water and marbles.

Comparing Containers

Students are given the same-sized sheet of thin cardboard and are asked to make a container that will hold rice. Students should be encouraged to create their own design.

In small groups, students compare containers and explain how they were made.

Possible questions include:

- whose container will hold the most/least rice?
- how could you work this out?

Groups are then given a bag of rice to compare the capacity of each container and order them from 'holds the most' to 'holds the least'.

Students repeat the activity with different filling material.

WM Displacement

Students are provided with a variety of materials to place in water, and small identical cups to collect the overflow.

Part A

Students stand a large container in a tray and fill it to the brim. Students predict what will happen when an object is placed in the container. They collect the overflow and pour it into a cup. They repeat the activity using different materials, each time collecting the overflow in separate cups. Students compare the cups and form conclusions.

Part B

Students partly fill a clear container with water and mark the level on the side with a felt pen. They immerse one stone and mark the new water level. They remove the stone and repeat, using different materials marking the new water level each time with different-coloured marks. Students compare the water levels marked and discuss results.

Extension: Students place 10 large interlocking cubes or blocks individually into a container and collect the overflow. They then make a model using the 10 cubes or blocks and repeat the activity.

Possible questions include:

- do you get the same result when you put the cubes in individually?
- how much water was displaced each time?

Smart Box

Students are given a box of Smarties that is packed to the top in layers. Students are asked: 'If you could create a Smartie of any shape, which shape Smartie would give you the most chocolate?'

Students discuss the different packaging for crisps, cereal, and small packs of lollies.

Resources

macaroni, pasta, lunch boxes, marbles, cups of different sizes, cubes, boxes, ice cream containers, golf balls, tennis balls, Smarties, chip packets, cereal boxes, packs of lollies, felt pens, interlocking cubes, jug, pan, rice, cardboard

Links

Multiplication and Division

Addition and Subtraction

Data

Language

capacity, volume, contain, size, level, thin, thick, tall, short, deep, shallow, sink, float, round, curved, flat, straight, heavy, light, least, most, exactly, wide, narrow, inside, under, below, above, even, level with, enough, not enough, holds more, holds less, packing, stacking, comparing, ordering, estimating, measuring, pouring, filling

4.9 Two-dimensional Space

Strand – Space and Geometry

Syllabus Content p 125

SGS1.2

Manipulates, sorts, represents, describes and explores various two-dimensional shapes

Key Ideas

Identify, name, compare and represent hexagons, rhombuses and trapeziums presented in different orientations

Make tessellating designs using flips, slides and turns

Identify a line of symmetry

Identify and name parallel, vertical and horizontal lines

Identify corners as angles

Compare angles by placing one angle on top of another

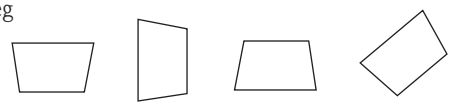
WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 1 content	Uses objects, diagrams, imagery and technology to explore mathematical problems	Describes mathematical situations and methods using everyday and some mathematical language, actions, materials, diagrams and symbols	Supports conclusions by explaining or demonstrating how answers were obtained	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 1 content

Knowledge and Skills

Students learn about

- manipulating, comparing and describing features of two-dimensional shapes, including hexagons, rhombuses and trapeziums
- using the terms 'sides' and 'corners' to describe features of two-dimensional shapes
- sorting two-dimensional shapes by a given attribute eg number of sides or corners
- identifying and naming hexagons, rhombuses and trapeziums presented in different orientations
  eg



- identifying shapes found in pictures and the environment
- making representations of two-dimensional shapes in different orientations, using drawings and a variety of materials
- joining and separating an arrangement of shapes to form new shapes
- identifying a line of symmetry on appropriate two-dimensional shapes
- making symmetrical designs using pattern blocks, drawings and paintings
- making tessellating designs by flipping, sliding and turning a two-dimensional shape
- identifying shapes that do, and do not, tessellate
- identifying and naming parallel, vertical and horizontal lines in pictures and the environment
- identifying the arms and vertex of the angle in a corner
- comparing angles by placing one angle on top of another

Working Mathematically

Students learn to

- select a shape from a description of its features (*Applying Strategies, Communicating*)
- visualise, make and describe recently seen shapes (*Applying Strategies, Communicating*)
- describe objects in their environment that can be represented by two-dimensional shapes (*Communicating, Reflecting*)
- identify shapes that are embedded in an arrangement of shapes or in a design (*Applying Strategies*)
- explain the attribute used when sorting two-dimensional shapes (*Communicating*)
- use computer drawing tools to complete a design with one line of symmetry (*Applying Strategies*)
- create a picture or design using computer paint, draw and graphics tools (*Applying Strategies*)
- manipulate an image using computer functions including 'flip', 'move', 'rotate' and 'resize' (*Applying Strategies*)
- describe the movement of a shape as a single flip, slide or turn (*Communicating*)
- recognise that the name of a shape doesn't change by changing its orientation in space (*Reflecting*)

Learning Experiences and Assessment Opportunities

WM Sorting Shapes

Students are given a collection of regular and irregular shapes with three sides, four sides, five sides and six sides.

Students are asked to sort the shapes into groups according to the number of sides. Students select one of the groups and arrange the shapes to form a picture.

Students write a description of their picture, commenting on the shapes they have used.

Possible questions include:

- can you show me how to draw and name each shape?
- what can you tell me about each shape?
- how are these shapes different/the same?

Making Shapes

In small groups, students are given a die and straws of two different lengths.

In turn, students roll the die and make a shape with the corresponding number of sides. Students are encouraged to make regular and irregular shapes.

Students name each shape, and record their shapes in appropriate groups.

Students discuss the difficulties encountered in making a shape when they roll a 1 or a 2, and develop a new rule for the game. For example, students may decide that a turn is missed if a 1 or a 2 is rolled.

New Shapes from Old Shapes

Students are given a variety of regular and irregular shapes.

Students are asked to:

- arrange two or more shapes to create a new shape eg combine 6 triangles to form a hexagon
- cut a square into four triangles and put the triangles together to make other shapes eg a rectangle
- cut a rectangle into two triangles and create new shapes.

Students describe and record what they have done. Some students might use fraction language in their description.

WM Shape Symmetry

Students find shapes that have a line of symmetry by folding the shapes in half. In pairs, they are given a collection of regular and irregular shapes that could include squares, rectangles, triangles, trapeziums, rhombuses, hexagons and circles.

Possible questions include:

- which shapes can be folded in half?
- which shapes can be folded in half in a different way?
- which shapes do not have a line of symmetry?

Students glue their shapes onto paper and record their findings.

Lines and Shapes in the Environment

Students identify lines and shapes in the classroom and playground eg the flag pole, a telegraph pole, the edge of the roof, the edge of the floorboards.

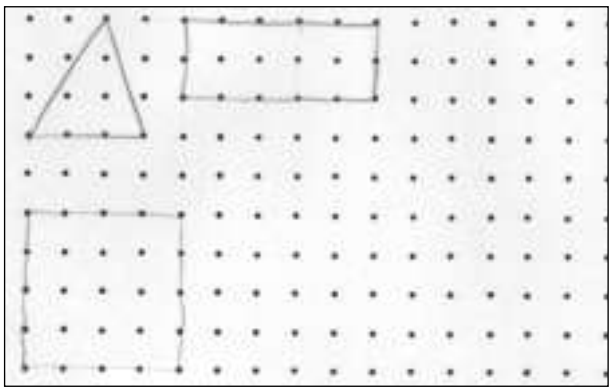
Students discuss and record their observations. They are encouraged to identify the most commonly occurring shapes, and horizontal and vertical lines.

Make a new shape

In pairs, students are provided with geoboards and elastic bands.

The teacher draws a triangle on the board and asks Student A to 'make this shape on your geoboard'. The student names the shape and states the number of sides. Both students draw and label the shape on dot paper.

Student B is then asked to add another side to the triangle on the geoboard. They name the new shape and state the number of sides. Again, both students draw and label the shape on dot paper.



Tessellation

In small groups, students select a shape (eg square, circle, triangle, hexagon, rhombus, trapezium) to investigate whether it tessellates.

Students trace around the shape and slide it to a new position attempting to cover the surface without leaving gaps.

Students share their drawings. They group the shapes according to those that tessellate and those that do not.

Corners as Angles

Part A

Students use one corner of a large cardboard square or rectangle to find other corners of the same size eg the corner of the classroom, the corner of a book. They then find angles that are smaller or larger than the corner of the square.

Part B

In pairs, students are given a selection of regular shapes including squares, rectangles, and triangles to compare the angles at the corners by superimposing one over the other. They could sort the shapes according to the size of the angles eg the same as a square, larger than a square, smaller than a square. Students then discuss and record results.

Geoboard Shapes and Angles

In pairs, students use geoboards and elastic bands to create shapes and discuss which shapes have the most sides and the most corners.

Students investigate angles on the geoboard and compare the number of sides and corners of the shapes they have created.

Students transfer shapes to dot paper and record the name of the shape, the number of sides and the number of corners.

Possible questions include:

- how can you describe the angles at the corners of each shape?
- are the angles at the corners of each shape the same or different?
- what happens when you place an angle from a square on top of an angle at the corner of a hexagon?
- can you describe the difference?

Barrier Symmetry

Student A makes a symmetrical design using pattern blocks. They describe it to Student B who attempts to replicate it.

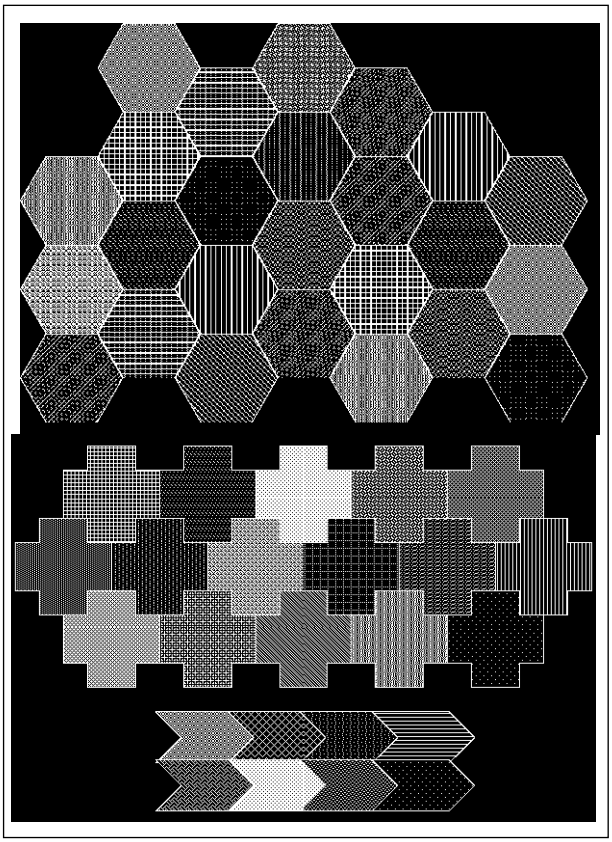
This process is repeated with the students swapping roles. Students should be encouraged to use appropriate language, including the names of the shapes and positional language.

WM Tessellating Designs on a Computer

In pairs, students create tessellating designs using a computer drawing program.

Students use the computer drawing tools to make a shape and then duplicate it to see if it tessellates.

Students print their designs and compare them with those made by other students.



Angle Hunt

In pairs, students find angles around the room that are larger, smaller or the same size as an angle tester made from cardboard or geostrips. Results could be recorded in a table.

Weaving Lines

The teacher provides students with several strips of paper in two colours to weave together.

Students identify and comment on the types of lines they have created eg straight lines, crossed lines, horizontal lines, vertical lines, parallel lines.

Variation: Students could make the loom with wavy lines.

Possible questions include:

- can you identify and name parallel, vertical and horizontal lines?

Flags

The teacher provides a number of flags for students to investigate symmetry.

In pairs, students choose flags from those displayed, determine which are symmetrical, and give reasons for their choice.

In pairs, students design their own symmetrical flags and display these for others to determine the lines of symmetry.

Alphabet Symmetry

In pairs, students cut out and fold capital letters in different ways to investigate their symmetry. They are then asked to glue the symmetrical letters onto one sheet of paper and the non-symmetrical letters onto another sheet.

Some letters have more that one line of symmetry. Students compare and discuss their responses.

Possible questions include:

- does any student in the class have a name with letters that are all symmetrical? eg TOM

WM Flip, Slide and Turn

In pairs, students make a design by placing a pattern block on paper, tracing around it and then flipping, sliding or turning the block to a new position and repeating the process.

Possible questions include:

- is your pattern different when you flip, slide or turn?
- which patterns are symmetrical? Why?
- how did you make your pattern?

Students combine the movements of flipping, sliding and turning in a variety of ways to create different designs.

Students describe the designs they have created and explain how they were made using the language of 'flip', 'slide' and 'turn'.

Creating Angles

Students construct a variety of angles using cardboard strips or geostrips.

Students are asked to make:

- an angle and then make one that is smaller and one that is larger
- an angle that looks like the corner of a square
- angles of the same size but with arms of various lengths
- an angle that looks like one made by another student.

Results can then be recorded in a table.

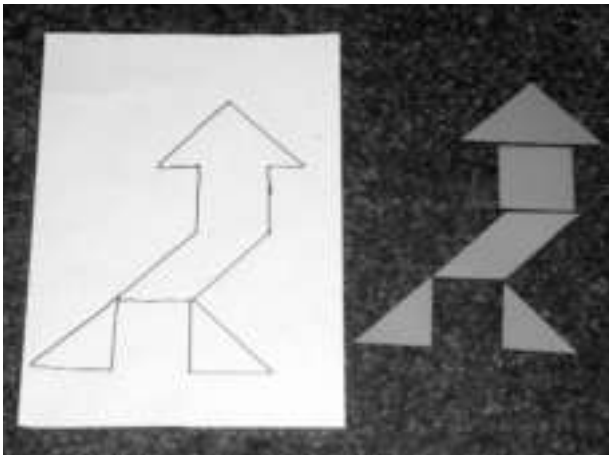
WM Five-Piece Puzzle Pictures

The teacher provides a five-piece 'tangram' for students to cut out.

Possible questions include:

- which shapes are in the puzzle?
- can you put the pieces back together to make a square?

Students make a picture using the five pieces, trace around the picture, and ask a peer to reconstruct it.



Resources

dice, five-piece 'tangram', cardboard, coloured paper, pattern blocks, bathroom tiles, foam blocks, regular and irregular shapes, alphabet letters, variety of regular and irregular shapes, geoboards, elastic bands, pattern blocks, mirrors, mira mirrors, scissors, elastic bands, computer, flags, geostrips

Links

Visual Arts

Fractions and Decimals

Three-dimensional Space

Language

symmetry, symmetrical, mirror, reflect, hexagon, rhombus, trapezium, flip, slide, turn, parallel, vertical, horizontal, angles, two-dimensional, symmetry, shapes, reflections, circle, oval, square, triangle, trapezium, rhombus, hexagon, angle, symmetry, two-dimensional, tessellation, arm, vertex, parallel

'This shape is balanced on each side.'

'All my shapes have four corners and four sides.'

'This shape has six sides.'

'The edges of the path are parallel.'

'A circle has lots of lines of symmetry.'

'When you flip a shape it is the same but backwards.'

4.10 Position

Strand – Space and Geometry

Syllabus Content p 135

SGS1.3

Represents the position of objects using models and drawings and describes using everyday language

Key Ideas

Represent the position of objects using models and drawings

Describe the position of objects using everyday language, including 'left' and 'right'

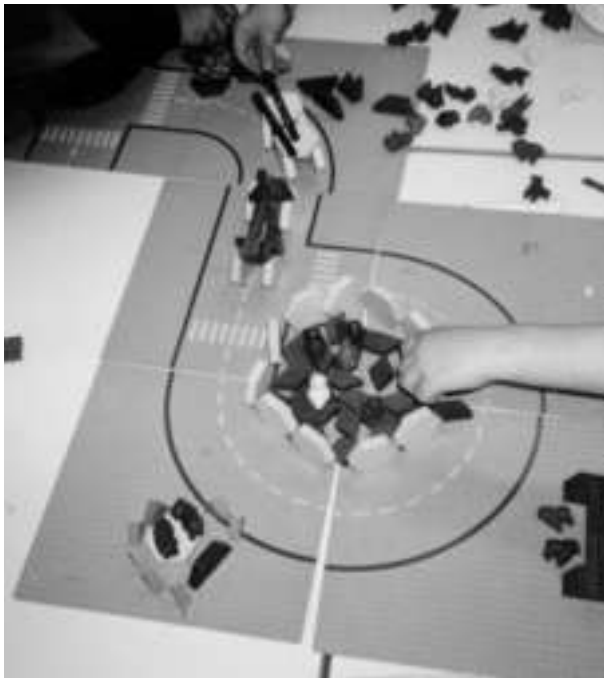
WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 1 content	Uses objects, diagrams, imagery and technology to explore mathematical problems	Describes mathematical situations and methods using everyday and some mathematical language, actions, materials, diagrams and symbols	Supports conclusions by explaining or demonstrating how answers were obtained	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 1 content

Knowledge and Skills

Students learn about

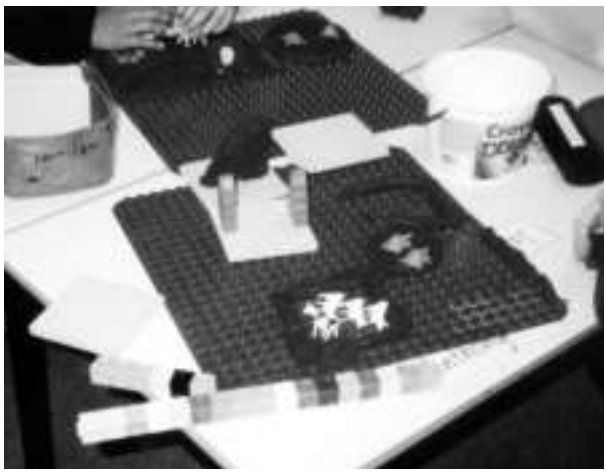
- making simple models from memory, photographs, drawings or descriptions
- describing the position of objects in models, photographs and drawings
- drawing a sketch of a simple model
- using the terms 'left' and 'right' to describe the position of objects in relation to themselves
  eg 'The tree is on my right.'
- describing the path from one location to another on a drawing
- using drawings to represent the position of objects along a path



Working Mathematically

Students learn to

- give or follow instructions to position objects in models and drawings eg 'Draw the bird between the two trees.' (*Communicating*)
- use a diagram to give simple directions (*Applying Strategies, Communicating*)
- give or follow simple directions using a diagram or description (*Applying Strategies, Communicating*)
- create a path using computer drawing tools (*Applying Strategies, Reflecting*)



Learning Experiences and Assessment Opportunities

WM Model of a Farm

In small groups, students make a model of a farm using small toys, pictures and junk materials.

Students are asked to describe the position of objects in relation to other objects eg 'The horses are next to the cows', 'The stable is behind the farmhouse.'

Students make a sketch of their model and plan a path the farmer could take each morning to ensure he feeds all of the animals.

Students could act out the path on the model and record the path on the sketch.

Variation: In pairs, students work on a computer and use simple shapes from a draw program to draw one of their sketched models. A line tool could be used to trace a route or path.

Possible questions include:

- can you sketch a model a friend has constructed?
- can you describe the position of objects in your model?
- what objects are on the left of the house? right of the house?

Memory Model

Students walk around the school observing the main buildings, landmarks and pathways.

In small groups, students use blocks, small boxes and junk materials to reconstruct a model of the school from memory.

Students are asked to identify the main features of their model eg 'This is the play equipment.'

Possible questions include:

- can you describe the position of features in relation to other features? eg 'The toilets are next to the play equipment.'
- can you demonstrate and describe the route taken to get to particular parts of the school?
- can you sketch your model and mark special routes onto your sketch in different colours?

Partner Left and Right

In pairs, facing each other, students follow a pattern for clapping eg 'Clap right hands together, left hands together, then both hands together.'

Possible questions include:

- what do you notice when you both clap left hands together?

Students learn some dances involving a clapping sequence with students facing each other in pairs eg 'Heel and Toe Polka'. Students could also learn other dances involving linking arms and moving right or left.

WM Where am I Going?

In pairs, Student A sketches a known route and describes it to Student B. Student B then guesses the destination from the described route. Student B checks their guess by looking at the route on the sketch.

Model from a Photograph or Map

The teacher accesses an aerial photograph or a tourist-style map eg a map of the zoo, a local town.

Students make a simple model from the photograph or map using small toys, blocks and junk materials.

Students discuss the position of objects in relation to other objects.

Possible questions include:

- can you plan a route that takes you from one location to another? Discuss the differences and similarities between various routes.
- what difficulties did you encounter when you built your model?

Model Town

In small groups, students are asked to list the main places in their community eg the supermarket, the fire station, homes, the playground. They then make a simple model of their community using a variety of materials.

Students reflect and justify the position of the main places in their community eg 'The supermarket should be where everyone can get to it.'

Students could then plan a bus route so that all children can get to school, or a fitness walk through the town.

Possible questions include:

- what is the shortest possible route?
- can you mark the quickest route for the fire engine to reach the school?
- how can you describe the position of the objects in your model?

Find my Special Place

In pairs, students select a 'special place' near the classroom or in the school. They write instructions using left and right turns and include references to special features and landmarks to lead to their special place.

Students swap instructions and then try to locate their partner's special place.

On the Left, On the Right

The teacher and students identify a variety of situations where 'left' and 'right' always apply.

Possible situations include:

- when entering our toilets, girls are on the left and boys are on the right.
- on the left side of the chalkboard are reading groups and on the right side of the chalkboard is mathematics.
- the left-hand door goes to the office, the right-hand door goes to the staffroom.

Left Foot, Right Foot

Students make re-usable tags from coloured lengths of wool, a strip of fabric or pipe cleaners that can be attached to shoelaces when playing games or dancing. A coloured tag can be attached to clothing with a safety pin to mark the left or right side of the body.

Students participate in activities involving left and right concepts, such as:

- kicking a ball using the left or right foot only.
- dancing the 'Hokey Pokey'.
- acting out songs and rhymes that use left or right body parts.

Moving to the Left or Right

The teacher identifies situations that are part of normal routine where the students turn left or right to reach a destination.

For example, 'Turn right off the assembly area to go to our room', 'Turn right at the corner to go to the library.'

In pairs, students record a series of instructions using left and right to move around the school and then back to the classroom. They give the instructions to another pair of students to follow. Students then discuss the effectiveness of their instructions.

Left Hand, Right Hand

Students make re-usable wrist tags or bracelets in an identifying colour to use when playing games and dancing eg lemon for left and red for right.

Students participate in games and dances involving left and right concepts eg catch and throw a ball using the left or right hand only.

WM Spreadsheet Directions

Part A

In pairs, students work on the computer using a spreadsheet program. Student A puts their name or initials in a cell. Student B chooses a different cell on the page, and puts their name or initials in it. The students take turns in finding a path from A to B, by using the arrow keys and placing an × in every cell they have used to create the path.

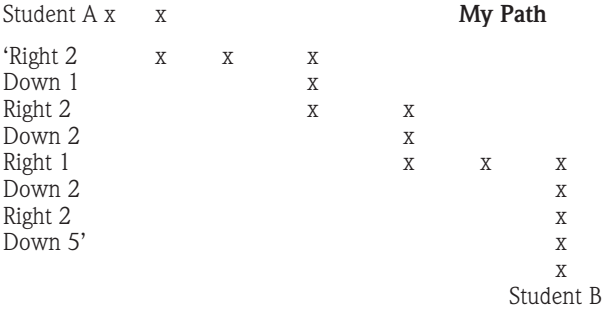
Possible questions include:

- can you find a longer /shorter path?
- can you write directions for a stepped path?
- is there a more direct route?
- can you create a path with 20 steps?

Variation: Students use other computer drawing programs or tools to create paths and designs such as regular or irregular shapes.

Part B

Students plan a path using grid paper. They write directions using the terms 'up', 'down', 'left', 'right' and 'across'. In pairs at the computer, students open a spreadsheet program. Student A tells Student B where to put the Xs for the start and finish positions. While Student A gives the directions, Student B plots the path by placing an x in every cell using the arrow keys to move. Student A checks Student B's path on the computer against the one they previously drew on grid paper. They then swap roles.



Resources

aerial photo or tourist-style map; materials to make a simple model; Lego; toys, pictures and junk materials to make a model of a farm; blocks; small boxes; wrist tags; balls; Hokey Pokey music; grid paper; computer; spreadsheet program

Links

Two-dimensional Space

PDHPE

Language

position, describe, left, right, between, path, map, above, across, along, around, after, back, before, behind, below, beneath, beside, between, centre, close, down, far, forward, further, further away, here, in, in front of, inside, into, last, low, middle, near, next, next to, on, onto, on top, turn, under, underneath, up, upside down, chart, direction, route, sketch, turn, backwards

'When you get to the seats turn left and keep walking.'

'I went forward about ten steps and then turned around the corner of the building.'

Stage 2
Sample Units of Work

5.1 Whole Numbers

Strand – Number

Syllabus Content p 44

NS2.1

Counts, orders, reads and records numbers up to four digits

Key Ideas

Use place value to read, represent and order numbers up to four digits

Count forwards and backwards by tens or hundreds, on and off the decade

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 2 content	Selects and uses appropriate mental or written strategies, or technology, to solve problems	Uses appropriate terminology to describe, and symbols to represent, mathematical ideas	Checks the accuracy of a statement and explains the reasoning used	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 2 content

Knowledge and Skills

Students learn about

- representing numbers up to four digits using numerals, words, objects and digital displays
- identifying the number before and after a given two-, three- or four-digit number
- applying an understanding of place value and the role of zero to read, write and order numbers up to four digits
- stating the place value of digits in two-, three- or four-digit numbers eg 'in the number 3426, the 3 represents 3000 or 3 thousands'
- ordering a set of four-digit numbers in ascending or descending order
- using the symbols for 'is less than' (<) and 'is greater than' (>) to show the relationship between two numbers
- counting forwards and backwards by tens or hundreds, on and off the decade
  eg 1220, 1230, 1240 (on the decade);
  423, 323, 223 (off the decade)
- recording numbers up to four digits using expanded notation eg 5429 = 5000+400+20+9
- rounding numbers to the nearest ten, hundred or thousand when estimating

Working Mathematically

Students learn to

- pose problems involving four-digit numbers (*Questioning*)
- identify some of the ways numbers are used in our lives (*Reflecting*)
- interpret four-digit numbers used in everyday contexts (*Communicating*)
- compare and explain the relative size of four-digit numbers (*Applying Strategies, Communicating*)
- make the largest and smallest number given any four digits (*Applying Strategies*)
- solve a variety of problems using problem-solving strategies, including:
  - trial and error
  - drawing a diagram
  - working backwards
  - looking for patterns
  - using a table (*Applying Strategies, Communicating*)

Learning Experiences and Assessment Opportunities

Counting Races

Students are divided into two groups. The teacher nominates a starting number eg 231. One group counts by tens, while the other counts by hundreds from the starting number. Both groups start counting and are asked to stop at the same time.

Before commencing the activity, students discuss:

- will both groups start/finish on the same number? Why?
- which group will stop on the highest number? Why?
- will both groups count number 281? Why?/Why not?
- what are some of the numbers both groups will count?
- what is a number only your group will count?

Variation: Students play 'Buzz' counting by tens on and off the decade. They 'buzz' on the hundreds.

WM Three- and Four-Digit Numbers

In small groups, students use a pack of playing cards with the tens and picture cards removed. The Aces are retained and count as 1 and the Jokers are retained and count as 0. Student A turns over the first 3 cards and each player makes a different three-digit number. Student A records the numbers and puts the cards at the bottom of the pile. They each take a turn turning over three cards and recording the group's three-digit numbers. When each student has had a turn they sort and order their numbers. Students extend the game by making four-digit numbers.

Possible questions include:

- can you read each number aloud?
- can you order the numbers in ascending and descending order?
- can you state the place value of each numeral?
- what is the largest/smallest number you can make using three cards/four cards?
- what is the next largest/smallest number you can make using three cards/four cards?
- can you identify the number before/after one of your three digit/four-digit numbers?
- can you find a pattern? How can you describe your pattern? How can you continue the pattern?
- how many different ways can you represent each number? (expanded notation, in words)
- can you count forwards/backwards by tens/hundreds from one of your three-digit/four-digit numbers?
- can you round one of your three-digit or four-digit numbers to the nearest hundred/thousand?

Variation: Students could represent numbers using numeral expanders, Base 10 material, or expanded notation, to show place value.

WM Four-Digit Number Hunt

Students investigate examples of numbers up to 9999 seen in the environment, the media, on the internet, or on car number plates. Students make displays where possible. Students discuss the use of zero as a place holder and at the beginning of a number eg 8065, ARK – 082.

Students discuss the place value of the numerals eg where all numbers are the same, as in 3333.

Extension: Students put numerals in ascending and descending order.

Less Than and Greater Than, Ordering

Part A

In pairs, students are given three different-coloured dice, representing hundreds, tens and ones. Students take turns to throw the dice, record their three-digit number and state the number before and after.

Part B

In pairs, students are given three different-coloured dice, representing hundreds, tens and ones. Students take turns to throw the dice and record their three-digit number. Students nominate whether they are 'greater than' or 'less than.' They compare their numbers by showing the relationship between the two three-digit numbers they have made by using a $<$ or $>$ sign eg Student A rolls 431 and is 'greater than' and Student B rolls 146 and is 'less than'. Student B wins the point. The winner is the first to 20. This activity could be repeated using four dice.

Wipe-Out

Students are asked to enter a four-digit number into a calculator eg 2657. The teacher then asks the students to 'wipe out' one digit ie change it to a zero. In the example above, 'wiping out the 5' would require a student to change the number to 2607 by subtracting 50. Students could demonstrate this using Base 10 material.

Problem Solving and Problem Posing

Students solve a variety of problems using a large number of strategies. The teacher should encourage students to pose their own problems involving numbers of up to four digits.

WM How Many Ways?

The teacher selects a four-digit number and records it on the board. Students express and/or present the number in as many ways as they can (a time limit may be imposed) with Base 10 material

eg 3605

three thousand, six hundred and five

3000+600+5

3600+5

Calculator

The teacher tells students the 7 key on their calculator is broken.

Students are asked to make the calculator display show 777 without pressing the 7 key. Students share their solutions. Students are asked which solutions they like best and why.

Variation: Students could repeat the activity using different target numbers and different 'broken' keys.

Estimating Counters

The teacher puts out a pile of about 20 counters and asks students to 'look and think about' how many there are. The teacher counts 10 counters and puts them aside. Students look again and think about how many counters there are. Students are allowed to change their estimates at any time. Students explain their strategies for working out their estimates.

Variation: The teacher puts out a large number of counters and again asks students to estimate how many there are. The teacher begins to count them into groups of 10 counters and asks students to rethink their estimates as the counting proceeds. The teacher models the rounding of numbers to the nearest 10 eg the teacher puts out a pile of about 100 counters and the student says 'I think there are 73.' The teacher responds with 'So you think there are about 70?' Numbers could also be rounded to the nearest 5.

Possible questions include:

- who thinks there are about 70? 80? 90?
- why did you revise your estimate?

WM Higher or Lower

Students play in groups of three (2 players and 1 adjudicator) 'Higher or Lower'. The adjudicator records a 'secret' three-digit number on a card and states the boundaries for the number eg 'The number is between 4000 and 5000.' Students draw their own number line, marking the boundaries for the number.

The first player chooses a number in the range and the adjudicator responds by stating whether the number is higher or lower than the one chosen. The players record the response on their number line. The second player then states a number and the adjudicator responds with 'higher' or 'lower'. The game continues until a player gives the correct number.

Students discuss the strategies they used to determine the secret number.

Rounding

Students use number cards 0 to 9 to create three and four-digit numbers. They randomly allocate a card to each place value column. They round the numbers to the nearest

- ten
- hundred
- thousand.

In pairs, students take turns in asking their partner to round a number. The partner explains strategies used.

Estimating How Many

Students are asked to estimate:

- how many students could sit comfortably in a specified large area of the school?
- how many big books could fit on the floor of the school hall?
- how many counters will fill a large container?

Students are asked to estimate a range by stating 'I think that there will be at least_____ but not more than _____'. They discuss how they can refine their estimate and make it more accurate without actually completing the task. Students revise their estimate. Students are encouraged to pose their own problems.

Resources

dice, number cards, popsticks, Base 10 material, numeral expanders, calculators, place value chart, newspaper, internet

Links

Addition and Subtraction

Multiplication and Division

Data

HSIE

Language

zero, digit, number, units, before, after, ones, tens, hundreds, thousands, place value, less than, forwards, backwards, greater than, largest, smallest, highest, lowest, trading, decade, rounding, estimating, less than, greater than, represent, ascending, descending

'1349 is the same as 1 thousand, 34 tens and 9 units.'

'One thousand two hundred and fifty-three.'

5.2 Addition and Subtraction

Strand – Number

Syllabus Content pp 49 – 50

NS2.2

Uses mental and written strategies for addition and subtraction involving two-, three- and four-digit numbers

Key Ideas

Use a range of mental strategies for addition and subtraction involving two-, three- and four-digit numbers

Explain and record methods for adding and subtracting

Use the formal written algorithm for addition and subtraction

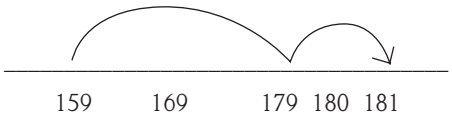
WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 2 content	Selects and uses appropriate mental or written strategies, or technology, to solve problems	Uses appropriate terminology to describe, and symbols to represent, mathematical ideas	Checks the accuracy of a statement and explains the reasoning used	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 2 content

Knowledge and Skills

Students learn about

- using mental strategies for addition and subtraction involving two-, three- and four-digit numbers, including:
  - the jump strategy
    eg 23 + 35; 23 + 30 = 53, 53 + 5 = 58
  - the split strategy
    eg 23 + 35; 20 + 30+3 + 5 is 58
  - the compensation strategy
    eg 63 + 29; 63 + 30 is 93, subtract 1, to obtain 92
  - using patterns to extend number facts
    eg 5 – 2 = 3, so 500 – 200 is 300
  - bridging the decades
    eg 34 + 17; 34 + 10 is 44, 44 + 7 = 51
  - changing the order of addends to form multiples of 10 eg 16 + 8 + 4; add 16 and 4 first
- recording mental strategies
  eg 159 + 22;
  'I added 20 to 159 to get 179, then I added 2 more to get 181.'
  or, on an empty number line



- adding and subtracting two or more numbers, with and without trading, using concrete materials and recording their method
- using a formal written algorithm and applying place value to solve addition and subtraction problems, involving two, three- and four-digit numbers

  eg

134 +	2459 +	568 –	1353 –
253	138	322	168

Working Mathematically

Students learn to

- pose problems that can be solved using addition and subtraction, including those involving money (*Questioning*)
- ask 'What is the best method to find a solution to this problem?' (*Questioning*)
- select and use mental, written or calculator methods to solve addition and subtraction problems (*Applying Strategies*)
- solve a variety of problems using problem-solving strategies, including:
  - trial and error
  - drawing a diagram
  - working backwards
  - looking for patterns
  - using a table (*Applying Strategies, Communicating*)
- use estimation to check solutions to addition and subtraction problems, including those involving money (*Reflecting, Applying Strategies*)
- check the reasonableness of a solution to a problem by relating it to an original estimation (*Reasoning*)
- check solutions using the inverse operation or a different method (*Applying Strategies, Reasoning*)
- explain how an answer was obtained for an addition or subtraction problem (*Communicating, Reasoning*)
- reflect on own method of solution for a problem, considering whether it can be improved (*Reflecting*)
- use a calculator to generate number patterns, using addition and subtraction (*Applying Strategies*)

Learning Experiences and Assessment Opportunities

WM Mental Strategies

Students are asked to calculate 34 + 17 in their heads. They are then asked to record the strategy they used. This process is repeated for other problems, such as:

73 – 25 162 – 69

63 + 29 188 – 89

Students discuss which methods are the most efficient.

Extension: Students are given increasingly more difficult problems to solve mentally. Students explain and discuss the strategies they use eg for '188 – 89 = ?' A student may say, 'I took away 88 and that was easy because it left 100 but I had to take away one more, because 88 + 1 = 89, so the answer is 99.' Students record the mental strategies they use.

Possible questions include:

- is there a better strategy?
- what is the best method to find a solution to this problem?

Recording on Empty Number Lines

Students are shown the number sentence 157 + 22 and an empty number line. The teacher marks the number 157 on the number line.

Possible questions include:

- what is the next multiple of ten after 157?
- how many do you add on to get that number?

Students record their answers on the number line.

Possible questions include:

- can you work it out with fewer steps?
- can you visualise the number line in your head and do it?
- can you write the numbers on paper to help you keep track?

Differences on Number Lines

In pairs, students draw an empty number line. Student A chooses two three-digit numbers and places them on the number line. Student B uses the number line to work out and record the difference between the two numbers. Students explain the mental strategies they used to find the answer. They reflect on their method, considering whether it can be improved.

WM Appropriate Calculations

Students are given a calculation such as 160 – 24 =136 and are asked to create a number of problems where this calculation would be needed. Students share and discuss responses.

Base 10 Material

Students use 2, 3 or 4 dice to generate a two-, three- or four-digit number and then represent this number using Base 10 material. Students then generate a second, smaller number by rolling one less die. Students represent this number using Base 10 material, then add the two numbers and show the result using Base 10 material.

Students repeat this process, subtracting the second number from the first. Students record their solutions.

Linking 3

Students record sixteen different numbers between 1 and 50 in a 4 × 4 grid

eg

19	28	17	13
2	18	41	5
16	1	38	49
15	26	40	7

Students link and add three numbers vertically or horizontally.

Possible questions include:

- can you find links that have a total of more than 50?
- can you find links that have a total of less than 50?
- how many links can you find that have a total that is a multiple of 10?
- what is the smallest/largest total you can find?
- can you find ten even/odd totals?

WM Estimating Differences

The teacher shows a card with the subtraction of a pair of two-digit numbers eg 78 – 32. Students estimate whether the difference between the numbers is closer to 10, 20, 30, 40 or 50 and give reasons why. The teacher shows other cards eg 51 – 18, 60 – 29, 43 – 25, 33 – 25. Students estimate the differences and discuss their strategies. They are asked to think about rounding numbers on purpose.

For example for 51 – 18, students may round 51 down to 50 and 18 up to 20.

Trading Games

The trading games Win 500 or Lose 500 can be adapted for Stage 2 by adding and subtracting two-digit numbers using, recording and evaluating mental strategies. Students are given a pack of playing cards with the tens and the picture cards removed. The Aces are is retained and represent 1 and the Jokers are retained and represents 0. Students flip two cards and assign place values to the numbers turned over. Students play Win 5000/50 000 and Lose 5000/50 000 to add and subtract three-digit and four-digit numbers. Students estimate their answer and then use formal written algorithms. Students could use a calculator to check their answer. Students are encouraged to pose problems, including money problems, using their numbers.

Estimating Addition of Three-Digit Numbers

The teacher briefly displays the numbers 314, 311, 310, 316, 312 on cards, then turns the cards over so that the numbers cannot be seen. Students are asked to estimate the total and give their reasons. The teacher reveals the numbers one at a time so that the students can find the total. The task could be repeated with other three-digit numbers and with four-digit numbers.

Take-away Reversals

In pairs, students choose a three-digit number without repeating any digit and without using zero eg 381. The student reverses the order of the digits to create a second number ie 183. The student subtracts the smaller number from the larger and records this as a number sentence. The answer is used to start another reversal subtraction. Play continues until zero is reached. The process could be repeated for other three-digit numbers. Students discuss their work and any patterns they have observed.

Extension: Students repeat using four-digit numbers.

WM What Went Wrong?

Students are shown a number of completed subtraction problems with a consistent error eg subtracting the smaller number in a column from the larger number. Students correct the calculations and describe the error that was made.

eg

666 –	345 –	1949 –
394	168	651
332	223	1318

Students plan how to teach a person who made this mistake a correct method for obtaining solutions.

WM The Answer Is …

Students construct subtraction number sentences with the answer 123. Students are challenged to include number sentences involving four-digit numbers.

How Many Days Have You Been Alive?

The teacher poses the question 'How many days have you been alive?' Students solve this problem using a calculator. Students record their solutions and compare the methods they used to solve the problem. Students are encouraged to pose and solve similar problems and evaluate their strategies.

WM Which Way is Best?

Students are asked to solve problems in three different ways: using a mental strategy, a formal written algorithm, and a calculator eg 'Our class has 356 points and another class has 567 points. How many points do we need to catch up?'

Students compare the strategies used and discuss the advantages and disadvantages of each method. If students come up with different answers, they are asked to show which answer is correct.

Variation: Students write their own problems and swap with others. Students could use four-digit numbers.

Number Cards

Students make number cards from 1 to 9 as shown.

1	2	3	4	5	6	7	8	9

Students use these cards to make two three-digit numbers that add to give the largest total possible and the smallest total possible eg Given 4, 5, 2 and 3, 1, 6:

Largest total possible is 542 + 631 = 1173

Smallest total possible is 245 + 136 = 381

Students arrange the cards to make three three-digit numbers that add up to 999. Students are challenged to find as many solutions as they can.

WM Estimating to the Nearest 1000

The teacher displays three cards with the following amounts written on them: $2450, $6155, $3500. Students estimate the total to the nearest $1000 and explain their strategies.

Cross-over

In pairs, students each choose a number between 1 and 1000. The student with the larger number always subtracts a number from their chosen number. The student with the smaller number always adds a number to their chosen number. The student who is adding must always have a number less than their partner's answer. The student who is subtracting must always have a number more than their partner's answer. Play continues until one student is forced to 'cross over' their partner's number.

The student who crosses over their partner's number loses the game.

Player A	Player B
Start number 135	Start number 899
135 + 600 = 735	899 – 99 = 800
735 + 60 = 795	800 – 4 = 796
795 + 1 = 796	Player B wins

Possible questions include:

- what strategy did you use in solving the addition or subtraction problems?
- can you find a quicker way to add/subtract?
- can you explain to a friend what you did?
- how can you show that your answer is correct?
- does the rule always work?
- can you use a different method?

How Much?

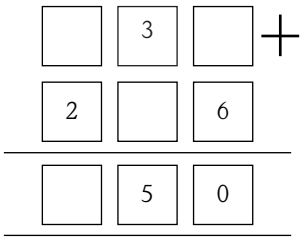
Students are told that a sofa and a desk cost $1116. If the sofa costs $700 more than the desk, how much does the desk cost? Students discuss. Students could pose other similar problems to solve such as 'What does each item cost if together they cost $1054 and one was $643 more than the other?'

Possible questions include:

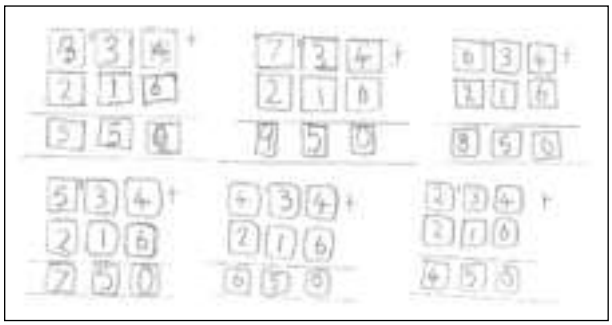
- what strategy did you choose to use and why?
- what was the key word/s in understanding the problem?
- how could you check that you have the correct solution?
- could there be more than one solution?

WM Missing Digits

Students are shown a calculation to find the sum of two three-digit numbers, with some of the digits missing.
eg



Students investigate possible solutions for this problem. Students are encouraged to design their own 'missing digits' problems. This activity should be repeated using subtraction.



Resources

number cards 1 to 9, calculator, paper, Base 10 material, place value chart, dice, playing cards

Links

Multiplication and Division

Whole Numbers

Language

place value, formal algorithm, addition, subtraction, solution, answer, digit, trade, jump strategy, split strategy, compensation strategy, bridging to decades, number line, difference, multiples, exchange, swap, greater, altogether, total

'Two hundred and thirty-one people are going to the concert. One hundred and eighty have collected their tickets. Twenty more makes two hundred and then another thirty-one makes fifty-one. So fifty-one still have to collect their tickets.'

'I left a space to show the thousands space.'

'I can add four thousand and eight thousand in my head.'

5.3 Multiplication and Division – Unit 1

Strand – Number

Syllabus Content p 54

NS2.3 – Unit 1 (multiplication and division facts)

Uses mental and informal written strategies for multiplication and division

Key Ideas

Develop mental facility for number facts up to 10×10

Find multiples and squares of numbers

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 2 content	Selects and uses appropriate mental or written strategies, or technology, to solve problems	Uses appropriate terminology to describe, and symbols to represent, mathematical ideas	Checks the accuracy of a statement and explains the reasoning used	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 2 content

Knowledge and Skills

Students learn about

- counting by threes, fours, sixes, sevens, eights or nines using skip counting
- linking multiplication and division facts using groups or arrays

  eg ● ● ● ● 3 groups of 4 is 12 $3 \times 4 = 12$

  ● ● ● ● 12 shared among 3 is 4 $12 \div 3 = 4$

  ● ● ● ●
- using mental strategies to recall multiplication facts up to 10×10, including
  - the commutative property of multiplication eg $7 \times 9 = 9 \times 7$
  - using known facts to work out unknown facts eg $5 \times 5 = 25$ so $5 \times 6 = (5 \times 5)+5$
  - the relationship between multiplication facts eg 'the multiplication facts for 6 are double the multiplication facts for 3'
- recognising and using $\div$ and $\overline{)}$ to indicate division
- using mental strategies to divide by a one-digit number, including
  - the inverse relationship of multiplication and division eg $63 \div 9 = 7$ because $7 \times 9 = 63$
  - recalling known division facts
  - relating to known division facts eg $36 \div 4$; halve 36 and halve again
- describing and recording methods used in solving multiplication and division problems
- listing multiples for a given number
- finding square numbers using concrete materials and diagrams

Working Mathematically

Students learn to

- recall multiplication facts up to 10×10, including zero facts (*Applying Strategies*)
- solve a variety of problems using problem-solving strategies, including:
  - trial and error
  - drawing a diagram
  - working backwards
  - looking for patterns
  - using a table (*Applying Strategies, Communicating*)
- explain why a rectangular array can be read as a division in two ways by forming vertical or horizontal groups eg $12 \div 3 = 4$ or $12 \div 4 = 3$ (*Reasoning, Communicating*)
- check the reasonableness of a solution to a problem by relating it to an original estimation (*Reasoning)*
- explain how an answer was obtained and compare own method/s of solution to a problem with those of others (*Communicating, Reflecting*)
- use multiplication and division facts in board, card and computer games (*Applying Strategies*)
- apply the inverse relationship of multiplication and division to check answers eg $63 \div 9$ is 7 because $7 \times 9 = 63$ (*Applying Strategies, Reflecting*)
- create a table or simple spreadsheet to record multiplication facts (*Applying Strategies*)
- explain why the numbers 1, 4, 9, 16, … are called square numbers (*Communicating, Reasoning, Reflecting*)

Learning Experiences and Assessment Opportunities

Models of the Multiplication Facts

Part A

Students construct models of the multiplication facts using interlocking cubes. They build a staircase eg with 3 blocks in the first step, 6 in the second etc, to represent the multiplication facts for 3. Students use a 10×10 grid to record their answers.

WM Part B

Students model the multiplication facts using rectangular arrays and record the associated inverse relationships

eg ● ● ● ●
● ● ● ● and
● ● ● ●

$3 \times 4 = 12$ $12 \div 3 = 4$
$4 \times 3 = 12$ $12 \div 4 = 3$

Variation: Students are given a number (eg 12) and asked to represent all its factors using arrays.

Multiplication Facts

Students write the multiplication facts on flash cards from 0×1 up to 10×10. In pairs, students test each other to find which facts they can immediately recall and put these into the 'known' pile. The others are put into the 'unknown' pile. Each day the students concentrate on learning from their 'unknown' facts.

Students could repeat this activity with division facts.

Variation: Students play 'Bingo' using multiplication and division facts.

Tables Races

Students make up cards for particular multiplication facts for particular numbers, shuffle them and put them into an envelope

eg

4	8	12	16	20
24	28	32	36	40

In groups, students are given an envelope of cards. Students race each other to put the cards into order, skip counting aloud. Students state which number has the multiplication facts their cards represent.

Variation: Students write numbers in descending order.

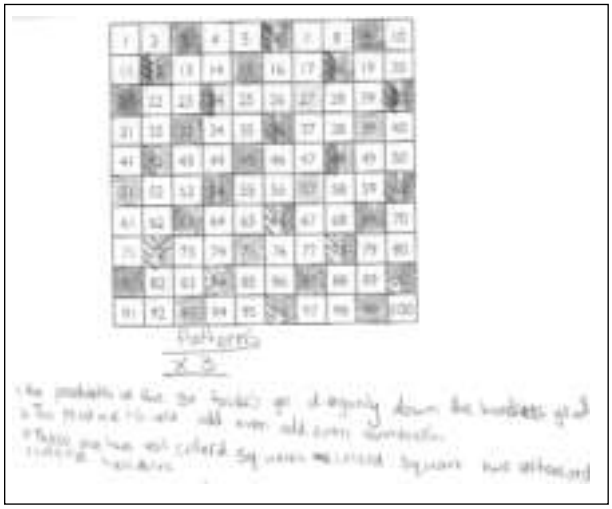
Multiplication Grid

Students keep a multiplication grid, as shown below. When students are sure they have learnt particular multiplication facts, they fill in that section of the grid. Students are encouraged to recognise that if they know $3 \times 8 = 24$ they also know $8 \times 3 = 24$, and so they can fill in two squares on the grid.

×	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Patterns

Students investigate patterns in the multiplication grid. Students discuss these patterns and record their observations. For example, students compare the multiplication facts for 3 and the multiplication facts for 6. They then investigate the multiplication facts for 9.



Students colour multiples on a hundreds chart and are encouraged to describe the patterns created.

WM Chocolate Boxes

The teacher poses the problem: 'Imagine you had the job of designing a chocolate box. There are to be 48 chocolates in the box. The box can be one or two layers high. How many ways could you arrange the chocolates in the box?'

Students draw or make models of their solutions and discuss these in terms of multiplication and division facts.

Doubles

Students work in small groups. A student chooses a small whole number and the next student doubles it. They take turns to keep doubling the number. A student checks the results with a calculator. In the next round they start with a different number.

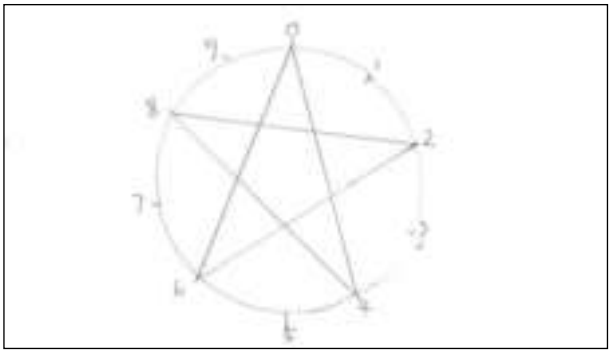
Possible questions include:

- what did you notice?
- did the pattern help you with your calculations?

WM Sequences of Multiples

Students record sequences of multiples and look for patterns. Students are asked if they can find patterns in the sequences of the numbers in the 'ones' column. Students plot these on a circle with the points 0 to 9 marked on the circumference, joining the numbers in order.

eg the multiples of 4 are 4, 8, 12, 16, 20, 24, 28, 32, 36, 40 etc and so the pattern for the digits in the ones column is 4, 8, 2, 6, 0, 4, 8, 2, 6, 0, …



Multiples

Students take turns in throwing a die and moving a counter along a hundreds chart the number of spaces indicated on the die. If the counter lands on a multiple of 3 they jump forward to the next multiple of 3. If they land on a multiple of 5 they jump backwards to the previous multiple of 5. Two counters may land on the same square. The winner is the first player to reach or pass 100.

Possible questions include:

- which numbers are multiples of 3 and 5?

Variation: The pair of multiples could be changed, or the sum of two dice could be used to indicate the number of squares the counter moves.

WM Mental Strategies

Students are asked to write a multiplication fact that they have trouble remembering eg 8×7. They are encouraged to try mental strategies to help them recall that fact by using known facts eg 'I know 7×7 is 49 so 8×7 must be 7 more than 49 which is 56' or using the inverse relationship of division: 'I know $56 \div 8 = 7$ so $8 \times 7 = 56$'.

Students are asked to write a division fact they have trouble remembering eg $36 \div 4$. They are encouraged to try mental strategies to help them recall the fact eg using known division facts 'I know $40 \div 4 = 10$ so $36 \div 4 = 9$'; using other known facts 'half of 36 is 18, then if I halve it again I get 9'; using the inverse relationship of multiplication: '$4 \times 9 = 36$ so $36 \div 4 = 9$'.

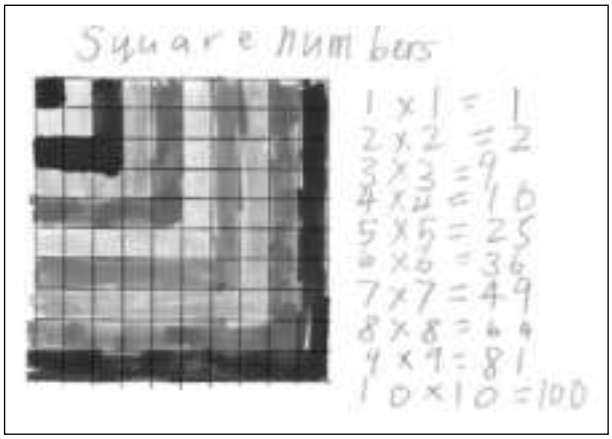
Halves

Students work in small groups. One student chooses a number. The next student halves it. Students take turns as they keep halving. The teacher asks how far they think they can go. A student checks the results with a calculator. Students try starting at a different number when playing the next round.

WM Square Numbers

Students make arrays using 1, 4, 9, 16, … counters and discuss the shape of each array. Students explain why these numbers are called square numbers and record the multiplication and division facts for each. Students experiment with other numbers and predict further numbers that will have a square array.

Variation: Students represent arrays on the computer in a simple table format.



Times Squares

The teacher chooses 4 cards between 1 and 9 and places them in a square

eg

4	6	24
3	5	15
12	30	

The student multiplies each row and column and records the answers. Students rearrange the cards and record the new multiplication squares.

WM Creating Several Arrays

Students use counters to make an array for a particular number. They create new arrays for this number. Students record their findings eg 36 can be 4 rows of 9 or 2 rows of 18.

Possible questions include:

- how many different arrays can you make?
- how many rows do I have if there are 6 counters in each row? (Adapted from CMIS)

Reducing Multiples

Students write the multiples of 9 and investigate.

Possible questions include:

- can you see patterns in the digits?
- what happens when you add the digits?

The teacher introduces the concept of 'reduced numbers', where the digits are added together until they are reduced to a single digit eg $45 \rightarrow 4 + 5 = 9$

$$99 \rightarrow 9 + 9 = 18 \rightarrow 1 + 8 = 9.$$

The teacher poses the question 'Are there any other sets of multiples that this can be done to?

Variation: Students create new circle patterns as in the 'Sequences of Multiples' activity.

Trading Game with Multiplication and Division

Students play the trading game 'Race to and from 1000' with the following variation. Students throw two dice, one numbered 0 to 5 and the other numbered 5 to 10. They multiply the numbers thrown and collect the necessary Base 10 material. The winner is first to 1000.

Extension: Students are asked to design their own games involving multiplication and division number facts.

WM Dominoes

The teacher creates a set of dominoes to be used for practising multiplication facts. Half of the domino has an answer while the other half has two numbers to be multiplied together (to obtain a different answer)
eg

56	5×6

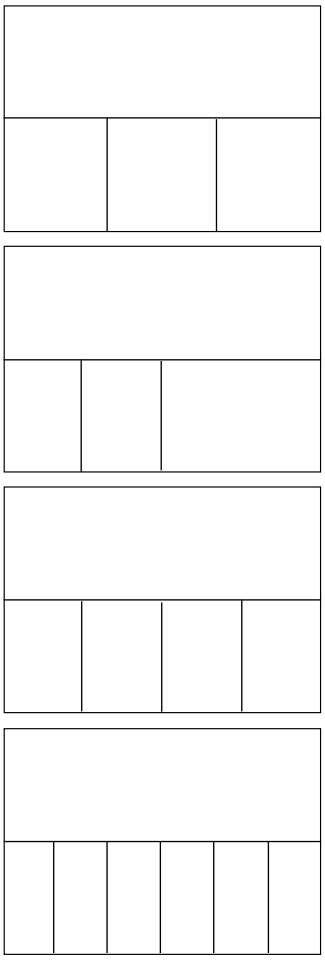
30	4×4

The students try and match the multiplication with its answer. They play the normal domino rules.

Variation: Students could use division facts.

Paddocks

Students are given an A4 sheet of paper that has been divided into sections
eg



Students are given plastic animals or counters. They place them into the 'paddocks' so that each animal has the same amount of space. Students record their findings.

Extension: In groups, students are given more counters and different configurations of paddocks. Students distribute the counters proportionately into their paddocks. That is, if one paddock is double the size of another then twice as many animals can fit into that paddock. Students discuss how they worked out the distribution and justify their decisions. Students draw their paddocks and write about their findings. (Adapted from CMIS)

Resources

calculators, multiplication and division grid, interlocking cubes, flash cards, string, envelope, hundreds chart, Base 10 material, place value chart, dice, counters

Links

Whole Numbers

Addition and Subtraction

Area

Language

multiplication, division, inverse relationship, arrays, groups of, skip counting, factors, number facts, multiple, estimate, product, remainder, number pattern, multiplied by, trade, twice as many

' The pattern for eights is twice as big as the pattern for fours. If you double the fours pattern you get the eights pattern.'

'I found out that twenty-four is a multiple of eight. It is also a multiple of three, four, six, twelve, two….'

'Twice as many means two times or double.'

'I think there'll be six groups of three in eighteen.'

'Thirty-five shared between five is equal to seven.'

'Forty-nine divided by six is equal to eight with one remaining.'

'I remember the multiplication and reverse it.'

5.4 Multiplication and Division – Unit 2

Strand – Number

Syllabus Content p 55

NS2.3 – Unit 2

Uses mental and informal written strategies for multiplication and division

Key Ideas

Use mental and informal written strategies for multiplying or dividing a two-digit number by a one-digit operator

Interpret remainders in division problems

Determine factors for a given number

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 2 content	Selects and uses appropriate mental or written strategies, or technology, to solve problems	Uses appropriate terminology to describe, and symbols to represent, mathematical ideas	Checks the accuracy of a statement and explains the reasoning used	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 2 content

Knowledge and Skills

Students learn about

- using mental strategies to multiply a one-digit number by a multiple of 10 (eg 3×20) by:
  - repeated addition (20+20+20 = 60)
  - using place value concepts (3×2 tens = 6 tens = 60)
  - factoring ($3 \times 2 \times 10 = 6 \times 10 = 60$)
- using mental strategies to multiply a two-digit number by a one-digit number, including
  - using known facts
    eg $10 \times 9 = 90$ so $13 \times 9 = 90 + 9 + 9 + 9$
  - multiplying the tens and then the units
    eg 7×19; is $(7 \times 10) + (7 \times 9) = 70 + 63 = 133$
  - the relationship between multiplication facts
    eg 23×4 is double 23 and double again
  - factorising eg $18 \times 5 = 9 \times 2 \times 5 = 9 \times 10 = 90$
- using mental strategies to divide by a one-digit number, in problems for which answers include a remainder

  eg $29 \div 6$; if $4 \times 6 = 24$ and $5 \times 6 = 30$ the answer is 4 remainder 5
- recording remainders to division problems
  eg $17 \div 4 = 4$ remainder 1
- recording answers, which include a remainder, to division problems to show the connection with multiplication eg $17 = 4 \times 4 + 1$
- interpreting the remainder in the context of the word problem
- describing multiplication as the product of two or more numbers
- describing and recording methods used in solving multiplication and division problems
- determining factors for a given number
  eg factors of 12 are 1, 2, 3, 4, 6, 12

Working Mathematically

Students learn to

- pose and solve multiplication and division problems (*Questioning, Applying Strategies*)
- select and use mental, written and calculator strategies to solve multiplication or division problems
  eg 'to multiply by 12, multiply by 6 and then double' (*Applying Strategies*)
- solve a variety of problems using problem-solving strategies, including:
  - trial and error
  - drawing a diagram
  - working backwards
  - looking for patterns
  - using a table (*Applying Strategies, Communicating*)
- identify the operation/s required to solve a problem (*Applying Strategies*)
- check the reasonableness of a solution to a problem by relating it to an original estimation (*Reasoning*)
- explain how an answer was obtained and compare own method/s of solution to a problem with those of others (*Communicating, Reflecting*)
- use multiplication and division facts in board, card and computer games (*Applying Strategies*)
- apply the inverse relationship of multiplication and division to check answers eg $63 \div 9$ is 7 because $7 \times 9 = 63$ (*Applying Strategies, Reflecting*)
- explain why a remainder is obtained in answers to some division problems (C*ommunicating, Reasoning*)
- apply factorisation of a number to aid mental computation eg $16 \times 25 = 4 \times 4 \times 25 = 4 \times 100 = 400$ (*Applying Strategies*)

Learning Experiences and Assessment Opportunities

WM Factors

Students are asked to find all of the factors of a given number (eg 24) and use counters to make the appropriate arrays. Using this knowledge, students are asked to use mental strategies to multiply numbers eg $24 \times 25 = 6 \times 4 \times 25 = 6 \times 100 = 600$. Students could also be challenged to find which of the numbers between 1 and 100 has the most factors and to record their findings.

Multiplying by Multiples of Ten

Students investigate multiplying numbers by 10 on a calculator. Students then discuss and record the results. Students then try multiplying one- and two-digit numbers by multiples of ten using mental strategies and discuss the results.

Possible questions include:

- what strategy did you use?
- what other strategies could you use?
- did you multiply the tens and then the units?
- did you use relationships between multiplication facts?

Calculations Race

Students work in three groups. One group solves a problem using a calculator, one group solves it using a written algorithm and the third group solves the problem using mental calculations. The following are examples of the types of problems to be used:

$2 \times 4000 =$

$20 \times 20 =$

$400 \div 5 =$

$39 \div 3 =$

Students discuss the efficiency of each method.

Variation: Groups rotate, trying the different methods of solution to a problem. Students discuss the efficiency of each method in relation to different problems.

Mental Calculations

Students are asked to calculate mentally 26×4.

Students discuss the various ways they solved the problem using mental calculation
eg

$26 \times 4 = 20 \times 4 + 6 \times 4 = 80 + 24 = 104$

$26 \times 4 = 25 \times 4 + 1 \times 4 = 100 + 4 = 104$

26×4 = double 26 and double 26 again = 52 + 52 = 104

Students are asked to pose problems to be solved using mental computation.

Remainders

Students explore division problems involving remainders, using counters eg 'We have to put the class into four even teams but we have 29 students. What can we do?' Students make an array to model the solution and record their answer to show the connection with multiplication eg $29 = 4 \times 7 + 1$.

Students could interpret the remainder in the context of a word problem eg 'Each team would have 7 students and one student could umpire.'

Students could record the answer showing the remainder eg $29 \div 4 = 7$ remainder 1. The teacher could model recording the students' solutions, using both forms of recording division number sentences.

The teacher sets further problems that involve remainders eg 'A school wins 125 computers. If there are seven classes, how many computers would each class receive?' Since only whole objects are involved, students discuss possible alternatives for sharing remainders. Students write their own division problems, with answers involving remainders.

WM Ancient Egyptian Long Multiplication

The teacher explains to the students that the Ancient Egyptians had a different number system and did calculations in a different way. They used doubling to solve long multiplication problems eg for 11×23 they would double, and double again,

$1 \times 23 = 23$

$2 \times 23 = 46$

$4 \times 23 = 92$

$8 \times 23 = 184$

$1 + 2 + 8 = 11$, so they added the answers to 1×23, 2×23 and 8×23 to find 11×23.

$$\begin{array}{r} 23 \\ 46 \\ 184 + \\ \hline 253. \end{array}$$

Students are encouraged to make up their own two-digit multiplication problems and use the Egyptian method to solve them.

Factors Game

The teacher prepares two dice, one with faces numbered 1 to 6 and the other with faces numbered 5 to 10. Each student is given a blank 6×6 grid on which to record factors from 1 to 60. Students work in groups and take turns to roll the two dice and multiply the numbers obtained. For example, if a student rolls 5 and 8, they multiply the numbers together to obtain 40 and each student in the group places counters on all of the factors of 40 on their individual grid ie 1 and 40, 2 and 20, 4 and 10, 5 and 8. The winner is the first student to put three counters in a straight line, horizontally or vertically.

Tag

Students find a space to stand in the classroom. The teacher asks students in turn to answer questions eg 'What are the factors of 16?' If the student is incorrect they sit down. The teacher continues to ask the same question until a correct answer is given. When a student gives a correct answer, they take a step closer to another student and may tip them if within reach. The 'tipped' student sits down. The question is then changed. Play continues until one student remains, who then becomes the questioner. This game is designed for quick responses and repeated games.

New From Old

Students are asked to write a multiplication and a division number fact. Each student uses these facts to build new number facts
eg

Starting with	$12 \div 3 = 4$	Starting with	$3 \times 2 = 6$
	$24 \div 3 = 8$		$6 \times 2 = 12$
	$48 \div 3 = 16$		$12 \times 2 = 24$
	$96 \div 3 = 32$		$24 \times 2 = 48$

Possible questions include:

- what strategy did you use?
- what other strategies could you use?
- what strategy did you use?
- did you use the relationship between multiplication and division facts?

Division Number Sentences

Students are asked to devise their own division number sentences with a two-digit number divided by a single-digit number. Students can do this by rolling a die or by choosing the numbers themselves. Students are asked to model the number sentences with materials and record their number sentences and solutions.

Possible questions include:

- when you were solving a division problem, was there any remainder?
- how did you know?
- how did you record the remainder?

WM Card Remainders

The teacher prepares a pack of 20 cards consisting of two sets of cards numbered 1 to 10 and 5 x 5 grid boards with the numbers 0 to 5 randomly arranged on them. In pairs, students shuffle the cards and place them face down in a pile. Student A decides on a two-digit target number eg 40. Students take turns to turn over the top card and divide the target number by the number on their card to find the remainder. For example, Student A turns over a '6'. $40 \div 6 = 6$ remainder 4: Student A places a counter on a '4' and returns the card to the bottom of the pile. Student B now turns over the next card and finds the remainder; for example, a '3' is turned over, $40 \div 3 = 13$ remainder 1. Once a number is covered another counter can go on top of it (stackable counters are best for this). In the next round Student B chooses the target number. Play continues until all numbers are covered. The winner is the player who has the most counters on the board when there are no numbers showing.

Remainders Game

Students make a game board on a 5×5 grid using the multiples of a known number. In pairs, they take turns at rolling a die. Student A rolls a die then chooses a number on the board and divides it by the number rolled. They cover that number on the board with a counter. This number cannot be used again. Student A scores the remainder and records it. Student B has a turn. The winner is the player who has the most points when the board is covered in counters.

Variation: The teacher makes a die with different numbers. If there is no remainder then the player has another turn.

Resources

calculators, multiplication and division grid, interlocking cubes, flash cards, string, envelope, hundreds chart, Base 10 material, place value chart, dice, counters

Language

factors, inverse relationship, remainder, multiplication, division, arrays, groups of, skip counting, number facts, multiple, estimate, product, number pattern, multiplied by, trade, twice as many

Links

Addition and Subtraction

Fractions and Decimals

Patterns and Algebra

5.5 Fractions and Decimals

Strand – Number

Syllabus Content p 62

NS2.4 – Unit 1

Models, compares and represents commonly used fractions and decimals, adds and subtracts decimals to two decimal places, and interprets everyday percentages

Key Ideas

Model, compare and represent fractions with denominators 2, 4, and 8, followed by fractions with denominators of 5, 10, and 100

Model, compare and represent decimals to 2 decimal places

Add and subtract decimals with the same number of decimal places (to 2 decimal places)

Perform calculations with money

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 2 content	Selects and uses appropriate mental or written strategies, or technology, to solve problems	Uses appropriate terminology to describe, and symbols to represent, mathematical ideas	Checks the accuracy of a statement and explains the reasoning used	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 2 content

Knowledge and Skills

Students learn about

- modelling, comparing and representing fractions with denominators 2, 4 and 8 by:
  - modelling halves, quarters and eighths of a whole object or collection of objects
  - naming fractions with denominators of two, four and eight up to one whole eg $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$, $\frac{4}{4}$
  - comparing and ordering fractions with the same denominator
    eg $\frac{1}{8}$ is less than $\frac{3}{8}$ is less than $\frac{6}{8}$
  - interpreting the denominator as the number of equal parts a whole has been divided into
  - interpreting the numerator as the number of equal fractional parts eg $\frac{1}{8}$ means 3 equal parts of 8
  - comparing unit fractions by referring to the denominator or diagrams eg $\frac{1}{8}$ is less than $\frac{1}{2}$
  - renaming $\frac{2}{2}$, $\frac{4}{4}$, $\frac{8}{8}$ as 1
- modelling, comparing and representing fractions with denominators 5, 10 and 100 by extending the knowledge and skills covered above to fifths, tenths and hundredths
- modelling, comparing and representing decimals to two decimal places
- applying an understanding of place value to express whole numbers, tenths and hundredths as decimals
- interpreting decimal notation for tenths and hundredths eg 0.1 is the same as $\frac{1}{10}$
- adding and subtracting decimals with the same number of decimal places (to 2 decimal places)

Working Mathematically

Students learn to

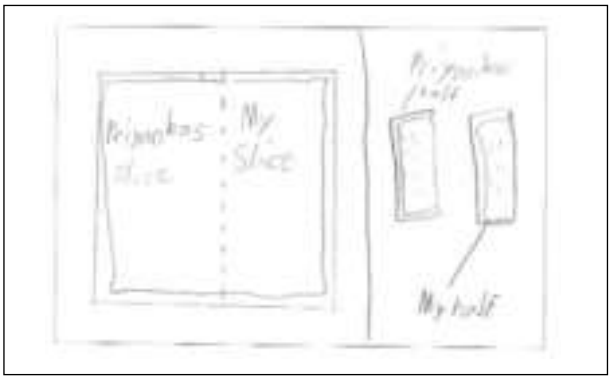
- pose questions about a collection of items
  eg 'Is it possible to show one-eighth of this collection of objects?' (*Questioning*)
- explain why $\frac{1}{8}$ is less than $\frac{1}{4}$

  eg if the cake is divided among eight people, the slices are smaller than if the cake is shared among four people (*Reasoning, Communicating*)
- check whether an answer is correct by using an alternative method eg use a number line or calculator to show that $\frac{1}{2}$ is the same as 0.5 and $\frac{5}{10}$ (*Reasoning*)
- interpret the everyday use of fractions and decimals, such as in advertisements (*Reflecting*)
- interpret a calculator display in the context of the problem eg 2.6 means $2.60 when using money (*Applying Strategies, Communicating*)
- apply decimal knowledge to record measurements
  eg 123 cm = 1.23 m (*Reflecting*)
- explain the relationship between fractions and decimals eg $\frac{1}{2}$ is the same as 0.5 (*Reasoning, Communicating*)
- perform calculations with money (*Applying Strategies*)

Learning Experiences and Assessment Opportunities

Sharing

Students form groups of 8 and share a slice of bread so that each person gets the same amount and there is none left over. Each group discusses how they shared the bread and names the pieces 'eighths'. Students regroup into groups of 4, and then into groups of 2, and repeat the activity, naming the pieces 'quarters' or 'halves'. Students compare the relative sizes of the fractions and then order them according to their size. Students record their findings.



Comparing and Ordering

Students are provided with four sets of cards representing the same fractions. The first set has the fractions represented in fraction notation, the second set has the fractions represented in words, the third set has the fractions represented as shaded regions and the fourth set has the fractions represented as the shaded part of a collection. The cards are randomly distributed to students who must find other students with the same fraction represented. Students then place the sets of fraction cards in order.

Match Up

The teacher provides two sets of cards, the first with tenths expressed in fraction notation, and the second with tenths expressed in decimal notation. The teacher distributes the cards randomly to the students who then find the student/students with the same fraction represented.

Possible questions include:

- how many of the same fractions/decimals did you find?
- how can you check if there are any more?
- is there another way to write that fraction/decimal?

Variations: This activity should be repeated using cards with hundredths and a mixture of tenths and hundredths.

Clothes Line

Part A

The teacher provides cards each naming a different fraction with the same denominator. Students choose a card and peg it on a string number line in the appropriate place.

Part B

The teacher provides cards, each naming a different decimal to 2 decimal places. Students choose a card and peg it on a string number line in the appropriate place.

Variation: Students make their own cards and arrange them on their desk or a sheet of paper.

WM Is It Possible?

Students are given 16 counters and need to determine whether it is possible to find $\frac{1}{2}$, $\frac{1}{4}$ or $\frac{1}{8}$.

eg I can find

$\frac{1}{2}$ of 16 (8)

$\frac{1}{4}$ of 16 (4)

$\frac{1}{8}$ of 16 (2).

Students record their findings. The activity should be repeated using different numbers of counters and extended to include fractions with denominators of 5, 10 and 100.

Fruit Salad

Students move about in an open space in a group of 24. The teacher asks the group to divide into halves, quarters or eighths. Any remaining students check the groupings. The activity should be repeated using groups of different sizes.

WM Design a Menu

Students design a menu for a local take-away food shop. Students investigate different selections from the menu that total different amounts eg $10, $20, $50.

Possible questions include:

- how much would it cost to feed yourself; yourself and a friend; or yourself and your family?
- what is the change from $10/$20/$50 after the purchases?

Students pose their own questions based on their own menu. This activity should be repeated using a restaurant menu.

Two Decimal Places Game

The teacher makes a die writing a decimal (between 0 and 1) to two places on each face. Students use a 10×10 grid as a score sheet. Students take turns to throw the die and colour the appropriate section on their grid. The winner is the first player to colour their 10×10 grid completely.

Variation: Students can make their own dice labelling them using common fractions, decimals or a combination of fractions and decimals.

Extension: Students record the decimal thrown and add decimals together after each throw. Students colour each throw differently.

Adding and Subtracting Decimals

In pairs, students are provided with a pack of playing cards with the tens and picture cards removed. The Aces are retained and represent 1 and the Jokers are retained and represent 0. Student A flips two cards and places them together to form a decimal to two decimal places. Student B flips two cards and places them together to form a decimal to two decimal places. Student A copies down the decimals and uses a written algorithm to find their sum. Student B checks Student A's answer. Students swap roles and the activity is repeated.

Variation: The activity is repeated to involve subtraction of decimals to two decimal places.

WM Paper Folding

Students are given four strips of different-coloured paper of the same length. The first strip represents one whole. The second strip is folded into halves and labelled. The third strip is folded into quarters and labelled. The fourth strip is folded into eighths and labelled. Students line up the four strips and discuss.

Possible questions include:

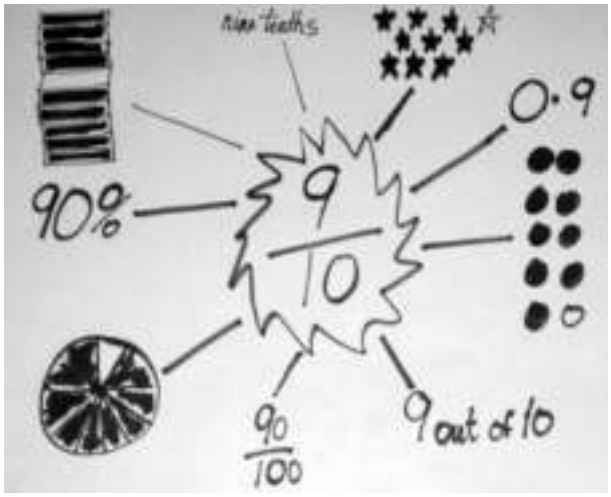
- what can you tell about the size of each fraction and the denominator?
- what strategies did you use to create your fractions?
- what strategies did you use to fold your strip into equal parts?

Variation: Students cut the folded strips into halves, quarters and eighths and order the strips from smallest to largest parts. They discuss their findings.

Extension: Students are given another set of coloured strips to represent and compare fifths and tenths.

Fraction Posters

Students choose a fraction and create a poster, writing everything they know about that fraction. Students report back to the group their findings about their fraction.



WM Representations – Card Game

Students work in groups of four to create a set of 40 playing cards representing hundredths, using as many names as possible eg 73 hundredths, 73 out of one hundred, $\frac{73}{100}$, 0.73. Students use the cards to play games such as Old Maid, Fish or Concentration.

Biggest or Smallest

The teacher places cards with the digits 0 to 9 into a bag. In pairs, students randomly select two cards from the bag. Students use the digits to make a decimal number less than 1 eg if 5 and 2 are selected the students record 0.25. Students use the two digits to make a new decimal ie 0.52.

Possible questions include:

- which decimal is larger?
- how do you know?
- how can you show this?

The number cards are replaced and the activity repeated.

Students record the decimal numbers on a number line.

Resources

decimals, fractions and percentages on cards, sample of menus from restaurants, bread, fraction cards, counters, string and pegs, newspapers

Links

Addition and Subtraction

Multiplication and Division

Language

fractions, decimals, numerator, denominator, equivalent, decimal point, whole numbers, decimal place, halves, quarters, eighths, fifths, tenths, hundredths, equal parts, one half, two halves, one quarter, two quarters…four quarters, one eighth, two eighths … eight eighths, percentages, one tenth, two tenths, … ten tenths, larger than, less than, ascending, descending, 12 out of 100, 12 hundredths, 100 hundredths is one whole

5.6 Chance

Strand – Number

Syllabus Content p 69

NS2.5

Describes and compares chance events in social and experimental contexts

Key Ideas

Explore all possible outcomes in a simple chance situation

Conduct simple chance experiments

Collect data and compare likelihood of events in different contexts

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 2 content	Selects and uses appropriate mental or written strategies, or technology, to solve problems	Uses appropriate terminology to describe, and symbols to represent, mathematical ideas	Checks the accuracy of a statement and explains the reasoning used	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 2 content

Knowledge and Skills

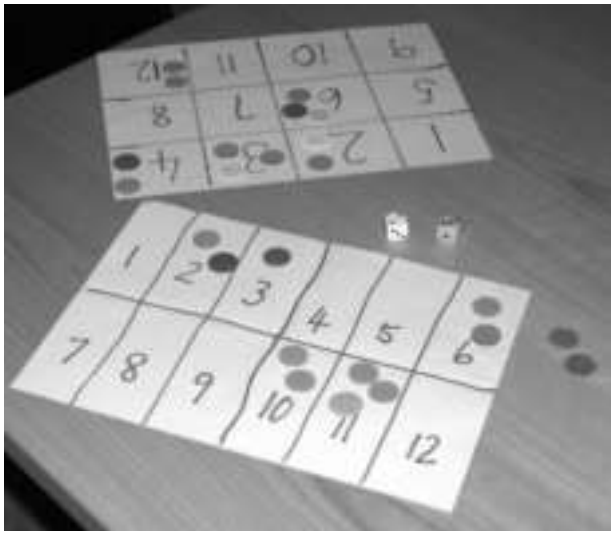
Students learn about

- listing all the possible outcomes in a simple chance situation eg 'heads', 'tails' if a coin is tossed
- distinguishing between certain and uncertain events
- comparing familiar events and describing them as being equally likely or more or less likely to occur
- predicting and recording all possible outcomes in a simple chance experiment
  eg randomly selecting three pegs from a bag containing an equal number of pegs of two colours
- ordering events from least likely to most likely
  eg 'having ten children away sick on the one day is less likely than having one or two away'
- using the language of chance in everyday contexts
  eg a 'fifty-fifty' chance, a 'one-in-two chance'
- predicting and recording all possible combinations
  eg the number of possible outfits arising from three different t-shirts and two different pairs of shorts
- conducting simple experiments with random generators such as coins, dice or spinners to inform discussion about the likelihood of outcomes eg roll a die fifty times, keep a tally and graph the results

Working Mathematically

Students learn to

- discuss the 'fairness' of simple games involving chance (*Communicating*)
- compare the likelihood of outcomes in a simple chance experiment eg from a collection of 27 red, 10 blue and 13 yellow marbles, name red as being the colour most likely to be drawn out (*Reasoning*)
- apply an understanding of equally likely outcomes in situations involving random generators such as dice, coins and spinners (*Reflecting*)
- make statements that acknowledge 'randomness' in a situation eg 'the spinner could stop on any colour' (*Communicating, Reflecting*)
- explain the differences between expected results and actual results in a simple chance experiment (*Communicating, Reflecting*)



Learning Experiences and Assessment Opportunities

Expected Result

Students are asked to predict the result of 10 tosses of a coin.

Possible questions include:

- what outcomes can occur when the coin is tossed once?
- what is the likelihood of tossing 'tails' on any one toss?
- how many 'heads' and 'tails' do you expect there to be?
- did the expected result and the actual result match?
- did tossing 'tails' on the previous toss increase the likelihood of tossing 'tails' on the next toss? Why?
- which outcome, 'heads' or 'tails', is more likely?

Students are encouraged to suggest how the experiment could be improved and implement their plan. This activity could be extended to tossing two coins.

Certain, Uncertain

The teacher writes headings 'Certain' and 'Uncertain' on a sheet of paper.

In pairs, students are asked to list under the headings things that they think are sure to happen ('certain') at school on the day and then things that they think are not sure to happen ('uncertain') at school on the same day. Students discuss their findings.

Variation: Extend the activity to include other categories using the language of chance eg impossible, uncertain, certain.

Extension: Students devise their own rating scale using the language of chance.

WM Pegs

In groups, students are given a bucket of pegs. The bucket could have 10 blue and 10 yellow pegs. Students are asked to sort and count the pegs and then return them to the bucket.

Students are asked to predict all possible combinations of pegs if two pegs are randomly taken from the bucket. They select one possible combination and, without looking, take two pegs out of the bucket. They see if the actual result matches their predicted result and discuss.

Students repeat the selection several times returning the pegs to the bucket after recording their selection. They write a description of the activity explaining their observations.

WM Fair Game?

Students play games such as Snakes and Ladders, Heads Down/Thumbs Up, or outdoor games such as Statues. Students are asked if they think the game played is a fair game or not. Students are encouraged to justify their answers and to associate the idea of fairness with the idea that everyone has an equal chance to win. This activity could be extended to playing a game designed to be obviously unfair in order to stimulate discussion.

Tossed Fruit Salad

The teacher labels a large die with three faces displaying an apple, two faces displaying a banana and one face displaying an orange, and shows the die to the class.

Students are asked to order the fruits from least likely to most likely to be rolled.

After a number of rolls, the students compare the results with their predictions. Students discuss whether their predictions were supported by their experiment and explain the differences between expected results and actual results in this simple chance experiment.

Possible questions include:

- how can we change the labels on the die so that the orange is most likely to be rolled?

The labels are then changed accordingly, and the die rolled a number of times to compare the results with the students' predictions. Students are encouraged to make other suggestions about altering the labels to change the outcomes and these suggestions are tested.

Toss and Add

Students are asked to predict what total is most likely to result from throwing two dice and adding the numbers obtained. Students are asked to suggest ways they could check their prediction. Students could graph the results of multiple tosses and compare the results with their predictions.

WM Removing Counters

Students make a game board containing the numbers 1 to 12. In pairs, each student is given 12 counters to place on any of the numbers on their game board. Students can choose to place more than one counter on particular numbers and no counters on others. Students take turns to roll and add two dice. If they have placed counters on the total obtained, they remove them. The first player to remove all their counters from their game board wins. Students discuss the likelihood of rolling certain totals.

Variation: Students create game boards on the computer.

Take-away Dice

In pairs, students play the following game to investigate the concept of fairness. In turns, they throw two dice and subtract the smaller number from the larger number eg if '4' and '6' is thrown, they calculate 6 – 4 = 2.

Player A scores a point if the answer is 0, 1, or 2. Player B scores a point if the answer is 3, 4, or 5.

Students play the game and are asked to comment on whether the game is fair and why. Students are asked how the rules of the game could be changed to make the game fairer and how they could be changed so it is impossible for one student to lose.

WM Sample Bags

Students place four counters or blocks (eg three blue and one white) into a bag. The teacher discusses with the students the chance of drawing out a blue block.

Possible questions include:

- would you have a good chance or a poor chance of drawing out a blue block? Why?
- what colour block is most likely to be drawn out? Why?

Students could trial their predictions by drawing a block out of the bag a number of times, recording the colour and replacing the block each time. Students discuss their findings.

The colours are then swapped to three white blocks and one blue block. The teacher discusses with the students the chance of drawing out a blue block from this new group.

Possible questions include:

- would you have a good chance or a poor chance of drawing out a blue block? Why?
- what colour block is most likely to be drawn out? Why?

Students complete a number of trials and discuss the results.

Students are encouraged to make summary statements eg 'If there are lots of blue blocks you have a good chance of getting a blue block.'

Is It Fair?

The class is organised into four teams. Each team is allocated a colour name: red, blue, green or yellow.

The teacher has a bag of counters composed of 10 red, 5 blue, 4 green and 1 yellow. The students are told that there are twenty counters and that each colour is represented in the bag. The composition of counters is not revealed to the students.

The teacher draws a counter from the bag and a point is given to the team with the corresponding colour. The counter is then returned to the bag and the process is repeated for twenty draws.

Individually, the students are then asked to predict the composition of coloured counters in the bag, explain their prediction and state whether the game is fair.

Possible questions include:

- what happens if one colour is not included?
- have you tried using a diagram to help you with your predictions?
- what are some possible explanations?
- how will you know if your generalisations are reasonable?

Students are then told the composition of colours in the bag and are asked to name the colours most and least likely to be drawn out.

WM Musical Chairs

Students play the game Musical Chairs removing one chair each time. The chance of each student getting a chair is discussed. The game is repeated with three or more chairs removed at a time and students are asked to comment on whether there is more or less chance of getting 'out' compared to the original game.

Variation: Other games could be played where an aspect of the game is changed to affect the chance of various outcomes occurring.

WM Combination Dressing

Students are told that they will be given three t-shirts and two pairs of trousers and are asked to predict how many different combinations of clothes they could make from them. They work out a strategy and follow it to calculate the number of combinations and compare the results to their predictions.

Resources

bucket of pegs, dice, flash cards, coins, counters, bags, simple board games, coloured blocks

Links

Whole Numbers

Addition and Subtraction

Data

Literacy

Creative and Practical Arts

Language

always, never, sometimes, often, might, fifty-fifty, probably, certain, possible, mostly, won't happen, will happen, can happen, can't happen, lucky

'That would never happen.'

'You don't know which colour you'll get because you can't see in the bag.'

'Yes, that might happen.'

'There's not much chance of that happening.'

5.7 Length

Strand – Measurement

Syllabus Content p 94

MS2.1

Estimates, measures, compares and records lengths, distances and perimeters in metres, centimetres and millimetres

Key Ideas

Estimate, measure, compare and record lengths and distances using metres, centimetres and/or millimetres

Estimate and measure the perimeter of two-dimensional shapes

Convert between metres and centimetres, and centimetres and millimetres

Record lengths and distances using decimal notation to two places

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 2 content	Selects and uses appropriate mental or written strategies, or technology, to solve problems	Uses appropriate terminology to describe, and symbols to represent, mathematical ideas	Checks the accuracy of a statement and explains the reasoning used	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 2 content

Knowledge and Skills

Students learn about

- describing one centimetre as one hundredth of a metre
- estimating, measuring and comparing lengths or distances using metres and centimetres
- recording lengths or distances using metres and centimetres eg 1 m 25 cm
- recognising the need for a smaller unit than the centimetre
- estimating, measuring and comparing lengths or distances using millimetres
- recognising that ten millimetres equal one centimetre and describing one millimetre as one tenth of a centimetre
- using the abbreviation for millimetre (mm)
- recording lengths or distances using centimetres and millimetres eg 5 cm 3 mm
- converting between metres and centimetres, and centimetres and millimetres
- recording lengths or distances using decimal notation to two decimal places eg 1.25 m
- recognising the features of an object associated with length that can be measured eg length, breadth, height, perimeter
- using the term 'perimeter' to describe the total distance around a shape
- estimating and measuring the perimeter of two-dimensional shapes
- using a tape measure, ruler or trundle wheel to measure lengths or distances

Working Mathematically

Students learn to

- describe how a length or distance was measured (*Communicating*)
- explain strategies used to estimate lengths or distances eg by referring to a known length (*Communicating, Reflecting*)
- select and use an appropriate device to measure lengths or distances (*Applying Strategies*)
- question and explain why two students may obtain different measures for the same length, distance or perimeter (*Questioning, Communicating, Reasoning*)
- explain the relationship between the size of a unit and the number of units needed eg more centimetres than metres will be needed to measure the same length (*Communicating, Reflecting*)

Learning Experiences and Assessment Opportunities

How Many Centimetres in a Metre?

Students make a metre strip using 1 cm grid paper. In groups, students randomly cut their metre into 3 pieces and place all the group's strips into a bag. Students take turns to select and measure one strip. Students estimate and calculate what length strip they would need to add to their selected length to make exactly 1 metre. They are asked to explain how they know it will be 1 metre. Calculations for each strip are recorded in a table.

Length	Fraction of 1 metre	Fraction remaining
32 cm	$\frac{32}{100}$	$\frac{68}{100}$

Variation: Students take two strips that together are less than 1 metre, measure them and add the lengths together. They estimate and calculate how long a third strip would need to be to make exactly 1 metre.

Students also record the measurements using decimal notation.

WM Investigating Perimeters

Students use geoboards to investigate perimeters of shapes. They use shapes that have square corners. Students construct shapes that have perimeters of 4 units, 6 units, 8 units, etc. They record the shapes on dot or square paper. Students try to make different shapes that have the same perimeters. Students are asked if it is possible to make shapes which have a perimeter of 3 units, 5 units, 7 units, etc. They use the geoboard to make a shape which has:

- the smallest perimeter
- the largest perimeter.

Perimeter Match

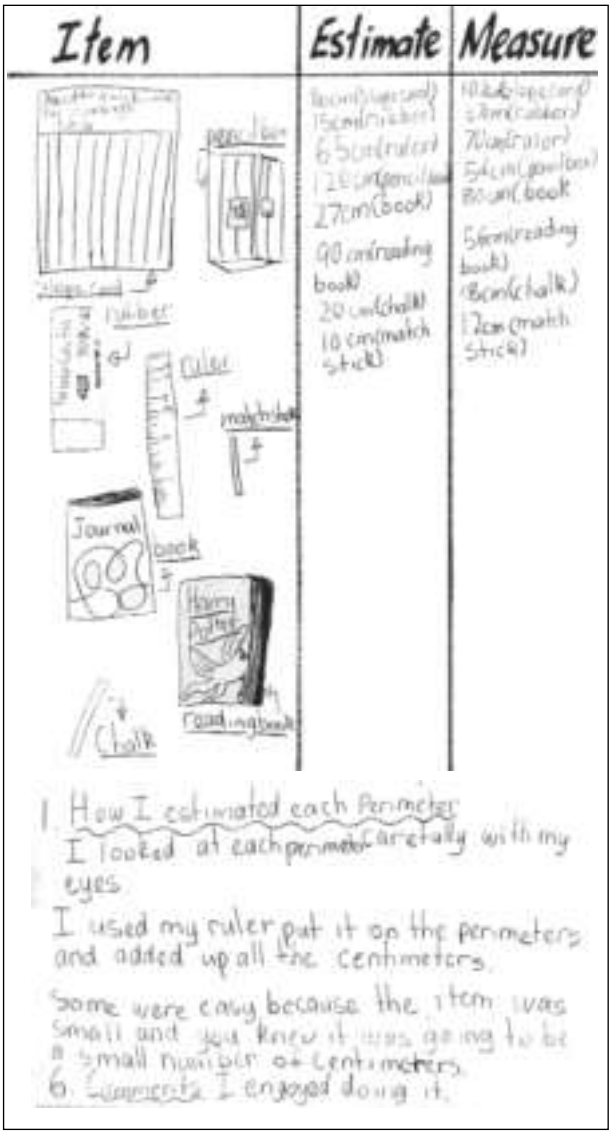
In pairs, students are given a length (eg 16 cm) and are required to construct a two-dimensional shape on a card with this perimeter. The teacher collects, shuffles and re-allocates cards to each pair. Students estimate and then measure the perimeter of their allocated shape. They then find their partner and compare and contrast their shapes.

Millimetres

Students make a table of things that have a dimension of 10 mm, 5 mm and 1 mm eg the width of a toothpick, the thickness of ten sheets of paper.

Perimeters

Students estimate and then measure, to the nearest centimetre, the perimeters of small items such as book covers, art paper, leaves. Students record the results and discuss.



WM Worms

Students make 'worms' using playdough. Students estimate, measure and label the length of their 'worms'. Some students will have the same length written in a different form eg 20 cm, 0.2 m. Students then order their worms in terms of length and note the different ways to record the same length.

Possible questions include:

- could you estimate, measure and record the length of your 'worm'?
- did you recognise the length of your worm recorded using a different unit?
- could you record your measurement using decimal notation to two decimal places?
- could you convert your measurement to millimetres? centimetres?

Measuring

Students estimate and measure the length or width of a selection of small objects to the nearest millimetre and record in a table using millimetres and a combination of millimetres and centimetres.

	Estimate	Measurement in mm	Measurement in cm and mm
Width of a pencil			
Length of a pencil sharpener			
Length of a paper clip			

Students could also measure larger objects that need to have precise dimensions eg width, height and thickness of the door, the diameter of a CD ROM.

WM Measuring Devices

In pairs, students are given a ruler, a trundle wheel and a tape measure. They select one of the measuring devices and choose an appropriate object and its dimensions to be measured using the device.

Students estimate, measure and record the measurements of each of the dimensions of the object in metres, centimetres and/or millimetres and use decimal notation where appropriate.

Students repeat the activity, selecting two objects for each of the measuring devices.

Possible questions include:

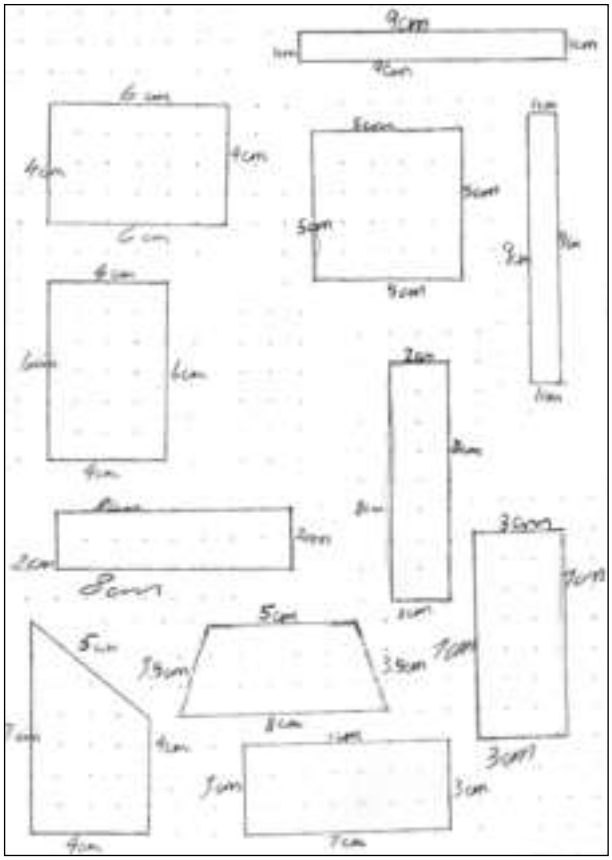
- how did you estimate the length or distance?
- what did you use to measure the length or distance? Why?
- what unit/s did you use to record your measurement?
- could you record your measurements another way?
- can you compare your measurements of the same lengths or distances with those of a friend?
- were they the same? Why? Why not?

Perimeter of 20 centimetres

Students are asked to investigate how many different four-sided shapes they can construct with a perimeter of 20 cm. Students record and share findings.

Possible questions include:

- how did you determine the dimensions of one shape?
- how did you find another shape?
- do you have all possible shapes that have a perimeter of 20 cm? How do you know?



WM Distances Around the School

Students brainstorm places around the school they regularly visit eg classroom next door, library. In groups, students are allocated a 'place' in the school. Groups estimate the distance from the classroom door to the designated place, select measuring devices and measure the distance. They record the distance in metres and centimetres, using decimal notation to two decimal places. Students compare and order the measurements.

Variation: Students are asked to choose a measuring device and an appropriate unit for measuring and recording smaller distances.

WM Measuring Using Centimetres and Metres

Students find objects between 1 m and 2 m long and record the lengths in a table.

Object	Estimate	Measurement	Decimal Notation
Teacher's desk	1 m 15 cm	1 m 7 cm	1.07 m

Students compare their table with those of other students to identify the longest and shortest objects.

Variation: Students record lengths in metres using decimal notation and in centimetres eg 1.05 m and 105 cm

Estimations

Students are given some lengths and instructed to find objects that they estimate to be these lengths. Students then measure the objects and reflect on the accuracy of their estimates.

Given length	Object	Actual length
30 cm		
0.6 m		
2.5 m		

Less than 30 cm

Students investigate ten objects that are less than 30 cm long.

Possible questions include:

- could you estimate and measure using only centimetres?
- what unit/s of measurement did you use?
- can you record your measurements in centimetres and millimetres?
- can you order your measurements?
- can you record your measurements another way?

Matching Measurements

The teacher prepares matching pairs of cards eg 1 m 23 cm, 1.23 m and 123 cm; 7 cm 3 mm, 7.3 cm and 73 mm.

Students use the cards to play games like Concentration, Old Maid and Fish.

Variations: The teacher provides sets of cards in pairs, each with the same measurement represented either in whole centimetres, whole metres or in decimal notation. Students are each given a card and must find the other person in the room with the same measurement on their card. Students then order themselves in terms of shortest to longest measurements on their cards.

Students could make their own sets of cards.

Rectangular Dimensions

In groups, students use a piece of string about 20 metres long to form a closed shape. Students make different rectangles using this fixed perimeter. Students record dimensions using metres and centimetres. Students share their solutions and look for patterns.

Find the Length

Students choose a 'length card' from a set of cards prepared by the teacher. They then find two items that they estimate to be the length shown. They measure, record and discuss their results. Students discuss the size of the unit and the number of units needed eg 'There are more centimetres than metres needed to measure the same length, because centimetres are a smaller unit.'

Resources

tape, ruler, toothpicks, environmental materials, cards, grid paper, string, plasticine, paper, trundle wheel, streamers, CD ROM, book cover, art paper, leaves, grid paper, dot paper

Language

metre, centimetre, circumference, millimetre, perimeter, estimating, measuring, two-dimensional, decimal point, around, outside, ruler, equal lengths, longer, shorter, standard, formal

Links

Two-dimensional Space

Addition and Subtraction

Fractions and Decimals

Area

5.8 Area

Strand – Measurement

Syllabus Content p 98

MS2.2

Estimates, measures, compares and records the areas of surfaces in square centimetres and square metres

Key Ideas

Recognise the need for square centimetres and square metres to measure area

Estimate, measure, compare and record areas in square centimetres and square metres

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 2 content	Selects and uses appropriate mental or written strategies, or technology, to solve problems	Uses appropriate terminology to describe, and symbols to represent, mathematical ideas	Checks the accuracy of a statement and explains the reasoning used	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 2 content

Knowledge and Skills

Students learn about

- recognising the need for the square centimetre as a formal unit for measuring area
- using a 10 cm × 10 cm tile (or grid) to find areas that are less than, greater than or about the same as 100 square centimetres
- estimating, measuring and comparing areas in square centimetres
- measuring a variety of surfaces using a square centimetre grid overlay
- recording area in square centimetres
  eg 55 square centimetres
- recognising the need for a unit larger than a square centimetre
- constructing a square metre
- estimating, measuring and comparing areas in square metres
- recording area in square metres eg 5 square metres
- using the abbreviations for square metre (m^2) and square centimetre (cm^2)

Working Mathematically

Students learn to

- question why two students may obtain different measurements for the same area (*Questioning*)
- discuss and compare areas using some mathematical terms (*Communicating*)
- discuss strategies used to estimate area in square centimetres or square metres eg visualising repeated units (*Communicating, Reflecting*)
- apply strategies for measuring the areas of a variety of shapes (*Applying Strategies*)
- use efficient strategies for counting large numbers of square centimetres eg using strips of ten or squares of 100 (*Applying Strategies*)
- explain where square metres are used for measuring in everyday situations eg floor coverings (*Communicating, Reflecting*)
- recognise areas that are 'smaller than', 'about the same as' and 'bigger than' a square metre (*Applying Strategies*)

Learning Experiences and Assessment Opportunities

WM 100 square centimetres

The teacher provides students with a 10 cm × 10 cm grid. Students estimate and count how many square centimetres it contains. Students then brainstorm items around the room that might be less than, more than, or about the same area as 100 square centimetres. Students collect items, compare them with their grid and record results in a table.

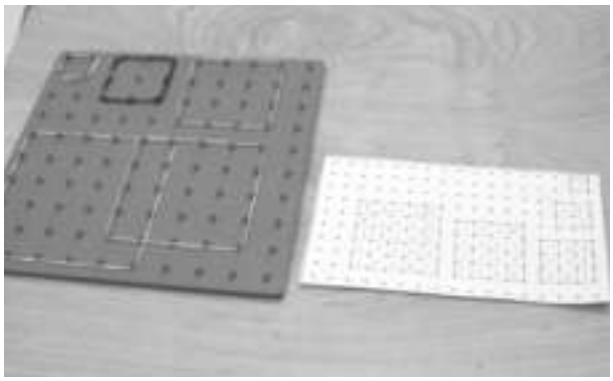
Item	Less than 100 cm^2	More than 100 cm^2	About the same as 100 cm^2

Geoboard Squares

Students make a unit square on a geoboard, connecting four pegs. Students then make a square with sides of 2 units and record the number of smaller squares contained within the larger one. Students continue making squares with sides of three, four, five, and six units and record their findings in a table. Students are encouraged to look for patterns
eg

Side lengths	Total number of squares
1 unit	1
2 units	4
3 units	9

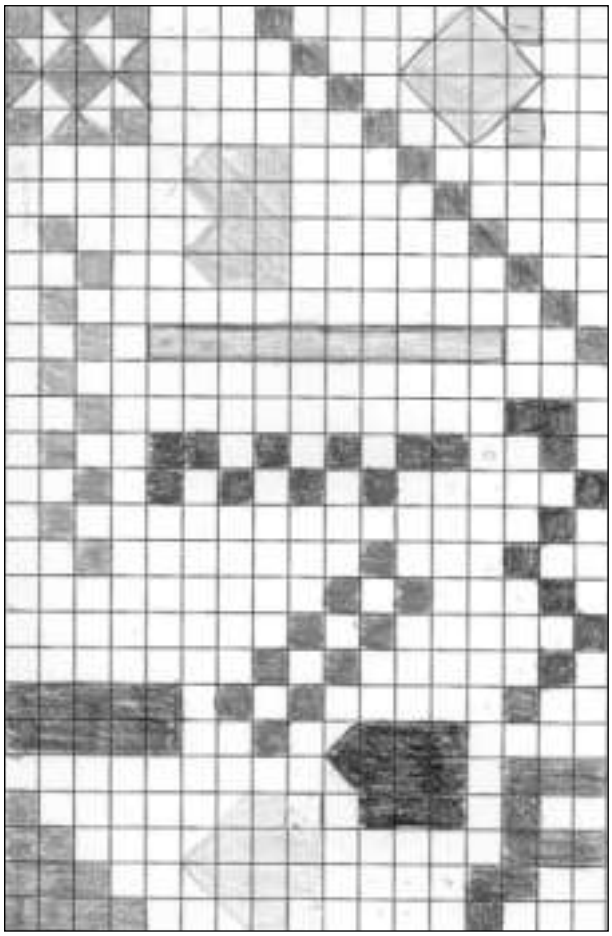
Students record their results on dot, grid or blank paper.



Area of 10 squares

Students use grid paper to construct a shape that has an area of 10 square units.

Students construct other shapes that have the same area and discuss that an area of ten square units may apply to many different shapes.



WM What Could It Be?

The teacher poses the question 'I have measured a surface in our room and found that it has an area of 8 square centimetres. What could it be?'

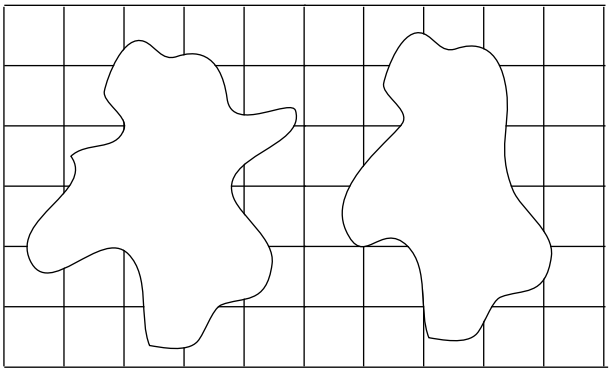
The teacher provides students with a square centimetre grid overlay. Students then use the grid overlay to identify items that match the teacher's description.

Students compare and record different-shaped items that have an area of 200 square centimetres.

Students measure a surface in the room using the square centimetre grid overlay, tell their partner the area and challenge their partner to find the surface.

Estimating Areas of Blob Prints

Students work in pairs. The teacher provides each pair with an A4 sheet of 1 cm grid paper. Students fold the sheet of paper in half and squirt a blob of paint on one half. Students then press the halves together and open the sheet again. When the paint has dried, students cut the sheet in half, separating the two blobs.



Each student estimates and counts the number of squares covered by the blob to calculate its area. Students record their results and compare them with those of their partner. Pairs of students compare their 'blob areas' with others to find the biggest and smallest blobs.

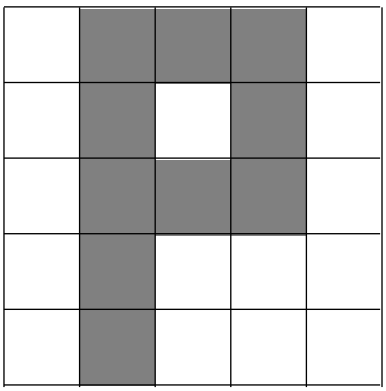
Possible questions include:

- what was the area of the biggest blob?
- did you get the same answer as your partner? Why? Why not?
- how did you count the parts where only a part of a square was covered by the blob?

Block Letters

The teacher provides students with 1 cm grid paper. Students select three letters to draw on their grid with a width of 1 cm

eg



Students measure and record the area of their letters eg the area of the P above is 10 cm^2. Students estimate whose letter will take up the most squares or have the greatest area. Students then compare the areas of their letters with those of other students to find the letter with the largest area.

Variation: Students draw the letters of their name.

Possible questions include:

- how many squares did it take to make your name?
- whose name would take the most squares? Why?

WM Constructing a Square Metre

In groups, students make a one square metre model out of newspaper sheets taped together. Students then discuss different shapes that could be created by cutting and rearranging the pieces. Students display the different shapes formed and label their areas 'One square metre'. Students examine the shapes.

Possible questions include:

- how can you fit the most people into a square metre?
- does an area of one square metre need to be shaped like a square? Why?
- what did you notice about the area of the newspaper when it was changed to a rectangular shape?
- can you name some other dimensions for a square metre?
- when you measured the area of your square, did you get the same answer as the person next to you? Why? Why not?

cm^2 and m^2

The teacher provides students with a collection of materials of various sizes. In pairs, students select the appropriate unit (cm^2 and m^2) and estimate the area of each item. Students check their estimates by measuring areas using square centimetre tiles/grids or square metre templates. Students then record their results in a table.

Item	cm^2 or m^2	Estimate	Measurement

Possible questions include:

- how did you decide when to use cm^2 ?
- what strategy did you use to estimate the areas?
- were your estimates close to the actual measurements?
- what device did you select to measure? Why?
- could you estimate, measure and record the area of six different surfaces or shapes?
- can you compare the measurements of each shape or surface?

WM Estimation

Students estimate, and then use square metre templates, to measure a variety of floor areas.

Possible questions include:

- how can you measure an area that is not quite a square metre?
- did you have any problems with overlapping?
- what did you do about it?

Direct Comparison

Students find things that are:

- smaller than a square metre
- equal to (or almost equal to) a square metre
- larger than a square metre.

Students record their findings in a table using the abbreviation m^2 eg

Less than 1 m^2	About 1 m^2	More than 1 m^2

Basketball Court/Play Area

Students work in small groups to estimate the area of the school's basketball court/play area in square metres. Students use a square metre template to measure the area.

Possible questions include:

- what strategy did you use to estimate the area?
- what strategy did you use to measure the area?
- would it be easier to measure the area in square centimetres? Why?
- how many classrooms would we need to put together to make a similar area?

Variation: Students find the area of their classroom or other large areas in the school.

WM Covering a Square Metre

The teacher poses the problem 'How many students do you think will fit onto a square metre?' Students record results for standing, sitting, lying down, etc. Students repeat the activity using a square metre in different shapes.

Possible questions include:

- were the results the same for the different shapes?
- why might there be a variety of results?

Students repeat the investigation with students from different classes and compare results.

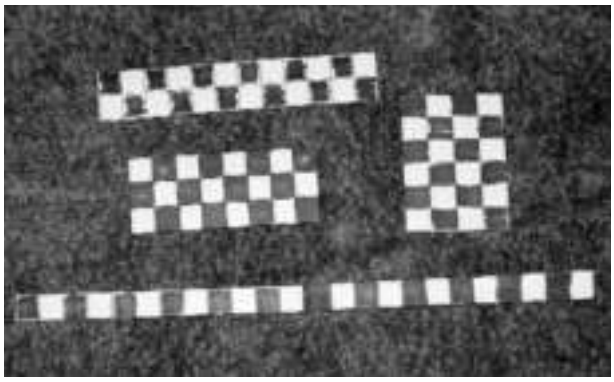
Investigating Rectangles

Students use square tiles of area 1 cm^2 to make all of the different rectangles that have an area of 24 cm^2.

Students draw the rectangles on grid paper and label lengths and breadths. Students tabulate results, including areas, and describe the number patterns that appear.

Variation: Students repeat the activity for other areas up to 36 cm^2 and record their findings.

Extension: Students imagine tiles are chocolates. They discuss packaging shape implications eg which rectangular dimensions are best suited for commercial use (display, transportation)?



Resources

newspaper, scissors, square centimetre tiles, geoboards, one metre ruler, tiles, elastic bands, 1 cm grid paper, grid overlays, 10 cm × 10 cm grids, 1 cm × 1 cm squares, tennis balls or stones or small boxes, paint

Links

Multiplication and Division

Fractions and Decimals

Length

Language

square metre, square centimetre, overlap, same as, more than, less than, smaller than, about the same, bigger than, grid

5.9 Time

Strand – Measurement

Syllabus Content p 114

MS2.5

Reads and records time in one-minute intervals and makes comparisons between time units

Key Ideas

Recognise the coordinated movements of the hands on a clock

Read and record time using digital and analog notation

Convert between units of time

Read and interpret simple timetables, timelines and calendars

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 2 content	Selects and uses appropriate mental or written strategies, or technology, to solve problems	Uses appropriate terminology to describe, and symbols to represent, mathematical ideas	Checks the accuracy of a statement and explains the reasoning used	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 2 content

Knowledge and Skills

Students learn about

- recognising the coordinated movements of the hands on an analog clock, including:
  - how many minutes it takes for the minute hand to move from one numeral to the next
  - how many minutes it takes for the minute hand to complete one revolution
  - how many minutes it takes for the hour hand to move from one numeral to the next
  - how many minutes it takes for the minute hand to move from the twelve to any other numeral
  - how many seconds it takes for the second hand on a clock or watch to complete one revolution
- associating the numerals 3, 6 and 9 with 15, 30 and 45 minutes and using the terms 'quarter-past' and 'quarter-to'
- identifying which hour has just passed when the hour hand is not pointing to a numeral
- reading analog and digital clocks to the minute eg 7:35 is read as 'seven thirty-five'
- recording digital time using the correct notation eg 9:15
- relating analog notation to digital notation eg ten to nine is the same as 8:50
- converting between units of time

  eg 60 seconds = 1 minute

  60 minutes = 1 hour

  24 hours = 1 day
- reading and interpreting simple timetables, timelines and calendars

Working Mathematically

Students learn to

- recall time facts eg 24 hours in a day (*Communicating, Applying Strategies*)
- discuss time using appropriate language (*Communicating*)
- solve a variety of problems using problem-solving strategies, including:
  - trial and error
  - drawing a diagram
  - working backwards
  - looking for patterns
  - using a table (*Applying Strategies, Communicating*)
- record in words various times as shown on analog and digital clocks (*Communicating*)
- compare and discuss the relationship between time units eg an hour is a longer time than a minute (*Communicating, Reflecting*)

Learning Experiences and Assessment Opportunities

Construct a Clock

Students construct an analog clock, label its parts and include any markings they already know. Students then compare their clock with a real analog clock and describe how the clocks are alike and different. They are given the opportunity to include any additional features on their clock.

WM Time Bingo

Part A

Students are given a page of blank analog clocks. They record their own times on the clocks. The teacher calls out various times. A counter is placed on a clock with the matching time. When all clocks are covered the student calls out 'Bingo.'

Part B

Students are given a page of blank digital clocks. Students record their own times on the clocks. The teacher calls out various times. A counter is placed on a clock with the matching time. When all clocks are covered the student calls out 'Bingo.'

Extension: Students are given a page with both analog and digital clocks. They record various times in both forms. The teacher calls out a time eg a quarter past 12. Students place a counter on the corresponding time, analog or digital ie a quarter past 12 or 12:15. When all the times are covered the student calls out 'Bingo'.

WM Reading Analog Clocks

The teacher presents the following scenario:

'Madeline is very good at reading digital clocks. All of the clocks in her house are digital. For Madeline's birthday her grandparents bought her an analog wristwatch but she is having trouble reading the time.'

Students are asked to write to Madeline, helping her to tell the time with her new watch. They are encouraged to use diagrams as part of their response.

The Minute and Hour Hands

Students observe and discuss the position of the hour hand at half past, quarter past and quarter to the hour, and on the hour. Students construct an analog clock with an hour hand only. In pairs, students position the hour hand anywhere on their clock and swap clocks with their partner. Students are then asked to identify the time represented on their partner's clock and give reasons.

Students are asked to display and name as many different times as possible using the minute and hour hands.

Turning Around the Room

Students stand in the middle of the classroom and are asked to pretend that the classroom is an analog clock with the students at its centre. Students are selected to position the number cards 12, 3, 6 and 9 on the classroom walls to represent a clock. Students are asked to start at the 'o'clock position' and make quarter turns in a 'clock-wise direction'. The activity is repeated with half turns and combinations of half and quarter turns to demonstrate 'half past' and 'quarter to'. One student is chosen to be the clock hands and points to the time. The rest of the class reads the time and records it on a clock face.

WM How Many Minutes?

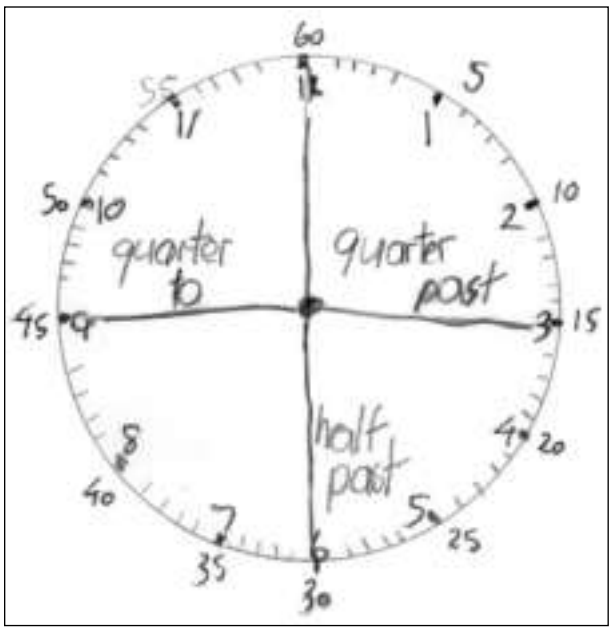
Students predict how many minutes it would take the minute hand to move from one numeral to another on an analog clock. Students then use a stopwatch to time how many minutes it takes for the minute hand to move from one numeral to the next. Students predict how many minutes it would take for the minute hand to complete one revolution and test their prediction with a stopwatch.

This activity can be extended to estimate and time how many minutes it takes the hour hand to move from one numeral to the next, how many minutes it takes the minute hand to move from the twelve to any other numeral, and how many seconds it takes for the second hand to complete one revolution.

Patterns in Time

Students write the minutes around an analog clock and describe the number patterns created eg 5, 10, 15, ….

Students divide the clock into quarters and highlight numbers related to 'half past', 'quarter to' and 'quarter past'.



WM Matching Times

The teacher provides students with sets of matching time cards in both analog and digital notation (eg ten to nine, 8:50). In small groups, students jumble the cards and place them face down. In turns, students turn two cards over. If the cards match, the student keeps them. The winner is the student with the most cards.

Following the game, students record times in other ways and make additional cards for the game. Students then repeat the game with the additional cards.

Possible questions include:

- can you read the time on each card?
- can you record the time on each card in another way?
- can you explain the relationship between the time units?

Duration of Activities

The teacher poses the problem 'An activity takes 15 minutes to complete. What might the activity be?' Students brainstorm a variety of activities. The problem is posed again using 30 minute and 45 minute durations. The teacher then provides students with cards which express 15, 30 and 45 minute durations in different ways eg 'quarter of an hour'. Students match times with activities
eg

30 minutes	**half an hour**	**$\frac{1}{2}$ hour**
reading, playing handball, watching television, washing dishes		

How Many Days?

The teacher poses the problem 'How many days have you attended school this term/year?' Students calculate a solution.

Students are asked ' How many other ways can you express this information?' eg in hours, in minutes. Students use a calculator to check their answers.

This activity could be extended by asking 'How many hours have you spent at recess and lunch this week?' Students could record information in days, hours or minutes on a spreadsheet and then draw a graph.

WM Patterns with Calendars

The teacher provides students with a variety of different calendars. Students discuss the common features.

Students record the dates for all the Tuesdays and Saturdays in the current month.

Possible questions include:

- what patterns can you see?
- what are the dates for Tuesdays and Saturdays in the following and the previous month?
- can you identify the features of a calendar?

Students access the Internet, find various calendars and compare features.

Barrier Game

Students form pairs. Student A is provided with a series of digital times recorded on cards. Student B is provided with an analog clock. Student A selects a card and explains to Student B where to position the hands on their clock to make a matching time. Student B records the time they have made both in analog notation and in digital notation eg twenty to eleven and 10:40. Student A checks the digital time with their card. Students swap roles and repeat the game.

Television Viewing

Students collect a variety of television guides from different sources eg magazines, newspapers. Students identify and discuss common features. Students then plan an evening of television viewing and record their plan in a table
eg

Program	Channel	Program begins	Program finishes

Students use a simple timetable.

Possible questions include:

- can you convert the digital times to analog times?
- what information can you interpret from a timetable?

Variation: This information could be used to draw a timeline.

Students exchange timelines and describe what the other student would be watching that evening and when.

Resources

television guides, time cards (eg ten to nine, 8:50), timelines, calendars, analog clocks, digital clocks, sets of numeral cards (3, 6, 9 and 12), cardboard, split pins stopwatch

Links

Multiplication and Division

Patterns and Algebra

Fraction and Decimals

Language

analog, digital, seconds, minutes, hours, days, weeks, year, time, clock, timetable, timeline, calendar, relationship, quarter to, quarter past, half past, clockwise, revolution, minute hand, hour hand, revolution, second hand, intervals

5.10 Position

Strand – Space and Geometry

Syllabus Content p 136

SGS2.3

Uses simple maps and grids to represent position and follow routes

Key Ideas

Use simple maps and grids to represent position and follow routes

Determine the directions N, S, E and W; NE, NW, SE and SW, given one of the directions

Describe the location of an object on a simple map using coordinates or directions

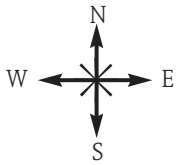
WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 2 content	Selects and uses appropriate mental or written strategies, or technology, to solve problems	Uses appropriate terminology to describe, and symbols to represent, mathematical ideas	Checks the accuracy of a statement and explains the reasoning used	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 2 content

Knowledge and Skills

Students learn about

- describing the location of an object using more than one descriptor eg 'The book is on the third shelf and second from the left.'
- using a key or legend to locate specific objects
- constructing simple maps and plans eg map of their bedroom
- using given directions to follow a route on a simple map
- drawing and describing a path or route on a simple map or plan
- using coordinates on simple maps to describe position eg 'The lion's cage is at B3.'
- plotting points at given coordinates
- using a compass to find North and hence East, South and West
- using an arrow to represent North on a map
- determining the directions N, S, E and W, given one of the directions
- using N, S, E and W to describe the location of an object on a simple map, given an arrow that represents North eg 'The treasure is east of the cave.'
- using a compass rose to indicate each of the key directions eg



- determining the directions NE, NW, SE and SW, given one of the directions
- using NE, NW, SE and SW to describe the location of an object on a simple map, given a compass rose eg 'The treasure is north-east of the cave.'

Working Mathematically

Students learn to

- use and follow positional and directional language (*Communicating*)
- create simple shapes using computer software involving direction and angles (*Applying Strategies*)
- discuss the use of grids in the environment eg zoo map, map of shopping centre (*Communicating, Reflecting*)
- use computer software involving maps, position and paths (*Applying Strategies*)
- create a simple map or plan using computer paint, draw and graphics tools (*Applying Strategies*)
- use simple coordinates in games, including simulation software (*Applying Strategies*)
- interpret and use simple maps found in factual texts and on the Internet (*Applying Strategies, Communicating*)

Learning Experiences and Assessment Opportunities

WM Ice-Cube Tray

In pairs, students are given an ice-cube tray. Students describe the position of a bead or counter to be placed in the ice-cube tray eg 'put the bead in the third square from the left in the top row'. Students find that position in their ice-cube tray and place a bead or counter there.

Students check and discuss their results. Students repeat the activity in opposing pairs. Student A describes the location of the opposition's bead for student B to place a corresponding bead in the correct position.

Variation: The activity could be played as a barrier game or Battleships.

Buried Treasure

The teacher hides mystery objects and gives simple compass directions and distances in paces from a starting point to enable students to find the objects.

Variation: Students work in groups and carry out searches to find objects.

WM Mystery Location

Students are asked to describe the location of an object in the classroom eg 'My picture is fifth from the left and it's in the second row on the back wall'. Students write a description of the object using positional clues. The teacher collects the clues and reallocates them back to the students. Students read the descriptions and locate the object.

Extension: In pairs, Student A hides an object in the room while Student B turns away. Student A gives Student B directions to find the hidden object. Student B then has a turn at hiding the object.

Body Turns

The teacher marks the four major compass directions on the ground. Students face north. Students are asked to turn left or right in quarter turns and state in which direction they then face. Students are given north and are then asked to face particular compass directions. Students record on a compass rose.

Students are then asked to face a place in the playground and name the direction they are facing.

Extension: NE, NW, SE and SW are introduced to enable students to describe places that lie between N, S, E and W.

Positional Concentration

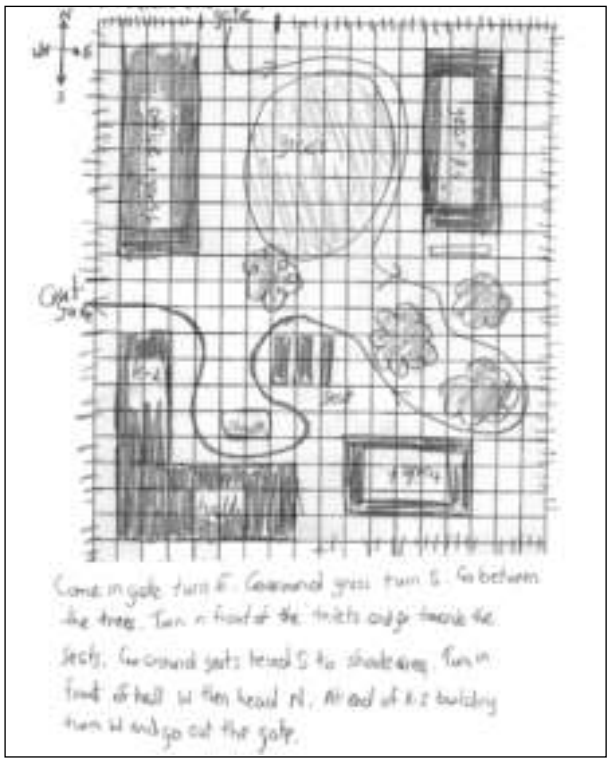
Students shuffle a pack of cards or part of a pack and place the cards face down in rows. In pairs, students take turns in instructing the other student, using the language of position, which cards to turn over eg turn over the fifth card in the second row. The aim of the game is to turn over two cards that match. If the two cards turned over match, then the student who gave the instruction wins the cards and has another turn. If the two cards do not match they are turned back over in the same position and the other player has a turn. The winner is the student who has the most cards when all the cards have been matched.

WM Bike Track

In pairs, students are given grid paper to design a bike track within the school grounds or the local park. Students discuss their layout, such as ensuring the route does not cross itself and provides an entry/exit to the school grounds.

Students draw a grid over their map and are asked to describe their bike tracks using positional language, in relation to other structures or pathways.

Students use a compass rose to indicate directions.



Maps

Students are given atlases and/or road maps and are asked to locate north and then find other compass points.

Students use a compass rose and use N, S, E or W to describe the location of a point on a map.

Students are asked to find places on a map that are in a given direction from a starting point eg find a town which is due north of Cairns. Students are asked to pose their own questions using directional language.

On a map of Australia students locate Alice Springs. They then locate places NE, NW, SW, SE of there. Students describe the location of the places in relation to Alice Springs and record using a compass rose.

WM Using a Compass

In small groups in the playground, students use a compass to locate the directions N, S, E and W. Students mark on the ground a grid with sufficient spaces for each student in the group to have a space of their own.

A leader is chosen and blindfolded to call out compass directions ie North, South, East, West. Students follow the directions, moving one grid space at a time, until they are off the grid and 'out'. Players must call 'I'm out' when they are off the grid. The last student to survive wins and becomes the new leader. The game can be extended, giving directions of North-East, North-West, South-East and South-West. Students could experiment with rule changes to add further interest to the game.

Variation: Students could do the same activity in the classroom using grid paper.

6 × 6 Position

Students draw a 6 × 6 grid and label the axes 1 to 6 and A to F. In pairs, students take turns to tell the other player where to put their counter. The winner is the first to set four of their own counters at the corners of a square.

Variation: In pairs, students draw a picture/pattern on the 6 × 6 grid and tell the other student how to draw the picture or pattern. They could use the computer to reproduce their pictures or patterns.

A and B

The teacher provides each student with grid paper marked with coordinates. Students are asked to draw a map of the room or playground using the grid paper. They are asked to include an arrow on their map to indicate North. Students choose two room or playground features and label them A and B. They determine the set of co-ordinates for A and B and use directional language to describe the location of other room/playground features related to A and B. In groups, they brainstorm the positional language required to complete the activity.

WM Street Directories

Students are given a simple map of a town with grid lines superimposed. They find places on the map, given coordinates. Students give the coordinates of particular places on the map.

Students use a page of a street directory or a map of the town in which they live. Students are asked to give the coordinates of:

- the place where they live
- the school
- the post office.

Students are asked to state what building or physical feature is shown on the map at certain grid positions eg 'What would we find if we walked to A7?'

Possible questions include:

- how many different ways can you get from one point to another?
- what does …….. mean in the key? Where can I find it on the map?
- can you describe the location of an object in relation to a landmark?
- what coordinates or directions can you use to identify the ……(landmark)?
- can you determine the directions N, S, E and W on the map? How did you know? What could you use to check?
- can you identify NE, NW, SE and SW on the map? can you identify a landmark NW of ……..?

Theatre Plans

Students draw a seating plan for a school performance in the assembly hall and number seats using coordinates. Students produce numbered tickets and distribute them. On the day of the performance students show people to their seats using their plan.

Classroom Grids

Part A

Students arrange desks in rows and columns. Each line (column) of desks is given a name or colour. Each desk in the line is given a number, starting with 1 at the front, from left to right. Students give a grid position for each class member. This could lead to games in which students are identified by their grid position and where students are assigned to seats according to grid position.

Part B

In pairs, students are given a 10 × 10 grid. They label the axes then draw pictures on the grid. Students take turns using coordinates to describe the position of each picture.

Variation: Students could play a Battleships game.

WM Turning in Right Angles

Students are encouraged to discuss compass points eg N, SW.

Students could use this knowledge to play 'Robots'. In pairs, students label grid paper using the same coordinates and a scale.

Student A gives directions while Student B is the robot eg Student A says 'Face East, go forward 3 paces, turn right one right angle, go forward 4 paces and turn two right angles to your left….'. At each instruction Student B tells Student A in which direction they are facing. Student B draws the route onto their grid paper. Students compare routes.

Possible questions include:

- what angle have you turned through?
- what direction would you be facing if you turned through one more right angle?

Boxes

Students play a variation of the game 'Boxes' on a 6 × 6 grid. In small groups, students take turns to roll two dice, one at a time. The first roll represents the number on the horizontal axis, and the second roll represents the number on the vertical axis. The student plots their point on the grid paper and gives the dice to the next player. Students continue to take turns to plot their coordinates, until one person has 4 points to make a 'box', putting their initials inside it. The game continues until all points are plotted or a time limit is up, and the person with the most boxes wins.

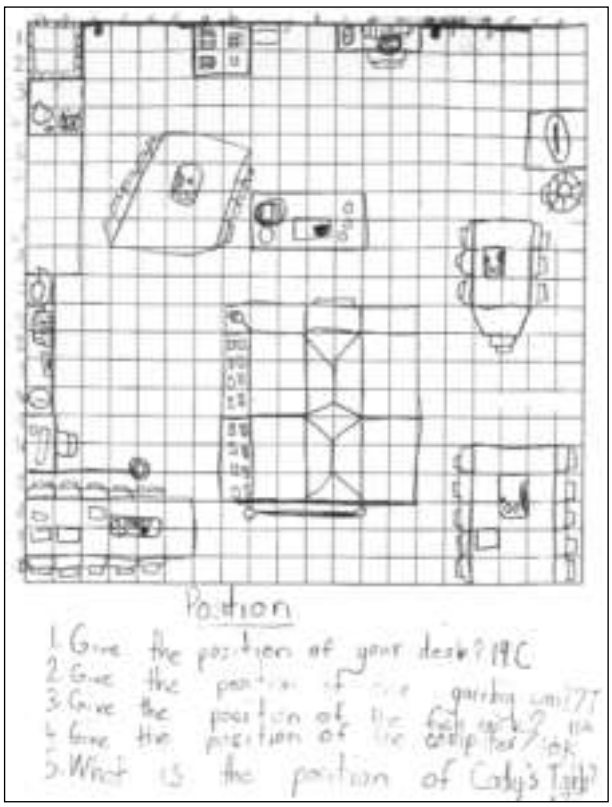
WM Construct a Simple Map/Plan

Students construct a simple map/plan of their bedroom, classroom or playground. Students plot coordinates on the map/plan and include a key.

Possible questions include:

- can you construct a simple map or plan using coordinates?
- does your key allow you to locate specific objects?
- can you draw a path from one point to another on your map/plan?
- can you describe how to get from one point to another?
- can you use directions to follow a route on your map?
- can you describe the location of an object in relation to another using more than one descriptor?
- can you describe the position of ……. using coordinates?

Extension: Students create a plan of a room of their choice using drawing tools on the computer.



Resources

compass, chalk, blindfold, mystery objects, ice-cube tray, beads, counters, tote trays, geoboards, dot paper, rubber bands, atlases, simple maps, street directories

Language

position, location, direction, coordinates, north, south, east, west, north-east, north-west, south-east, south-west, plot, legend, key, path, route

Links

HSIE

Length

Two-dimensional Space

Stage 3
Sample Units of Work

6.1 Multiplication and Division

Strand – Number

Syllabus Content p 56

NS3.3

Selects and applies appropriate strategies for multiplication and division

Key Ideas

Select and apply appropriate mental, written or calculator strategies for multiplication and division

Use formal written algorithms for multiplication (limit operators to two-digit numbers) and division (limit operators to single digits)

Explore prime and composite numbers

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 3 content	Selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations	Describes and represents a mathematical situation in a variety of ways using mathematical terminology and some conventions	Gives a valid reason for supporting one possible solution over another	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 3 content

Knowledge and Skills

Students learn about

- applying appropriate mental, written or calculator strategies to solve multiplication and division problems
- recognising and using different notations to indicate division eg $25 \div 4$, $4\overline{)25}$, $\frac{25}{4}$
- recording remainders as fractions or decimals, where appropriate eg $25 \div 4 = 6\ \frac{1}{4}$ or 6.25
- multiplying three- and four-digit numbers by one-digit numbers using mental or written strategies

	(mental)	(written)
eg 432×5	$= 400 \times 5 + 30 \times 5 + 2 \times 5$ $= 2000 + 150 + 10$ $= 2160$	432 $\times\ \ 5$ 2160

- multiplying three-digit numbers by two-digit numbers using the extended form (long multiplication)

eg
$$\begin{array}{r} 521 \\ \times\ 22 \\ \hline 1042 \\ 10420 \\ \hline 11462 \end{array}$$

- dividing a number with three or more digits by a single divisor using mental or written strategies

	(mental)	(written)
eg $341 \div 4$	$340 \div 4 = 85$ $1 \div 4 = \frac{1}{4}$ $341 \div 4 = 85\ \frac{1}{4}$	$85\ \frac{1}{4}$ $4\overline{)341}$

- using mental strategies to multiply or divide a number by 100 or a multiple of 10
- finding solutions to questions involving mixed operations eg $5 \times 4 + 7 = 27$
- determining whether a number is prime or composite by finding the number of factors eg '13 has two factors (1 and 13) and therefore is prime; 21 has more than two factors (1, 3, 7, 21) and therefore is composite'

Working Mathematically

Students learn to

- estimate answers to problems and check to justify solutions (*Applying Strategies, Reasoning*)
- select an appropriate strategy for the solution of multiplication and division problems (*Applying Strategies, Reflecting*)
- use a number of strategies to solve unfamiliar problems, including:
  - trial and error
  - drawing a diagram
  - working backwards
  - looking for patterns
  - simplifying the problem
  - using a table

  (*Applying Strategies, Communicating*)
- use the appropriate operation in solving problems in real-life situations (*Applying Strategies, Reflecting*)
- give a valid reason for a solution to a multiplication or division problem and check that the answer makes sense in the original situation (*Communicating, Reasoning*)
- use mathematical terminology and some conventions to explain, interpret and represent multiplication and division in a variety of ways (*Applying Strategies, Communicating*)
- use and interpret remainders in answers to division problems eg realising that the answer needs to be rounded up if the problem involves finding the number of cars needed to take 48 people to an event (*Applying Strategies, Communicating*)
- question the meaning of packaging statements when determining the best buy eg 4 toilet rolls for $2.95 or 6 toilet rolls for $3.95 (*Questioning*)
- determine that when a number is divided by a larger number a fraction which is less than 1 is the result (*Reflecting*)
- calculate averages in everyday contexts eg temperature, sport scores (*Applying Strategies*)
- explain why a prime number when modelled as an array has only one row (*Communicating, Reflecting*)

Learning Experiences and Assessment Opportunities

WM Comparing Mental and Written Strategies

Students estimate, then multiply three- and four-digit numbers by one-digit numbers, to compare mental and written strategies when solving problems eg 'There are 334 students in a school. If each student watches 3 hours of television per day, how many hours of television is this?'

Students share their strategies and determine which is the most efficient.

Possible questions include:

- how did your estimation help?
- which operation did you use?
- can you describe your strategy?
- is your strategy efficient? Why?
- did your answer make sense in the original situation?
- how can you check whether your answer is correct?

Students write their own problems using large numbers. They check answers on a calculator.

Factor Game

Part A

In pairs, students are provided with a pack of playing cards with tens and picture cards removed. The Aces remain and count as 1 and the Jokers remain and count as 0. The students flip a card each and place them together to make a one- or two-digit number. Students use a calculator to find all of the factors of the number created. They record the number and the factors in two groups: composite numbers and prime numbers.

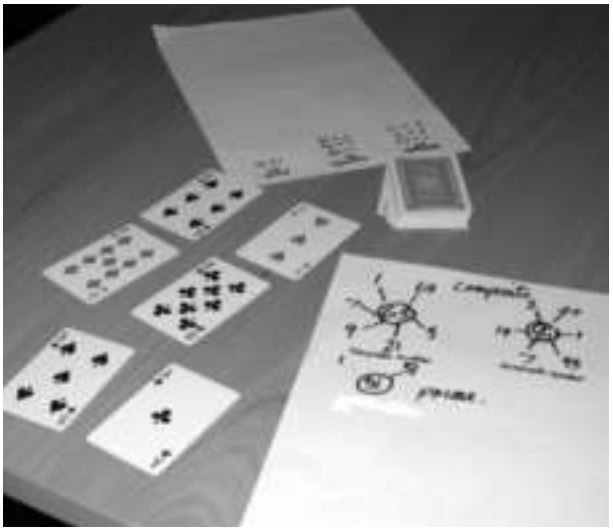
Part B

In pairs, students select 5 composite numbers and 5 prime numbers. They use counters to make arrays for their numbers.

Possible questions include:

- why does a prime number, when modelled as an array, have only one row?

Extension: Students record and discuss square and triangular numbers and look for patterns eg numbers with 3 factors are squares of prime numbers.



Multiples of 10

Part A

Students are asked to multiply some two-digit numbers by ten and discuss their findings. They are asked to determine mental strategies for doing this. Students then try multiplying the same two-digit numbers by 20, 30,……100. They are asked to determine mental strategies for doing this.

Part B

Students are asked to divide some two-digit numbers by ten and discuss their findings. They are asked to form a rule for doing this. Students then try dividing the same two-digit numbers by 20, 30, ….100. They are asked to determine mental strategies for doing this.

Possible questions include:

- does your strategy apply to all two-digit numbers?
- does your strategy apply to multiplying/dividing by 20, 30,….100?

WM Dividing by Ten

The teacher poses the scenario: 'On the way to school 4 children found a $50 note. They handed it in to the principal. They will get a share of the $50 if no one claims it after a week.'

Possible questions include:

- how much would each child get?
- how much would each child get if $5 was found?
- how much would each child get if 50c was found?
- which operation would you use to check if your answer is correct?

Students discuss the solutions and make generalisations about placement of the decimal point when dividing by ten. They investigate similar problems to test their ideas.

Written Division

Students solve problems that involve dividing a three-digit number by a one-digit number using written strategies, showing remainders as a fraction:

$$4\overline{)34^{2}1} \quad 85\frac{1}{4}$$

Students solve division problems interpreting when remainders need to be rounded up eg finding the number of cars with four seats to take 341 people to an event, the solution would be 86 not 85 $\frac{1}{4}$.

Variation: Students use calculators to check answers and discuss.

Mixed Operations

Students express each of the numbers from 1 to 100 using mixed operations.

eg $1 = 2 \times 1 - 1$

$2 = 2 \div 2 + 1$

$3 = 4 - 3 + 2$

$4 = 9 \div 3 + 1$

Extension: Students express a number using all 4 operations.

Mixed Operations Game

In pairs, students are given a set of different-coloured counters each, three dice and a game board. Students create the game board by using any 25 numbers from 1 to 50. In turns, students roll the three dice, use these numbers with any operations to create a number from the board, and cover the number with a counter .The game continues until one player has three counters in a row in any direction.

20	11	38	47	16
19	17	8	15	12
1	20	3	7	35
26	42	34	43	49
21	17	16	29	50

Variation: Students use four dice and make game boards with higher/lower numbers.

The game could also be played with cards.

WM Rounding up division

The teacher poses the scenario:

'A farmer has 49 eggs. He needs to put them into cartons, that each hold a dozen eggs, to send to market. How many cartons does he need?'

Possible questions include:

- how many eggs will fit into each carton?
- what strategy did you use to find the solution?
- can you think of another way that the farmer could pack the eggs?

Students record the strategies used.

Students write their own problems involving division with remainders. They publish their work using a computer software package eg Powerpoint, Kidspix, Slideshow.

Variation: The teacher poses the scenario involving larger numbers of eggs and different-sized cartons.

WM Number Patterns

Students are given a table such as:

$2 \times 8 = 16$	$16 \div 2 = 8$
$2 \times 80 = 160$	$160 \div 2 = 80$
$2 \times 800 = 1\,600$	$1600 \div 2 = 800$

They are asked to continue the pattern and describe the number pattern created. Students are encouraged to create further number patterns and are given access to a calculator. Further number patterns could include:

$10 \times 40 =$	$400 \div 10 =$	$10 \times 500 =$	$5000 \div 10 =$
$20 \times 40 =$	$800 \div 20 =$	$20 \times 500 =$	$10000 \div 20 =$
$70 \times 40 =$	$2800 \div 70 =$	$70 \times 500 =$	$35\,000 \div 70 =$

Possible questions include:

- what happens if you multiply a number by a multiple of ten?
- what happens if you divide a number by a multiple of ten?
- can you devise a strategy for multiplying by a multiple of ten?
- can you devise a strategy for dividing by a multiple of ten?

In Pairs

The teacher gives each group of students a pack of number cards (0 – 9). They shuffle the cards and place them in a pack face down in the centre of the group of players. One player who is the 'dealer' turns over the top three cards. Players can use each digit up to four times to create a number that is a multiple of 2, 3, 4, 5, 6, 7, 8, 9. The aim of the game is to make two-digit numbers that are multiples of 2, 3, 4, 5, 6, 7, 8, 9.

eg CARDS 6 8 9

88 is a multiple of 2

96 is a multiple of 3

68 is a multiple of 4

… is a multiple of 5

96 is a multiple of 6

… is a multiple of 7

… is a multiple of 8

… is a multiple of 9.

A point is scored for each correct example. All answers are to be checked on the calculator by the 'dealer'. Each player has a turn at being the 'dealer' and then scores are tallied. The winner is the player who creates the largest number of correct examples.

Variation: Students may use each digit up to five times or play with four cards each time.

WM Value for Money

Students collect supermarket brochures advertising weekly sales. Students investigate prices (eg 4 ice-blocks for $2.95 or 6 ice-blocks for $3.95), in order to recommend the best buys.

Possible questions include:

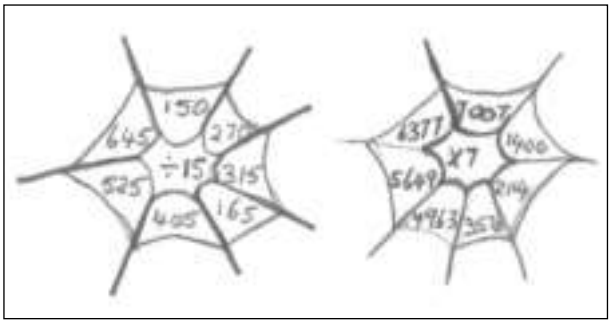
- can you explain the best buy? Why is it the best buy?
- how did you work it out?
- is there a better strategy you could use to work it out?

Variation: Students collect a variety of brochures and rate prices according to value for money.

Multiplication/Division Webs

Students create web patterns using three- or four-digit numbers. They draw the web with multiplication facts on one side and division facts on the back. Students swap their webs with a partner and write the answers in the outer web. They check the answers with a calculator.

Variation: Students create multiplication or division webs using large numbers.



Extended Form of Multiplication

Students multiply numbers by breaking the calculation into two parts

eg $32 \times 14 = 32 \times 10 + 32 \times 4$.

Students are shown how these can be combined in using an extended algorithm.

$$\begin{array}{r} 32 \\ \times\ 14 \\ \hline 128 \\ +320 \\ \hline 448 \end{array}$$

Extension: Students solve three-digit problems by two-digit multiplication using extended multiplication.

WM Product Estimations

Students pose questions and estimate the answers.

Possible questions include:

- what are 2 two-digit numbers that would have a product between 2000 and 2400?
- will 85×95 be between 7600 and 8000? (Students estimate first and then check.)
- estimate the answer for 39×61.

Students then use a calculator to check their estimations. Students are encouraged to practise estimating and checking using other examples.

Spin, Estimate and Check

Students make two octagonal spinners, one with three-digit numbers within a given range (eg 850 to 950) and the other with the numbers 2 to 9. Student A spins the two spinners and estimates the answer when the three-digit number is divided by the single-digit number.

eg $920 \div 7$ is about 130.

Student B checks the answer on a calculator.

Student A scores 1 point if their estimate is 21 or more away from the answer, 2 points if their estimate is 11 to 20 away from the answer and 3 points if their estimate is 10 or less away from the answer. Students swap roles. Students take turns and keep a tally of their scores. The game continues until one student scores 20 or more points.

Variation: Students could repeat the activity for multiplication.

WM Averages

Students calculate averages related to a range of everyday situations eg temperature, heights of students. Students investigate open-ended questions eg if the average height of 3 students is 140 cm, what are possible heights for each of the students?

Variation: Students collect data on the exchange rate of the Australian dollar (AUD), petrol prices or the distribution of newspapers over a week, and determine averages. Students experiment with other ways of representing the information.

Resources

supermarket brochures, calculators, problems involving two- and three-digit numbers, grid paper, number cards 1 to 20, counters

Links

Whole Numbers
Area
Fractions and Decimals
Patterns and Algebra
Data

Language

strategies, efficient, multiplication, division, average, calculate, mental, written, multiply, divide, operations, product, quotient, prime, composite, fraction, decimal, solution, select, appropriate, estimate, explain, guess, check, is equal to, share, remainder, remaining

6.2 Fractions and Decimals

Strand – Number

Syllabus Content p 64

NS3.4 - Unit 1

Compares, orders and calculates with decimals, simple fractions and simple percentages

Key Ideas

Model, compare and represent commonly used fractions (those with denominators 2, 3, 4, 5, 6, 8, 10, 12 and 100)

Find equivalence between thirds, sixths and twelfths

Express a mixed numeral as an improper fraction, and vice versa

Multiply and divide decimals by whole numbers in everyday contexts

Add and subtract decimals to three decimal places

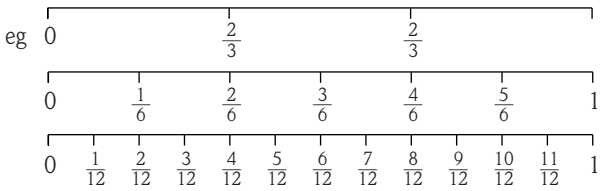
WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 3 content	Selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations	Describes and represents a mathematical situation in a variety of ways using mathematical terminology and some conventions	Gives a valid reason for supporting one possible solution over another	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 3 content

Knowledge and Skills

Students learn about

- modelling thirds, sixths and twelfths of a whole object or collection of objects
- placing thirds, sixths or twelfths on a number line between 0 and 1 to develop equivalence



- expressing mixed numerals as improper fractions, and vice versa, through the use of diagrams or number lines, leading to a mental strategy
- recognising that $1 + \frac{1}{2} = 1\frac{1}{2}$
- using written, diagram and mental strategies to subtract a unit fraction from 1 eg $1 - \frac{1}{3} = \frac{2}{3}$

- using written, diagram and mental strategies to subtract a unit fraction from any whole number eg $4 - \frac{1}{3}$
- adding and subtracting fractions with the same denominator eg $\frac{5}{6} + \frac{3}{6}$
- expressing thousandths as decimals
- interpreting decimal notation for thousandths
- comparing and ordering decimal numbers with three decimal places
- placing decimal numbers on a number line between 0 and 1
- adding and subtracting decimal numbers with a different number of decimal places
- multiplying and dividing decimal numbers by single digit numbers and by 10, 100, 1000

Working Mathematically

Students learn to

- pose and solve problems involving simple proportions eg 'If a recipe for 8 people requires 3 cups of sugar, how many cups would be needed for 4 people?' (*Questioning, Applying Strategies*)
- explain or demonstrate why two fractions are or are not equivalent (*Reasoning, Reflecting*)
- use estimation to check whether an answer is reasonable (*Applying Strategies, Reasoning*)
- interpret and explain the use of fractions, decimals and percentages in everyday contexts eg $\frac{3}{4}$ hr = 45 min (*Communicating, Reflecting*)
- apply the four operations to money problems (*Applying Strategies*)
- interpret an improper fraction in an answer (*Applying Strategies*)
- use a calculator to explore the effect of multiplying or dividing decimal numbers by multiples of ten (*Applying Strategies*)

Learning Experiences and Assessment Opportunities

Brainstorm Fractions

The teacher selects a fraction between 0 and 1 with a denominator of 2, 3, 4, 5, 6, 8, 10, 12 or 100. Students brainstorm everything they know about that fraction eg equivalent fractions, decimal equivalence, location on the number line.

This could be done at the beginning and at the end of a unit on fractions and decimal numbers to assess learning.

Variation: Students record different ways to represent a fraction eg $\frac{1}{2}$, 50%, 0.5.

WM Equivalence

Part A

Students are given three strips of paper of the same length in different colours eg red, blue, green. They fold the red strip into 12 equal sections, the blue strip into 6 equal sections and the green strip into 3 equal sections. Students label each red section $\frac{1}{12}$, each blue section $\frac{1}{6}$, and each green section $\frac{1}{3}$.

They use these sections to determine equivalence of fractions with denominators 3, 6, and 12.

eg $\frac{1}{3} = \frac{2}{6} = \frac{4}{12}$

Part B

Students use their knowledge of equivalence of fractions with denominators 3, 6 and 12 to place thirds, sixths and twelfths on a number line between 0 and 1. Students then name equivalent fractions with denominators 3, 6 and 12. Possible questions include:

- how do you know if two fractions are equivalent?
- how can you demonstrate this?

Mystery Fraction Cards

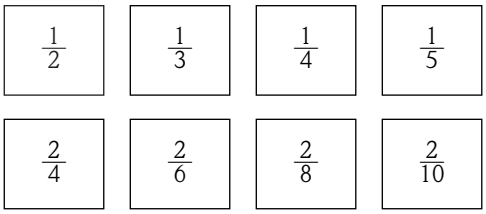
Students are given 'mystery fraction cards' with clues to solve.

Mystery Fraction
It is improper fraction.
It is more than 1.
It is less than one and a half.
When written as mixed numeral, $\frac{1}{4}$ is a part of it.

Students construct other 'mystery fraction cards' and exchange them with those of other students.

Comparing and Ordering Fractions

The teacher prepares a series of fraction cards such as:



Students are asked to place the cards on a number line.

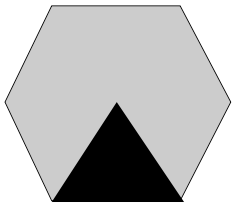
Students are encouraged to discuss the correct placement of the cards and why some cards need to be placed on top of other cards.

This activity could be extended to include improper fractions and renaming them as mixed numerals eg placing $\frac{3}{2}$ half-way between 1 and 2 on the number line and renaming it $1\frac{1}{2}$.

Variation: The teacher could scan images of fraction cards onto a computer. Students then click and drag the images to the correct position on a number line.

WM Pattern Block Fractions

In pairs, students play a fraction trading game using pattern blocks. Students determine that if a hexagon is given the value of 1, then a triangle is $\frac{1}{6}$ and a trapezium is $\frac{1}{2}$.



The aim of the game is to be the first person to win three hexagons. In turn, students roll a die and pick up the corresponding number of triangles. Three triangles $(\frac{3}{6})$ can be traded for a trapezium $(\frac{1}{2})$. Two trapeziums $(\frac{2}{2})$ can be traded for a hexagon (1). Students record each turn and the trading as number sentences

eg $\frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$.

This activity could be extended to subtraction by playing the game in reverse, where the aim is to be the first to lose 3 hexagons.

Make 1

Part A

In pairs, students are given a number sentence in which a unit fraction is subtracted from 1 eg $1 - \frac{1}{3} = \frac{2}{3}$. Students fold a strip of paper into the appropriate number of sections determined by the denominator and colour the number of sections to be subtracted. They complete the number sentence. Students are encouraged to use mental strategies to subtract unit fractions from whole numbers.

Part B

Students are given a unit fraction and are asked to name the fraction that they need to add to it to make 1.

Part C

Students in pairs, Student A enters a decimal number between 0 and 1 on the calculator. Student B estimates the number that needs to be added to make exactly 1. Student A adds the estimate to the number on the calculator. Each student starts with a score of 1. If the answer is not exactly 1 then Student B takes the difference between the answer and 1 off their score eg 1.4 is the answer so Student B's score is 0.6. Students take turns to choose the start number. The game continues until one player has no score. Students discuss the mental strategies used for their estimations.

WM Thousandths

The teacher introduces the term 'thousandths'. Students discuss its meaning. The teacher tells the students that they are going to try to count from 0 to 1 by thousandths. Students enter 0.001 on their calculators. Students press +0.001= to add another thousandth and then continue pressing =. Students stop when their calculator reads 0.01 and discuss why their calculator does not read 0.010. Students continue to count by thousandths by pressing + + and then repeatedly pressing =. Students stop at regular intervals and talk about the numbers they have on their calculators. Students stop when they reach 0.25 and discuss their progress in counting by thousandths from zero.

Possible questions include:

- how many thousandths have you counted?
- how many hundredths is this?
- what have you noticed?
- why doesn't the calculator say 0.250?
- what will the calculator read when you have reached 500 thousandths? Why?
- how many hundredths is this?
- how many tenths is this?
- what will the calculator read when you reach 1000 thousandths? Why?

WM Fractions to Decimals

The teacher demonstrates how to use the calculator to produce decimal fractions from common fractions by dividing the numerator by the denominator eg 1÷ 2 = 0.5. Students find a number of fractions equivalent to 0.5, 0.25 and 0.125.

Fraction Cards

In groups, students are given a set of fraction cards where the fractions have denominators 2, 3, 4, 5, 6, 8 and 10. They are asked to record each fraction as a decimal and a percentage. Students display their recordings and share their findings with the class.

Variation: The fraction cards could contain multiple representations of the same fraction eg $\frac{1}{2}$, 50%, 0.5. Students could use these cards to play Concentration, Snap, or Old Maid.

WM What's the Question?

The teacher poses the following: 'The answer to a question is $1\frac{1}{2}$, what might the question be?' Students record a variety of questions, including word problems, number sentences and questions that involve more than one operation. They are encouraged to include a variety of questions that cover all four operations and combinations of operations eg

$$\frac{1}{2} + \frac{1}{2} + \frac{1}{2} = \frac{3}{2} \quad \text{or} \quad 2 - \frac{1}{2} = \frac{3}{2}$$

The teacher poses the scenario:

'Dad had a recipe for 20 buns that needed 5 cups of flour. If he only wants to make 6 buns, how much flour will he need?' Students write their own problems where the answer is

$1\frac{1}{2}$ or $2\frac{1}{2}$.

Add and Subtract Fractions

In small groups, students are given a circle template that has been divided into sixths, eighths or twelfths.

One group cuts the circle into 6 equal pieces. Another group cuts it into 8 equal pieces and another into 12 equal pieces.

Each student takes a piece of 'pizza' and writes number sentences to represent the situation

eg $\frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{3}{6}$

The activity is continued with each group having more than one circle

eg $\frac{3}{12} + \frac{7}{12} + \frac{5}{12} = \frac{15}{12}$ or $1\frac{3}{12}$

The groups are rotated so that each student works with a variety of denominators

eg $\frac{1}{6} + \frac{1}{12} + \frac{5}{12} + \frac{3}{6} = \frac{14}{12}$

Bulls-eye

In pairs, students are given a number less than 100 and take turns in estimating what number to multiply it by to get an answer between 100 and 101. They test their estimation on the calculator.

eg the starting number is 24

Player 1: Estimation: 3.8 Test: $24 \times 3.8 = 91.2$

Player 2: Estimation: 4.35 Test: $24 \times 4.35 = 104.4$

Player 1: Estimation: 4.1 Test: $24 \times 4.1 = 98.4$

Player 2: Estimation: 4.2 Test: $24 \times 4.2 = 100.8$ (Winner)

Students repeat the activity using other numbers less than 100.

Decimals and the Four Operations

Part A: Addition and Subtraction

In pairs, students are provided with a pack of playing cards with tens and picture cards removed. The Aces remain and count as 1 and the Jokers remain and count as 0. Student A turns over up to five cards and makes a decimal number of up to three decimal places. Student B turns over up to five cards and also makes a decimal number of up to three decimal places. Student A records and adds the two numbers. Student B observes and checks Student A's answer. Students swap roles and the activity is repeated.

This activity can be extended to involve subtraction of decimal numbers, addition of three or more decimal numbers and the addition and subtraction of money.

Part B: Multiplication and Division

In pairs, students are provided with a pack of playing cards with tens and picture cards removed. The Aces remain and count as 1 and the Jokers remain and count as 0. Student A flips up to five cards, makes a decimal number up to three decimal places, and reads the number aloud. Student B flips one card. Student A writes the numbers and uses an algorithm to multiply the numbers. Student B observes and checks Student A's answer on a calculator. Students swap roles and repeat.

This activity can be extended to involve division of decimal numbers by single-digit numbers and the multiplication and division of money.

Adding and Subtracting to Three

The teacher poses the problem:

'Choose three decimal numbers that add up to 3. At least one of the numbers must have a different number of decimal places eg 1.6 + 0.04 + 1.36 = 3.'

Students record their solutions.

Possible questions include:

- how many different solutions can you find?

Variation: Students write a number sentence involving subtraction where at least one of the numbers used to obtain 3 has a different number of decimal places. The teacher could change the number of decimal places required or the answer to be found.

Ordering Fractions and Decimals

Each student is given a set of cards with decimal numbers on them and is asked to order them on a number line between 0 and 1.

Each student is then given a mixed set of cards with decimals and fractions on them eg $\frac{75}{100}$, 0.15, $\frac{25}{100}$, 0.45.

Students place them on a number line, discussing and justifying their placements.

Students then select two of the numbers eg 0.15 and $\frac{75}{100}$ and record six decimals or fractions between the numbers

eg 0.15, 0.2 , $\frac{25}{100}$, 0.37, $\frac{1}{2}$, $\frac{59}{100}$, $\frac{7}{10}$, $\frac{75}{100}$

WM Multiplying and Dividing Decimals

Part A

Students enter a decimal number, between 0 and 1, with up to three decimal places into a calculator. Students predict what will happen when the number is multiplied by 10. Students record their prediction and then test it. Students repeat the activity using other decimal numbers between 0 and 1. Students are asked to write a strategy for multiplying a decimal number by 10. The activity could be repeated for multiplying by 100, 1000. Students are encouraged to multiply decimals by multiples of ten without a calculator.

Part B

Students repeat the above activity using division.

Possible questions include:

- what happens to the decimal point when you multiply/divide a number by 10? 100? 1000?
- can you devise a strategy for multiplying/dividing a decimal number by 10? 100? 1000? a multiple of ten?

Students use mental or written strategies to multiply/divide a decimal number by 10, 100, 1000.

Resources

fraction kits, pattern blocks, fraction cards, paper, calculators

Links

Addition and Subtraction

Multiplication and Division

Patterns and Algebra

Chance

Data

Language

fraction, decimal, percentage, thousandth, tenth, decimal places, whole, part of, half, quarter, third, sixth, eighth, twelfth, mixed numeral, proper fraction, improper fraction, denominator, numerator

6.3 Chance

Strand – Number

Syllabus Content p 70

NS3.5

Orders the likelihood of simple events on a number line from zero to one

Key Ideas

Assign numerical values to the likelihood of simple events occurring

Order the likelihood of simple events on a number line from 0 to 1

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 3 content	Selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations	Describes and represents a mathematical situation in a variety of ways using mathematical terminology and some conventions	Gives a valid reason for supporting one possible solution over another	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 3 content

Knowledge and Skills

Students learn about

- using data to order chance events from least likely to most likely eg roll two dice twenty times and order the results according to how many times each total is obtained
- ordering commonly used 'chance words' on a number line between zero (impossible) and one (certain) eg 'equal chance' would be placed at 0.5
- using knowledge of equivalent fractions and percentages to assign a numerical value to the likelihood of a simple event occurring eg there is a five-in-ten, $\frac{5}{10}$, 50% or one in two chance of this happening
- describing the likelihood of events as being more or less than a half (50% or 0.5) and ordering the events on a number line
- using samples to make predictions about a larger 'population' from which the sample comes eg predicting the proportion of cubes of each colour in a bag after taking out a sample of the cubes

Working Mathematically

Students learn to

- predict and discuss whether everyday events are more or less likely to occur or whether they have an equal chance of occurring (*Applying Strategies, Communicating*)
- assign numerical values to the likelihood of simple events occurring in real-life contexts eg 'My football team has a fifty-fifty chance of winning the game.' (*Applying Strategies, Reflecting*)
- describe the likelihood of an event occurring as being more or less than half (*Communicating, Reflecting*)
- question whether their prediction about a larger population from which a sample comes would be the same if a different sample was used eg 'Would the results be the same if a different class was surveyed?' (*Questioning, Reflecting*)
- design a spinner or label a die so that a particular outcome is more likely than another (*Applying Strategies*)

Learning Experiences and Assessment Opportunities

WM Fifty-Fifty

Students are asked to suggest events that have a 'fifty-fifty' chance of occurring. Students are asked where an equal chance event would occur on a number line marked from 0 to 1. Students list events that have no chance, an equal chance, or are certain, of occurring.

Students use knowledge of equivalent fractions and percentages to assign a numerical value to the likelihood of a simple event occurring eg 'fifty-fifty' is the same as 50%, a five-in-ten chance, $\frac{5}{10}$, a one-in-two chance, 0.5 chance.

WM Running Race

The teacher uses a game board representing a 1000 m track, with six counters (runners) at the starting line.

	200 m	400 m	600 m	800 m	1000 m
Runner 1					
Runner 2					
Runner 3					
Runner 4					
Runner 5					
Runner 6					

Students take turns to roll a die and state the number shown on the die. They move the 'runner' with the corresponding number 200 m (one square) eg if 4 is rolled 'Runner 4' is moved 200 m (one square).

The teacher allows the students to play for a few moves. Students are then asked to predict which runner will win.

Possible questions include:

- what chance of winning has Runner 6? 4? 3? 1? 2? 5? Why?
- is any runner more likely to win than another? Why?

Students then prepare to play their own games by predicting which 'runner' they think will win. In pairs, they play the game. The teacher gathers all results. Students compare the results with their prediction and discuss.

Variation: Students design a spinner to ensure that a particular runner is more likely to win than another.

Sampling

The teacher places one hundred counters into a paper bag, 70 red, 20 white and 10 green. A student takes out 10 counters without looking. Students predict the proportion of counters of each colour in the bag using this sample.

Possible questions include:

- how many of each colour do you think are in the bag? Why?
- do you think your prediction is very accurate?

Students return the counters to the bag and select another sample of 10. They make another prediction and compare this with that of other student.

Students discuss the predictions and compare with the actual sample. They are encouraged to make up their own sample experiments using this as a model. Students discuss where sampling could be a useful tool.

Sampling the School Population

Students select a sample of a group of students and ask them to name their favourite food, TV program, etc. From this sample students predict school population results.

Possible questions include:

- would we get different results if all students in the sample were from Year 2? were girls? were tall? had blue eyes?
- what strategies could be used to ensure the sample reflected the whole population?
- what examples of sampling are used in real-life situations?

WM Heads and Tails Game

Students stand up and choose to be 'heads' (place their hands on their head) or 'tails' (place their hands behind their back). The teacher flips a coin and calls out 'heads' or 'tails'. If it is 'heads', the students who chose 'heads' remain standing and the students who chose 'tails' sit down; and the reverse for 'tails'. Students standing then choose again either 'heads' or 'tails'. The game continues until only one student remains standing and is declared the winner.

Possible questions include:

- did your choice of 'heads' or 'tails' affect your chances of getting out? Why?
- if the previous toss was 'heads', did this affect the chance that the next toss would be 'heads'? Why? Why not?

Students' ideas are recorded and then checked by playing several more games, where the result of each flip of the coin is recorded, tallied and graphed. Students could try to record the information in a table, list or diagram.

Fair Game

The teacher challenges the students to a dice game. Two dice are rolled. If the total is 7 the teacher wins. If the total is not 7 the students win. The game is played 20 times with the total recorded each time.

Possible questions include:

- was the game fair? Why? What are your reasons for thinking that?
- what total occurred most often? Why?

Students design a die so that a particular outcome is more likely to occur than another.

Design a Chance Game

The teacher tells the story: 'Two students decide to invent an addition dice game, where they are sure to win. Before they invent the game they decide to determine the odds. Students roll two dice 20 times. They add the numbers shown on the two dice, tally the results and record the chance of each answer occurring eg 6 occurred 3 out of 20 times.'

Possible questions include:

- do all totals have an equal chance of being rolled?
- how could you change the likelihood of certain totals occurring?

Students invent a game using two dice of their own design where they have a greater chance of winning. They explain and discuss the approach taken in inventing their game.

Variation: Students invent a multiplication or division dice game where they have a greater chance of winning.

WM Mini Lotto

Students label ten table tennis balls with the numbers 1 to 10. Students select two numbers from 1 to 10 as their lotto entry.

The teacher draws two balls at random. Students discuss their chances of winning using the language of chance.

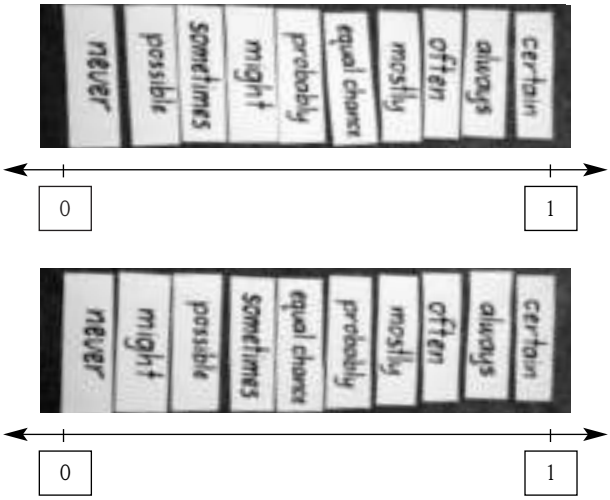
Students design a mini lotto game that increases the chance of a certain number being drawn. They then discuss the chance of each number occurring eg 5 has a 50% chance of being drawn because half the balls are numbered 5 while 2 has no chance of being drawn because none of the balls are numbered 2.

Chance Words

Students are given the following chance words on cards: always, never, sometimes, often, might, equal chance, probably, certain, possible, mostly.

In groups, students are asked to order them on a number line from 0 (impossible) to 1 (certain). Students compare their order with other groups and discuss.

They then match each word with an everyday event eg 'We *sometimes* play tips at lunchtime.' 'There is an equal chance it will rain tonight.' 'The teacher *might* read the book *Pigs Might Fly* by Emily Rhodda.'



Assigning a Number Value

Students survey the whole school or a sample of students, and consider the chance of the next enrolment at the school being:

- a boy
- left-handed
- brown-eyed
- the eldest in the family
- a twin.

The students assign a number value between 0 and 1 for each possibility. Students compare data for the whole school to their predictions.

Resources

dice, table tennis balls, plastic money, game board, flash cards

Language

outcomes of events, trial, chance of occurring, sampling, predict, impossible, certain

Links

Fractions and Decimals

6.4 Data

Strand – Data

Syllabus Content p 88

DS3.1

Displays and interprets data in graphs with scales of many-to-one correspondence

Key Ideas

Determine the mean (average) for a small set of data

Draw picture, column, line and divided bar graphs using scales of many-to-one correspondence

Read and interpret sector (pie) graphs

Read and interpret graphs with scales of many-to-one correspondence

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 3 content	Selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations	Describes and represents a mathematical situation in a variety of ways using mathematical terminology and some conventions	Gives a valid reason for supporting one possible solution over another	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 3 content

Knowledge and Skills

Students learn about

- using the term 'mean' for average
- finding the mean for a small set of data

Picture Graphs and Column Graphs

- determining a suitable scale for data and recording the scale in a key eg ♥ = 10 people
- drawing picture or column graphs using a key or scale
- interpreting a given picture or column graph using the key or scale

Line Graphs

- naming and labelling the horizontal and vertical axes
- drawing a line graph to represent any data that demonstrates a continuous change eg hourly temperature
- determining a suitable scale for the data and recording the scale on the vertical axis
- using the scale to determine the placement of each point when drawing a line graph
- interpreting a given line graph using the scales on the axes

Divided Bar Graphs and Sector (Pie) Graphs

- naming a divided bar graph or sector (pie) graph
- naming the category represented by each section
- interpreting divided bar graphs
- interpreting sector (pie) graphs

Working Mathematically

Students learn to

- pose questions that can be answered using the information from a table or graph (*Questioning*)
- collect, represent and evaluate a set of data as part of an investigation, including data collected using the Internet (*Applying Strategies*)
- use a computer database to organise information collected from a survey (*Applying Strategies*)
- use a spreadsheet program to tabulate and graph collected data (*Applying Strategies*)
- determine what type of graph is the best one to display a set of data (*Reflecting*)
- explain information presented in the media that uses the term 'average' eg 'The average temperature for the month of December was 24 degrees.' (*Communicating*)
- discuss and interpret graphs found in the media and in factual texts (*Communicating, Reflecting*)
- identify misleading representations of data in the media (*Reflecting*)
- discuss the advantages and disadvantages of different representations of the same data (*Communicating, Reflecting*)

Learning Experiences and Assessment Opportunities

Picture Graph

Students collect data for organisation into a picture graph eg daily canteen sales of pies, drinks, ice blocks. Students decide on an appropriate scale, symbol, and key eg □ = 10 drinks.

Possible questions include:

- what key did you use?
- have you given your graph a title and a key?
- what is the mean for the set of data?
- how did you determine the scale?
- how do the scale and key enable interpretation of your graph?
- can you pose three questions that can be answered using the information from your picture graph?

The students could represent data in a picture graph using a computer.

WM Temperature

The teacher divides the students into two groups. Students in the first group record the temperature in the playground every hour, while the students in the second group record the temperature every half hour, for a day. In groups, students draw a line graph to display their data. The first group estimates the half-hourly temperatures from their line graph and compares with the actual recordings taken by the second group.

Possible questions include:

- how have you labelled the axes?
- how did you determine a suitable scale for the data you collected?
- how did the 'hourly' line graph help you to predict half-hourly temperature changes?
- is a line graph the most suitable way to represent this data? Why?
- who could use a graph like this? Why?
- can you record the data another way?

This activity could be extended to determining the average temperature for the day.

Populations of Countries

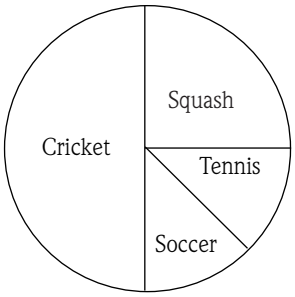
Students use the Internet to find the population of ten countries. They graph their findings using an appropriate scale to represent large numbers. Students are encouraged to represent the data using different types of graphs and discuss the advantages and disadvantages of each representation.

WM Sector Graphs

Students collect sector graphs from sources such as newspapers and the Internet, or the teacher provides a graph. Students discuss the relative sizes of sectors, stating absolute quantities only where half and quarter circles are involved. Students answer questions using the data in the sector graph

eg

Favourite Sports



Possible questions include:

- what sport do half the people surveyed prefer?
- what sport do a quarter of the people surveyed prefer?
- which two sports combined are preferred by a quarter of the people surveyed?

Table

Students collect data, and represent the information in a spreadsheet or table.

Possible questions include:

- what type of graph could you draw to represent this data?
- will you need a scale?
- where will your scale go on your graph?
- how will you label your graph?
- how else could your data be represented?
- can you find the mean?
- where else have you seen this type of graph used?

Students make a generalisation about the best way to represent the data. This activity could be completed using a spreadsheet program to graph the data. Students could represent the data using different types of graphs and discuss the advantages and disadvantages of each type.

WM Who is the Average Student?

Students collect numerical data from other students eg number of family members, height and age. They determine the mean for each set of data.

Students consider whether there is a student in the class who fits one of the three averages or all three averages. Students discuss their findings.

Alphabet Hunt

Students predict which letter of the alphabet is most frequently used. They justify their predictions and suggest how they could test their predictions.

Possible questions include:

- would some letters occur more than others? Why?
- which letters would be least likely to occur? Why?
- which letter do you write most often?

The teacher gives each student a page from a text eg a novel, a newspaper, a school magazine. Each student is allocated a letter to count on the page. The results are collated into a class table, and each student draws a graph to show the results. They then make statements about the results and their predictions eg 'I knew it would be a vowel, because all words have vowels so I chose A.'

Students could use technology to graph the data.

Variation: The teacher poses a different scenario: 'Would the letter frequency change if you used a different piece of literature or factual text?' or 'If you picked the "A" volume of the encyclopaedia would that be fair?' Students discuss their predictions.

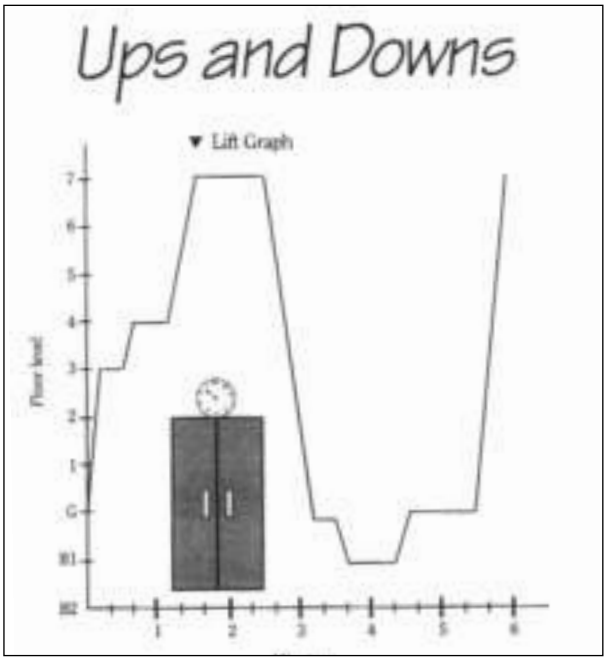
Ups and Downs

The teacher provides each student with a copy of a graph that shows the movement of a lift over a period of time.

Possible questions include:

- how many minutes are shown on the graph?
- how many floors are in the building?
- what happened when the line goes up sharply?
- why did the lift stop for 20 seconds?

In small groups, students discuss the graph suggesting possible explanations for the movement of the lift. Each group writes a story to match the graph, either as a narrative or as a report. Each group then shares their story with the rest of the class who discuss and comment on the interpretation.



WM Class Sector Graph

Students write the name of a country they would like to visit from a selection of four. They sit in a circle organised by their choice of country. The teacher uses lengths of string to separate the sections and create a sector graph.

Students draw the graph and describe fractional parts.

For example, if there were 30 students and 15 chose to visit the USA, then that part of the circle can be described as $\frac{15}{30}$ and represents half of the circle.

Students collect a variety of graphs and tables.

Possible questions include:

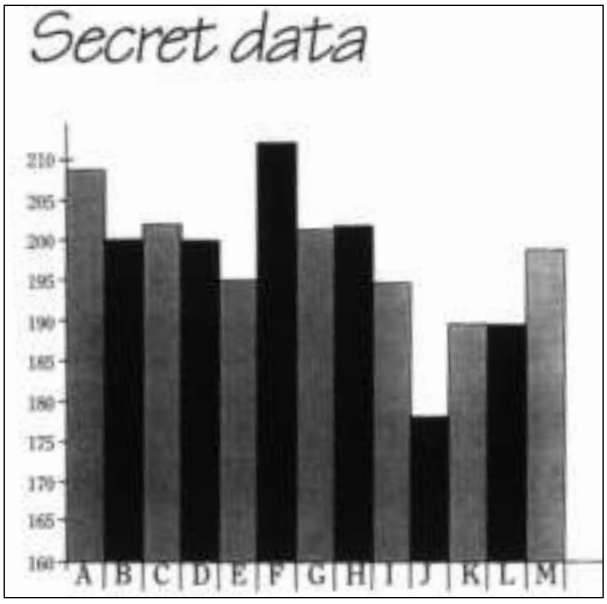
- what sort of information is represented?
- why do you think the information is represented in this way?
- how can it be represented differently?
- what questions can we ask?
- what information is best represented by line graphs, column graphs, picture graphs, sector graphs, tables?

WM Secret Data

The teacher displays a graph on an overhead with the vertical axis marked in centimetres and the horizontal axis labelled with the letters A to M, but with no title. In small groups, students discuss what the title could be and record suggestions and reasons. Each group then chooses its best title and reports back to the class arguing the merits of its choice. The class decides which is the most appropriate title for the graph.

Possible questions include:

- what strategies did you use to decide on your title?
- what information do you need on a graph to interpret data correctly?



(This graph represents the heights of 13 players from the Sydney Kings basketball team.)

Variation: Students obtain graphs from a variety of sources or make their own. They erase the title and the information on one of the axes. In groups, they decide on a title for the graph, justifying their choice.

Tell me a Story

Students use the placement of points on a line graph, that represent the changes in the depth of water, to write a story. They are provided with the completed line graph with axes marked eg time and depth of water in centimetres. Students give their graph a suitable title. Students brainstorm a checklist of events for each point on the line graph that they will include in their story and then write their story. Students share their story with the class. The class uses the checklist and the placement of points on the line graph to assess each story.

WM Media Graphs

Students collect a variety of graphs used in the media and in factual texts. They consider each graph separately.

Possible questions include:

- what type of graph is used? What is its purpose?
- what information can you interpret from the graph?
- who would use the information?
- who produced the graph and why?
- is the graph misleading? Why?

Students represent the information in a different way.

Divided Bar Graphs

Students are provided with examples of divided bar graphs and discuss their common features. They collect data and make a concrete model of a divided bar graph by attaching unifix cubes in bands of colour eg yellow for blond hair. Students then draw their divided bar graph using an appropriate scale. Students discuss the relative sizes of the sections.

Possible questions include:

- what did you name your bar graph and the categories represented by each section?
- what fraction of the total does each section represent?
- how can you check that you are correct?

Students represent the data on a spreadsheet.

WM Mean

Students are provided with information presented in the media that uses the term 'average' eg travel brochures, weather forecasts. They find the meaning of the terms 'mean' and 'average' and discuss their usage. The students discuss both words and their meanings. The students collect mean temperatures of a city and represent the data in a graph.

WM Survey

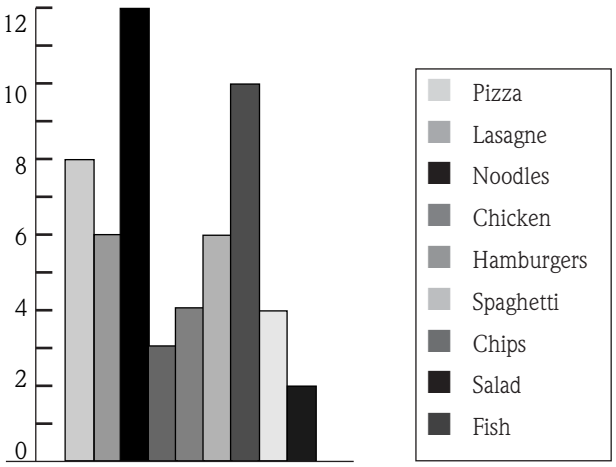
Students survey the class on their favourite sport, food, colour, number, etc. Students determine what type of graph is the best to display the set of data and use the data to draw their graph on a computer. Students share and compare graphs.

Possible questions include:

- what type of graph did you select? Why?
- what are the advantages and disadvantages of different types of graphs to display this data?
- could you have used a different type of graph?
- how did you determine the scale?
- how have you labelled your axes?
- what title did you give your graph?

Our Favourite Food

Pizza	8
Lasagne	6
Noodles	12
Chicken	3
Hamburgers	4
Spaghetti	6
Chips	10
Salad	4
Fish	2



Resources

newspapers, thermometer, centicubes, sector graphs, computer software

Links

Whole Numbers

Addition and Subtraction

Multiplication and Division

Two-dimensional Space

Language

data, represent, graph, column graph, line graph, bar graph, sector graph, results, symbols, vertical, horizontal, scale, many-to-one, average, mean, category, predict, representation, advantages, disadvantages, key, arrangement

6.5 Length

Strand – Measurement

Syllabus Content p 95

MS3.1

Selects and uses the appropriate unit and device to measure lengths, distances and perimeters

Key Ideas

Select and use the appropriate unit and device to measure lengths, distances and perimeters

Convert between metres and kilometres; and millimetres, centimetres and metres

Record lengths and distances using decimal notation to three places

Calculate and compare perimeters of squares, rectangles and equilateral and isosceles triangles

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 3 content	Selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations	Describes and represents a mathematical situation in a variety of ways using mathematical terminology and some conventions	Gives a valid reason for supporting one possible solution over another	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 3 content

Knowledge and Skills

Students learn about

- recognising the need for a unit longer than the metre for measuring distance
- recognising that one thousand metres equal one kilometre and describing one metre as one thousandth of a kilometre
- measuring a kilometre and half-kilometre
- using the abbreviation for kilometre (km)
- converting between metres and kilometres
- measuring and recording lengths or distances using combinations of millimetres, centimetres, metres and kilometres
- converting between millimetres, centimetres and metres to compare lengths or distances
- recording lengths or distances using decimal notation to three decimal places eg 2.753 km
- selecting and using the appropriate unit and device to measure lengths or distances
- interpreting symbols used to record speed in kilometres per hour eg 80 km/h
- finding the perimeter of a large area eg the school grounds
- calculating and comparing perimeters of squares, rectangles and triangles
- finding the relationship between the lengths of the sides and the perimeter for squares, rectangles and equilateral and isosceles triangles

Working Mathematically

Students learn to

- describe how a length or distance was estimated and measured (*Communicating*)
- explain the relationship between the size of a unit and the number of units needed eg more metres than kilometres will be needed to measure the same distance (*Communicating, Reflecting*)
- question and explain why two students may obtain different measures for the same length (*Questioning, Communicating, Reasoning*)
- interpret scales on maps and diagrams to calculate distances (*Applying Strategies, Communicating*)
- solve problems involving different units of length eg 'Find the total length of three items measuring 5 mm, 20 cm and 1.2 m'. (*Applying Strategies*)
- explain that the perimeters of squares, rectangles and triangles can be found by finding the sum of the side lengths (*Communicating, Reasoning*)
- solve simple problems involving speed eg 'How long would it take to make a journey of 600 km if the average speed for the trip is 75 km/h?' (*Applying Strategies*)

Learning Experiences and Assessment Opportunities

WM Less Than, More Than, About the Same

Students estimate whether places known to them are less than, more than, or about one kilometre, from the front gate of the school. These can be checked by measuring. Students record the results in a table.

Place	Less than 1 km	About 1 km	More than 1 km
Library			
Post Office			

Coming to School

The teacher poses the question: 'What distance do you travel to school?' Students suggest ways to determine the distance, such as checking the odometer on the car or bus, borrowing a trundle wheel and measuring the walk to school, estimating the distance using a street directory. Students record their answers using a combination of kilometres and metres, and express the distance in kilometres to three decimal places eg 1.375 km.

Converting Between Millimetres, Centimetres and Metres

Students find, measure and record the lengths of three things:

- smaller than 1 cm
- bigger than 1 cm and smaller than 10 cm
- bigger than 10 cm and smaller than 1 m.

Students record measurements in metres, centimetres and millimetres, using decimal notation.

Measurement	In metres	In centimetres	In millimetres
Watch band width	0.018 m	1.8 cm	18 mm

Possible questions include:

- can you estimate and measure the perimeter of six different objects in the classroom?
- what measuring device did you use? Why? What unit did you use to record your measurement initially?
- how did you convert your measurements to millimetres? centimetres? metres?

Appropriate Measure

The teacher poses the problem:

'Arthur needs to measure the length of his eraser. What measuring device and unit of measurement do you suggest would be best for him to use?'

He now needs to measure the length of his desk, the room, the playground and the distance to his home. What measuring device and unit of measurement would you suggest he uses?

Students write problems where different measuring devices and units of measurement are necessary to solve the problem.

WM Fun Run

In pairs, students plan the course of a fun run of 1 km within the school grounds. Students check the measurements in the school grounds using tapes, trundle wheels etc. Students are provided with a map of the school and discuss the scale they will use to draw a diagram of their course. They then draw and label their diagram.

Possible questions include:

- how many metres long is your fun run course? How do you know?
- how did you measure the distance?
- how could the distance be halved for younger runners?
- how could you measure this distance?
- how could the distance be doubled without retracing steps?

Extension: Students place markers at intervals along the course to mark the distances and direction. They calculate and record the distances between the markers in metres (eg 80 m) and convert them to kilometres. They add the distances using a calculator to determine the length of the course.

Kilometres per Hour

In pairs, students plan a trip between two towns in NSW. Using a scale map, they decide the route to be taken and the distance to be travelled, recording the distance in metres and kilometres. They calculate and display in a table the time it will take if the average travelling speed is: 50 km/h, 60 km/h, 80 km/h, 100 km/h. Students are encouraged to select two more towns and repeat the activity.

Tyres

Students use a piece of string (or similar) to measure the circumference of a bike or car wheel. They then measure the string to determine the distance travelled in one revolution of the tyre and record the measurement in millimetres and centimetres. They calculate the distance travelled in 5 revolutions, 10 revolutions, 100 revolutions and 1000 revolutions, recording the distances using combinations of millimetres, centimetres, metres and kilometres, and using decimal notation to three decimal places.

Perimeter

Students are presented with the following case:

'The perimeter of the school was measured by two students. Winnie stated that the perimeter is 1 kilometre and Omar stated that it is 982 metres.'

Students record how the difference in the measurements could have occurred.

In pairs, students measure the perimeter of the school and compare and discuss the results obtained.

Measuring Perimeter

Students select the appropriate measuring device and unit of measurement to measure the perimeter of their desktops, the perimeter of the classroom floor and the perimeter of the school. Students compare their measurements and discuss.

Variation: Students find the perimeter of a face of a small object eg an eraser. Students write their own list of objects for which perimeters could be measured.

Possible questions include:

- how could we categorise the list?

In small groups, students categorise items into groups under the headings suggested.

WM Calculating Perimeter

Students are given a sheet of paper on which a square, a rectangle, an equilateral triangle and an isosceles triangle have been drawn. Students calculate the perimeter of each shape. Students record and compare their findings.

Possible questions include:

- how will you calculate the perimeter of each shape?
- did you discover an easy way to calculate the perimeter of squares, rectangles and triangles?

Three Decimal Places

Students choose a distance of less than one kilometre and write their distances in metres on a card. On the back of the card students record the distance in kilometres eg 276 m = 0.276 km.

The teacher asks:

- 'Who has the shortest distance?' This student stands at the front of the room.
- 'Who has the longest distance?' This student stands at the back of the room.

The remainder of the class sort themselves between these two students in order. Students compare the two ways of recording the distances.

Variation: Students write other distances and repeat the activity.

Fixed Perimeter

Students construct a rectangle, a square and a triangle, with a given perimeter eg 30 cm. Students label the shapes and explain why they have the same perimeter.

This activity could be extended to students discussing whether the areas of shapes with the same perimeter have the same area.

Adding Lengths

Students measure dimensions of three items, each involving a different unit of length eg thickness of an eraser, length of a pencil and length of a desk. They add these three measurements eg 5 mm, 20 cm and 1.2 m together to find the total length. Students choose three other items and measure and add their lengths.

Variation: Students record measurements in decimal notation. They record and order their lengths.

WM Metre, Centimetre and Millimetre Race

Students are told they are going to race across the playground in small groups. Students are given three different coloured dice, one for metres, one for centimetres and one for millimetres. They are asked to choose the equipment they would need to measure the playground eg a metre ruler and a centimetre/millimetre ruler. The groups start at one side of the playground. Each student takes a turn at rolling the three dice. They measure the distance shown on the three dice (eg 3 m, 5 cm and 4 mm), add to the group's line on the ground, and record the total distance each time eg 3.54 m or 354 cm. The winner is the first group to reach the other side of the playground.

Students compare and discuss the results. Results could be checked on the calculator.

Possible questions include:

- what strategies did you use to record your distances?
- were there any differences in distances between the groups? Why?
- would you do it differently next time?

Variation: Students measure a smaller/larger distance and vary the equipment used.

Resources

trundle wheel, tape measure, ruler, calculators, grid paper, rulers, street directory, string, bike wheel, tyre

Links

Whole Numbers

Fractions and Decimals

Two-dimensional Space

Area

Position

Science and Technology - 'Out In Space'

Language

decimal point, decimal notation, perimeter, square, triangle, rectangle, relationship, distance, converting,

scale, kilometre, perimeter, distance apart, distance between, to, from, decimal, metre, centimetre, millimetre, measuring device

6.6 Time

Strand – Measurement

Syllabus Content p 115

MS3.5

Uses 24-hour time and am and pm notation in real-life situations and constructs timelines

Key Ideas

Convert between am and pm notation and 24-hour time

Compare various time zones in Australia, including during daylight saving

Draw and interpret a timeline using a scale

Use timetables involving 24-hour time

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 3 content	Selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations	Describes and represents a mathematical situation in a variety of ways using mathematical terminology and some conventions	Gives a valid reason for supporting one possible solution over another	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 3 content

Knowledge and Skills

Students learn about

- using am and pm notation
- telling the time accurately using 24-hour time eg '2330 is the same as 11:30 pm'
- converting between 24-hour time and am or pm notation
- determining the duration of events using starting and finishing times to calculate elapsed time
- using a stopwatch to measure and compare the duration of events
- comparing various time zones in Australia, including during daylight saving
- reading, interpreting and using timetables from real-life situations, including those involving 24-hour time
- determining a suitable scale and drawing a timeline using the scale
- interpreting a given timeline using the scale

Working Mathematically

Students learn to

- explain where 24-hour time is used eg transport, armed forces, VCRs (*Communicating, Reflecting*)
- select the appropriate unit to measure time and order a series of events according to the time taken to complete them (*Applying Strategies*)
- determine the local times in various time zones in Australia (*Applying Strategies*)
- use bus, train, ferry, and airline timetables, including those accessed on the Internet, to prepare simple travel itineraries (*Applying Strategies*)
- use a number of strategies to solve unfamiliar problems, including:
  - trial and error
  - drawing a diagram
  - working backwards
  - looking for patterns
  - simplifying the problem
  - using a table (*Applying Strategies, Communicating)*

Learning Experiences and Assessment Opportunities

Timetables

Students access timetables on the Internet or the teacher provides students with a variety of timetables eg bus, plane, train, ferry, theme parks, movies. Students describe any visible patterns eg 'Buses leave every 15 minutes on weekday mornings.' Students calculate the duration of different journeys or events using start and finish times. They develop an itinerary for a given time-frame eg 4 hours.

Students plan their 'ultimate' 24-hour itinerary. Students record their itinerary in 12-hour time using am and pm notation, and 24-hour time. Students discuss which timetables use 24-hour time and why it is important.

WM Stopwatches

Students read digital stopwatch displays showing time from left to right in minutes, seconds and hundredths of a second.

2 : 34 : 26

Students use stopwatches to time various events and order them according to the time taken. Students discuss cases where accurate timing is important eg athletics, swimming, television advertisements.

Extension: Students research the world records of different sports. They then record and order them.

Reading a Timeline

The teacher displays a timeline related to real life or a literary text. Students write what they can interpret from the timeline.

Olympic Timeline

1896 The first modern Olympic Games held in Athens, Greece.
1900 Women first compete in the Games, in tennis and golf.
1904
1908
1912
1916 Games cancelled due to the First World War.
1920
1924
1928
1932
1936
1940 Games cancelled because of the Second World War
1944 Games cancelled because of the Second World War.
1948
1956 Olympic Games held in Melbourne
1960
1964
1968
1972 Munich Olympics marred by terrorist attack
1976 Montreal hosts the games.
1980 The United States, Canada and 50 other countries boycott the Moscow Games following the invasion of Afghanistan by the Soviet Union.
1984 The Soviet Union boycotts the Olympics in Los Angeles.
1988
1992 South Africa permitted to the games for the first time after a 30-year ban. 12 separate teams represent the countries formerly part of the USSR.
1996
2000 Olympic Games held in Sydney.

Reading a Timeline

Three times 1916, 1940 and 1944 the games were cancelled because of war. The games were boycotted twice. Before 1992 South Africa were not permitted to attend the games. Terrorist attacked the games in 1972 in Munich. After 1900 women were allowed to compete in the games. USSR in 1992 was no longer a country.

Timing Experiments

Students estimate the amount of time selected events will take and then check by timing the events with a stopwatch eg

- the time for a ball dropped from the top floor of a building to reach the ground
- the time for a car seen in the distance to reach a chosen point.

Students record the times in a table and order the events.

Events in Order

Event	order	minutes	seconds	Hundredth of seconds
To walk from the library to our classroom	3rd	0	29	21
To drop a ball from 2 metres to the floor	1st	0	0	45
To time the [illegible] on the flying fox	2nd	0	1	29
To run around the tennis court	4th	0	33	29
To complete a [illegible]	5th	4	17	97

WM A Day In My Life

Students list at least eight things they do on a particular day of the week along with the time they do each activity.

They then record these times on a sheet of clock faces. Students convert the times to 24-hour time.

They use the 24-hour times and activities to draw a timeline using an appropriate scale.

Possible questions include:

- how could you order the events according to the time taken?

Matching Times

In pairs, students are given two blank cards. They record the time in am or pm notation on one card and 24-hour time on the other. The teacher collects the cards, shuffles them and redistributes the cards to the class.

Each student has to find their partner by asking other students questions to identify the matching time.

Students can only answer 'yes' or 'no'.

Possible questions include:

- do you have an o'clock time?
- is your time ten minutes after 7:15 am?
- is your time 2130 in 24-hour time?

Students then group themselves into am and pm times. Each group then orders its cards.

WM Drawing and Interpreting Timelines

Students research key dates in Australian history. Students construct a timeline using an appropriate scale. In small groups, students compare scales used and any observations.

Possible questions include:

- what scale did you use? Why?
- how does the scale help to interpret the timeline?
- did your chosen scale cause any problems? Why?
- what is the importance of the scale?

Spending Time

Students collect data and record on a graph the amount of time they spend on average watching television, sleeping, eating, working at school and engaged in other activities, using start time and finish time to calculate elapsed time. They compare and discuss their graphs.

Variation: Students calculate how much time is spent on different subjects each day/week, when looking at the class timetable.

Time Zones

Students research different time zones in Australia where their relatives or friends live. Students use atlases to sort states, towns or cities into time zones. The teacher poses the question: 'What time would it be in Perth at the moment?' The activity should be extended to include daylight-saving times.

Possible questions include:

- why does Australia have different time zones?
- where could you find out about different time zones?

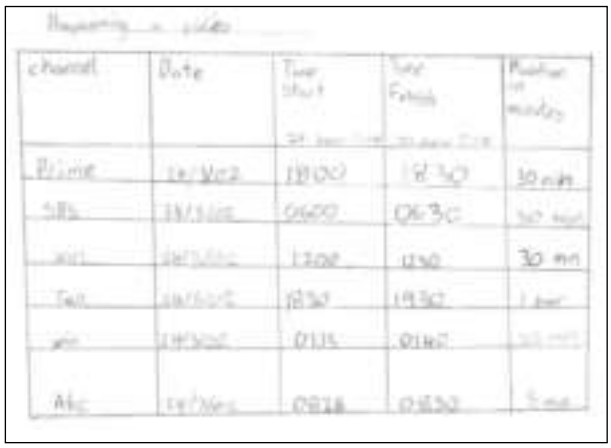
Extension: Students use the Internet to research different time zones.

WM Calculating Elapsed Time

The teacher provides students with a copy of a television guide. Students are told that they will be given a 180 minute video tape. Students use the television guide to calculate the duration of programs they would like to tape. Students then record their information in a 'program table' using 24-hour time.

Possible questions include:

- how did you work out elapsed time?
- did you manage to use the whole 180 minutes?



Resources

atlases, class timetable, copies of clock faces, stopwatches, television programs, blank cards, timetables (bus, plane, train, theme parks, movies)

Links

Position

Length

HSIE

Language

timetable, timeline, scale, time zones, daylight saving, 24-hour time, am and pm notation, duration of events, converting, arrive, depart, decade, century, millennium, latitude, longitude, elapsed time

6.7 Three-dimensional Space

Strand – Space and Geometry

Syllabus Content p 121

SGS3.1

Identifies three-dimensional objects, including particular prisms and pyramids, on the basis of their properties, and visualises, sketches and constructs them given drawings of different views

Key Ideas

Identify three-dimensional objects, including particular prisms and pyramids, on the basis of their properties

Construct three-dimensional models given drawings of different views

Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 3 content	Selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations	Describes and represents a mathematical situation in a variety of ways using mathematical terminology and some conventions	Gives a valid reason for supporting one possible solution over another	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 3 content

Knowledge and Skills

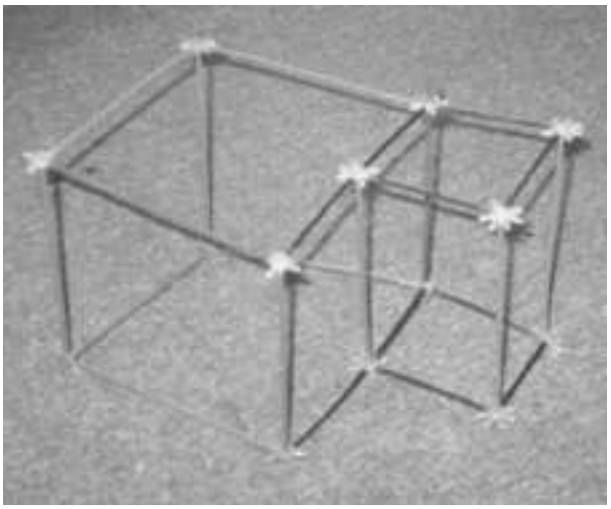
Students learn about

- recognising similarities and differences between pyramids or prisms eg between a triangular prism and a hexagonal prism
- naming prisms or pyramids according to the shape of their base eg rectangular prism, hexagonal prism
- identifying and listing the properties of three-dimensional objects
- visualising and sketching three-dimensional objects from different views
- constructing three-dimensional models given drawings of different views
- visualising and sketching nets for three-dimensional objects
- showing simple perspective in drawings by showing depth

Working Mathematically

Students learn to

- explain why particular three-dimensional objects are used in the built environment or appear in the natural environment (*Communicating, Reflecting*)
- describe to a peer how to construct or draw a three-dimensional object (*Communicating*)
- reflect on own drawing of a three-dimensional object and consider whether it can be improved (*Reflecting*)
- ask questions about shape properties when identifying them (*Questioning*)



Learning Experiences and Assessment Opportunities

Prisms

Students are given a selection of prisms and pyramids to investigate the number of faces, edges, and vertices. They look for similarities and differences between the objects. Students construct a table to record findings.

Name	Faces	Edges	Vertices
Triangular prism	5	9	6
Rectangular prism	6	12	8
Pentagonal prism	7	15	10
Square pyramid	5	8	5

Sorting and Classifying Three-dimensional Objects

Students are provided with a variety of objects including multiple examples of prisms and pyramids. Students investigate the faces, edges, vertices and cross-sections. They record the following information in a table or list: the name of each object according to the shape of its base, a list of properties of each object, a sketch of a net of each object, a simple perspective drawing and a list of similarities and differences.

Possible questions include:

- how could you improve your drawing?
- how could you classify the objects?

Students write an explanation of the properties of each object.

WM Different Views

Students sketch different everyday objects eg buildings, power pole. They are asked to sketch a front, side and top view on separate cards. Students swap their sketches with a partner who names the object.

Variation: The teacher collects the cards and photocopies them so that there are enough sets for the class to play a concentration game with the cards. In small groups, students place all the cards face down in the centre of the group. Each player takes a turn at turning over three cards. If the three cards turned over match the front, side and top view of one object then that player keeps the cards, but if they do not match then they are turned back over and the next student has a turn. The winner is the player who has the most cards when all the cards have been collected.

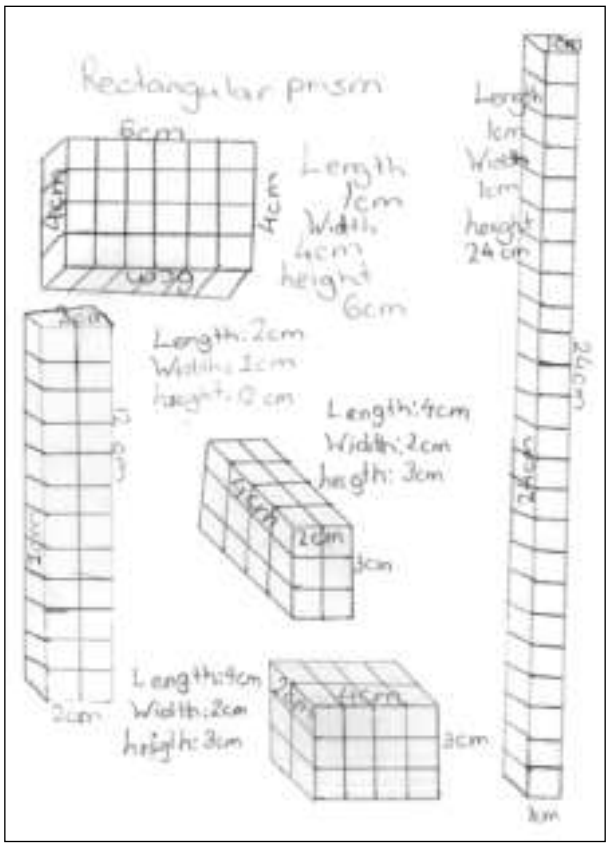
Barrier Game

In pairs, students sit opposite each other with a barrier between them. Student A selects a three-dimensional object and describes how to draw it. Student B follows the instructions to draw the object. Both students reflect on the drawing. Students then reverse roles.

Rectangular Prisms

Students are given 24 interlocking cubes. They are asked to make a rectangular prism with a volume of 24 cubic units. They describe their rectangular prism in terms of its length, breadth and height and record this information. The teacher poses the question. 'Can you make other rectangular prisms with a volume of 24 cubic units?' Students attempt to do this, record the results and describe what they notice. Students draw a simple perspective drawing of each prism showing depth.

Variation: Students make prisms with a variety of volumes and discuss.



WM Three-Dimensional Viewpoints

The teacher prepares cards that show the front, top and side view of various prisms. Students label each card, naming the view. They then use the cards to construct a three-dimensional model, naming it according to the shape of its base.

Students display their labelled cards and models. The other students in the class match the model to the cards.

Extension: Students make their own cards and repeat the activity.

Construction Views

Students collect a variety of three-dimensional objects eg boxes, cylinders. In small groups, they use the objects to build a tower. Students sketch the view from their own perspective. Each group shuffles the sketches and leaves them and the model on the table. Groups rotate to a new table where they sort the sketches according to the perspective.

Possible questions include:

- what strategies did you use when sketching the tower?
- what strategies did you use to correctly match perspectives?

Variation: Students deconstruct their towers leaving the objects on the table. The groups rotate and are given the sketches of the different views of the tower and rebuild it.

Possible questions include:

- what strategies did you use to rebuild the tower?

WM Construct a model

Students are given 8 straws/pop sticks and blue tack. They construct a three-dimensional model using all 8 straws/sticks. Students display their models.

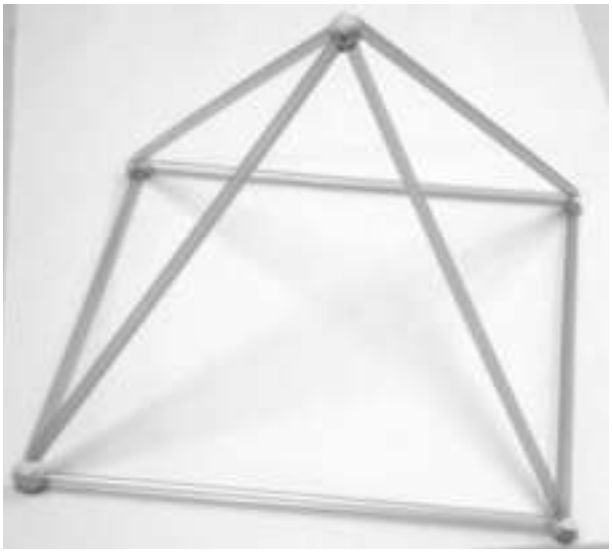
Possible questions include:

- what is the name of your model?
- can you list its properties?

Students draw the model showing simple perspective.

Variation: The number of straws could be varied.

Commercially produced construction equipment could be used to produce other models.



What Three-Dimensional Object Am I?

Students select an object and write a description of its properties. Other students ask questions to identify the object eg 'Does your object have 6 faces?' 'Are your object's opposite faces equal?' 'Is your object's base a rectangle?' 'Are your object's faces rectangular?' 'Is your object a rectangular prism?'

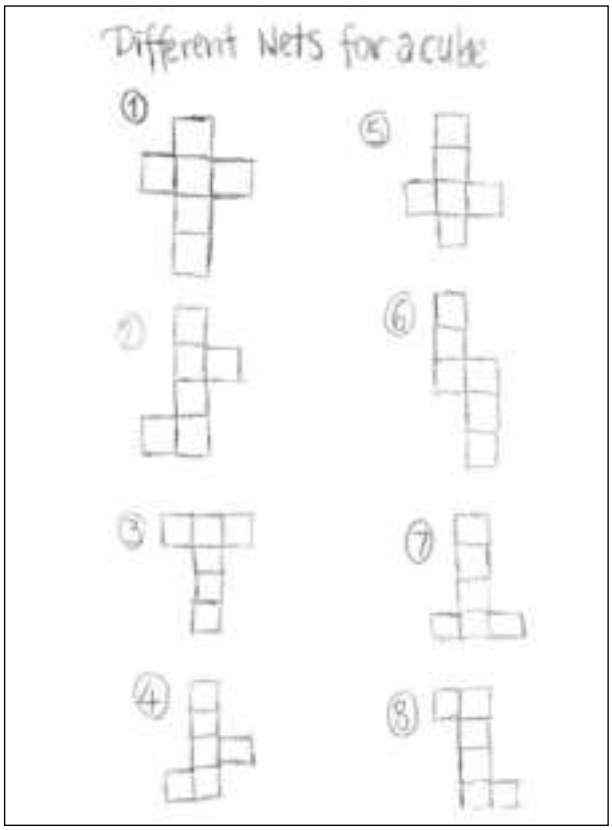
Variation: Students make 'What Object am I?' booklets.

WM Net Challenge

Students are challenged to create all the possible nets for a cube. Students could use polydrons, grid paper or tiles to create the nets. Students are encouraged to decide if each solution is different or if it is the same net in a different orientation.

Students record the nets on paper or by using a computer package.

Variation: Students draw the nets of other prisms and pyramids. They find nets of other three-dimensional objects.



Object Hunt

Students walk around the school and list 10 three-dimensional objects that they see. They record each in a table with the name of the object. Students compare lists and suggest reasons why particular three-dimensional objects occur in built and natural environments.

Views of Models

The teacher draws a 4 × 4 grid on paper. Students are given a side and a front view of a model made with cubes. They make a model that conforms to the views
eg

side view front view

Possible questions include:

- what is the most/least number of cubes you can use to make the model?
- have you made the only possible model? How do you know?

Variation: Students create their own three-dimensional model and then draw the side and front view. They swap the drawing with a partner who makes the model.

WM Perspectives

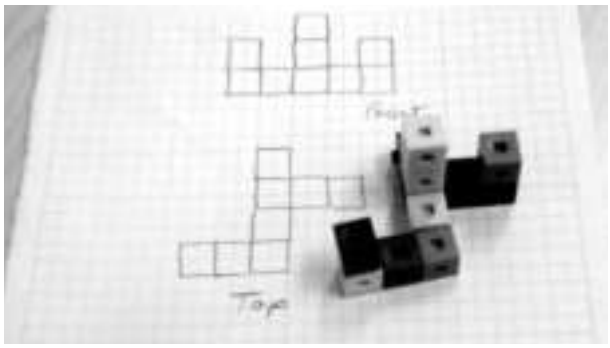
Students draw the school building showing perspective. They discuss their work and reflect on how they could improve their drawing.

Variation: Students draw other things around the school showing perspective.

WM Models

Students are asked to use cubes to construct a three-dimensional model given a drawing of its top view. Students then sketch their model from other views.

Extension: Students are asked to make and draw different models with this top view.



Cube Puzzle

Students are told that a wooden cube that measures 3 cm along each edge is painted red. The painted cube is then cut into 1 cm cubes.

Possible questions include:

- how many of the 1 cm cubes do not have paint on any face?
- how many of the 1 cm cubes have paint on just one face?
- how many of the 1 cm cubes have paint on just two faces?
- how many of the 1 cm cubes have paint on 4 or more faces?

Three-Dimensional Models

Students collect pictures of three-dimensional objects that occur in everyday life from magazines, papers or the Internet. In small groups, students classify the pictures into prisms or pyramids and list their similarities and differences. Each student then chooses one of the pictures and explains why that particular three-dimensional shape was used. The students choose a picture and draw a simple perspective drawing of an object in the picture eg rear of a building, side view of a house.

Variation: In groups, students create a model of a three-dimensional object from the pictures using a variety of equipment eg papier mache, playdough.

Resources

three-dimensional objects, boxes, polydrons, geoshapes, paper, interlocking cubes, wooden cubes, plasticine, fishing line, paint

Links

Two-dimensional Space

Length

Language

face, edge, vertex, vertices, triangular prism, square prism, cube, rectangular prism, pentagonal prism, triangular pyramid, square pyramid, rectangular pyramid, cross-section, perspective, surface, curved, view points

6.8 Two-dimensional Space – Shapes

Strand – Space and Geometry

Syllabus Content p 128

SGS3.2a

Manipulates, classifies and draws two-dimensional shapes and describes side and angle properties

Key Ideas

Identify right-angled, isosceles, equilateral and scalene triangles

Identify and draw regular and irregular two-dimensional shapes

Identify and name parts of a circle

Enlarge and reduce shapes, pictures and maps

Identify shapes that have rotational symmetry

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
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Knowledge and Skills

Students learn about

- identifying and naming right-angled triangles
- manipulating, identifying and naming isosceles, equilateral and scalene triangles
- comparing and describing side properties of isosceles, equilateral and scalene triangles
- exploring by measurement angle properties of isosceles, equilateral and scalene triangles
- exploring by measurement angle properties of squares, rectangles, parallelograms and rhombuses
- identifying and drawing regular and irregular two-dimensional shapes from descriptions of their side and angle properties
- using templates, rulers, set squares and protractors to draw regular and irregular two-dimensional shapes
- identifying and drawing diagonals on two-dimensional shapes
- comparing and describing diagonals of different two-dimensional shapes
- creating circles by finding points that are equidistant from a fixed point (the centre)
- identifying and naming parts of a circle, including the centre, radius, diameter, circumference, sector, semi-circle and quadrant
- identifying shapes that have rotational symmetry, determining the order of rotational symmetry
- making enlargements and reductions of two-dimensional shapes, pictures and maps
- comparing and discussing representations of the same object or scene in different sizes eg student drawings enlarged or reduced on a photocopier

Working Mathematically

Students learn to

- select a shape from a description of its features (*Applying Strategies, Communicating*)
- describe side and angle properties of two-dimensional shapes (*Communicating*)
- construct a shape using computer drawing tools, from a description of its side and angle properties (*Applying Strategies)*
- explain classifications of two-dimensional shapes (*Communicating*)
- inscribe squares, equilateral triangles, regular hexagons and regular octagons in circles (*Applying Strategies*)
- explain the difference between regular and irregular shapes (*Communicating*)
- construct designs with rotational symmetry, including using computer drawing tools (*Applying Strategies*)
- enlarge or reduce a graphic or photograph using computer software (*Applying Strategies*)
- use computer drawing tools to manipulate shapes in order to investigate rotational symmetry (*Applying Strategies*)

Learning Experiences and Assessment Opportunities

WM What am I?

Students select a shape and write a description of its side and angle properties. Students share their descriptions with the class who attempt to identify the shape eg 'My shape has four sides and four equal angles. The opposite sides are the same length. What am I?'

Variation: Students create flipbooks recording clues and share with a friend. Students reproduce shapes and clues using a computer software package eg Logo.

Barrier Game

In pairs, students are positioned back to back. One student is the 'sketcher', the other student is the 'describer'. The 'describer' describes a given two-dimensional shape focusing on side and angle properties. The 'sketcher' listens to the description and sketches the two-dimensional shape described. The 'sketcher' names the two-dimensional shape sketched and then compares their sketch with the describer's shape. The students swap roles and repeat the activity.

Properties of Two-Dimensional Shapes

Students examine regular and irregular two-dimensional shapes and name their parts. Angle testers, set squares or protractors could be used to compare the size of angles and to identify equal angles. Rulers could be used to compare lengths of sides and to identify sides of equal length.

Students are asked to identify shapes that have rotational symmetry.

Students could present the information as descriptions of each shape's side and angle properties.

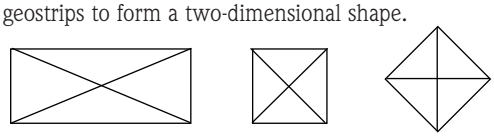
Circles

In small groups, students draw a large circle in the playground using a range of materials eg ropes, stakes, chalk, tape measures. Students assess their circle and the strategy they used. They label parts of their circle: centre, radius, diameter, circumference, sector, semi-circle and quadrant. Students then investigate materials in the classroom they can use to draw circles eg a pair of compasses, a protractor, round containers, templates. They then draw and label circles.

This activity could be extended to students drawing squares, equilateral triangles, regular hexagons, and regular octagons with in circles.

Diagonals

Students explore diagonals by joining two geostrips of equal length at their centres. They then join the ends of these to other geostrips to form a two-dimensional shape.

eg 

Students join three or more geostrips of different lengths at their centres and use other geostrips to join the ends of these to make various two-dimensional shapes.

Possible questions include:

- what is the relationship between the number of sides and the number of diagonals?
- which shapes are the strongest?
- what happens when the diagonals are removed?

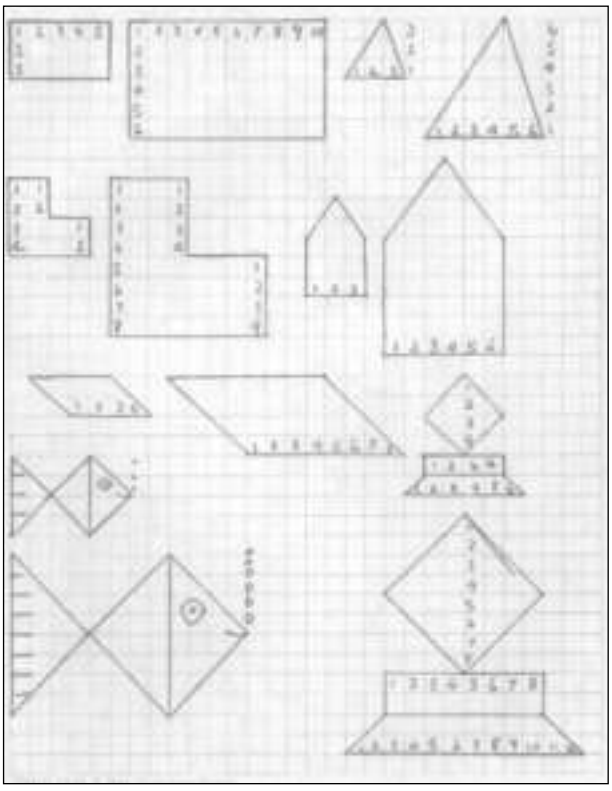
In groups, students draw their two-dimensional shapes complete with diagonals, and record their findings. The students' posters could be displayed.

Enlarging and Reducing

Students are given drawings of a variety of two-dimensional shapes on grid paper. Students enlarge or reduce the shapes onto another piece of grid paper. Possible questions include:

- what features change when a two-dimensional shape is enlarged or reduced?
- what features remain the same?
- do properties change or remain the same? Why?

Students explain the process they used to enlarge and reduce two-dimensional shapes.



Scale Models

In small groups, students sketch the classroom from an aerial perspective. Students use their sketch, and grid paper, to produce an appropriately scaled drawing of the major features of the classroom. Students then make an enlargement and reduction of their scale drawing.

Variation: Students use drawing software to enlarge or reduce their sketches.

Students sketch a scale drawing of their bedroom.

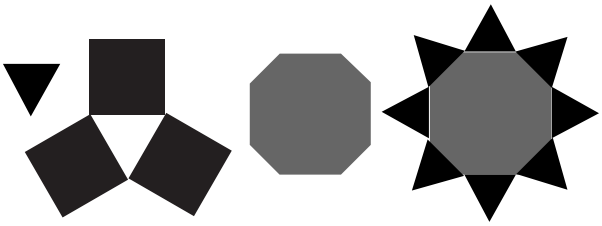
WM Rotational Symmetry

Students make a two-dimensional shape out of cardboard and trace it onto paper. They pin the tracing to the cardboard shape through its centre. While the cardboard shape remains still, students rotate the tracing around the pin. As it is being rotated, students count the number of times in a complete turn the tracing and the cardboard shape match, and check the total against the number of axes of symmetry of the shape.

Students are given a variety of cardboard shapes to investigate their rotational symmetry in the same way. Students draw shapes on grid paper and predict whether they have rotational symmetry. They then check their predictions.

Pattern Blocks

Students make shapes that they predict will match one, two, three, four, five or six times when rotated. Students start with a central shape and build around this. The shapes can be traced and the objects rotated to match the tracing.



WM Computer Design

Students explore rotational symmetry and patterns through computer applications. The students are challenged to design a logo that incorporates rotational symmetry.

Possible questions include:

- how many times can you get your shape to match its original outline in one full turn?
- how many axes of symmetry does your logo have?

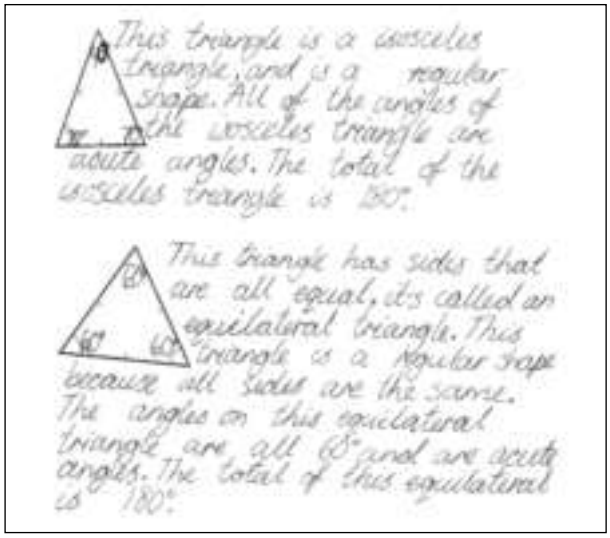
Students discuss their logos.

WM Triangles

The teacher provides students with a variety of scalene, isosceles, equilateral and right-angled triangles. In small groups, students discuss the side and angle properties of each triangle and sort triangles with similar properties into groups. Students devise a description for each type of triangle eg equilateral triangles have three equal sides and three equal angles.

Students share sorting procedures and descriptions.

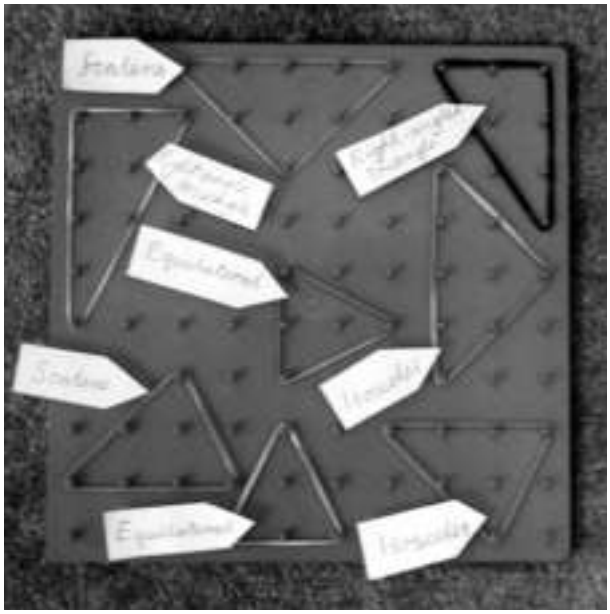
Variation: Students construct triangles using a variety of equipment eg set squares, protractors, rulers, templates. They then sort the triangles and describe their properties.



Geoboards

Students are asked to create as many different triangles as they can, with no pegs inside them, on the geoboard. Students are provided with dot paper to record the triangles that have been created. Students are encouraged to discuss whether the triangles are the same or different. Possible questions include:

- are the angles the same?
- are the sides the same?
- are there any differences between the triangles?
- do triangles retain their properties when their size is doubled or tripled?



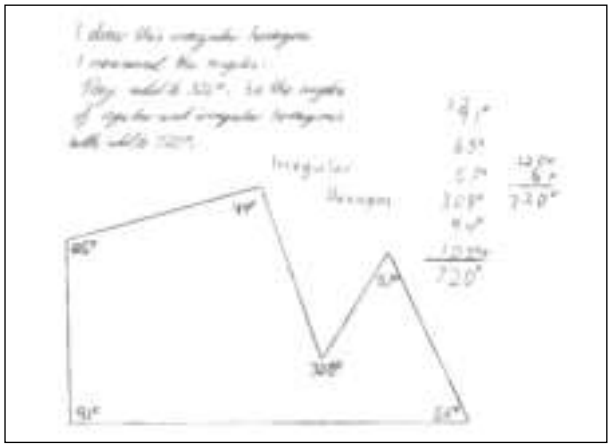
Drawing and Manipulating

Students are given access to a variety of geometric equipment (including rulers, protractors, templates, pairs of compasses, set squares, drawing software) to draw regular and irregular two-dimensional shapes.

Possible questions include:

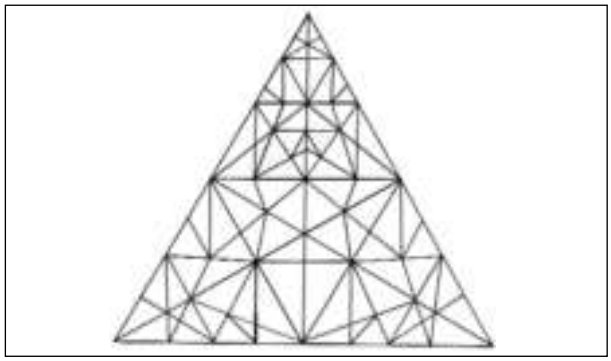
- what did you use to construct angles?
- how did you ensure angle, side and diagonal properties were correct?
- what did you use to construct circles?
- what is the difference between a regular and an irregular shape?

This activity could be extended to writing a list of properties for the various two-dimensional shapes.



Creating Triangles

Students are given an equilateral triangle of side 20 cm. They draw the axes of symmetry. Students draw lines in the triangle to create smaller triangles.



Students check that all shapes made are triangles.

Possible questions include:

- how did you check that the shapes were all triangles?
- what did you notice about the triangles you created?
- can you identify any scalene, equilateral, isosceles and right-angled triangles?
- what type of triangle occurred the most?

Students check and colour code the triangles to create a design eg scalene: blue, equilateral: red

Variation: Students create similar designs using a computer.

Extension: Students create triangle designs in a circle.

Resources

chalk, rope, string, stakes, tape measure, protractor, pair of compasses, templates, paper circles, pattern blocks, geoboards, elastic bands, rulers, set squares, grid paper, templates of two-dimensional shapes, geostrips, paper, computer

Links

HSIE

English

Visual Arts

Science and Technology

Language

circle, circumference, a pair of compasses, radius, diameter, centre, triangles, equilateral, scalene, isosceles, right-angled triangle, rotation, symmetry, polygons, angle, degree, symmetry, names of shapes, square, regular, irregular, diagonal, enlarge, reduce, side, angle, enlargement, reduction, turning symmetry, rotational symmetry, tracing, matching

6.9 Two-dimensional Space – Angles

Strand – Space and Geometry

Syllabus Content p 129

SGS3.2b

Measures, constructs and classifies angles

Key Ideas

Classify angles as right, acute, obtuse, reflex, straight or a revolution

Measure in degrees and construct angles using a protractor

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 3 content	Selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations	Describes and represents a mathematical situation in a variety of ways using mathematical terminology and some conventions	Gives a valid reason for supporting one possible solution over another	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 3 content

Knowledge and Skills

Students learn about

- identifying the arms and vertex of an angle where both arms are invisible, such as rotations and rebounds
- recognising the need for a formal unit for the measurement of angles
- using the symbol for degrees (°)
- using a protractor to construct an angle of a given size and to measure angles
- estimating and measuring angles in degrees
- classifying angles as right, acute, obtuse, reflex, straight or a revolution
- identifying angle types at intersecting lines

Working Mathematically

Students learn to

- describe angles found in their environment (*Communicating, Reflecting*)
- compare angles in different two-dimensional shapes (*Applying Strategies*)
- explain how an angle was measured (*Communicating*)
- rotate a graphic or object through a specified angle about a particular point, including using the rotate function in a computer drawing program (*Applying Strategies*)

Learning Experiences and Assessment Opportunities

WM Ball Games

Students roll a wet tennis ball along the ground at an angle to the wall. Students observe the ball rolling to and rebounding from the wall. The wet lines form the arms of the angle and the point where the ball hits the wall is the vertex of the angle.

Possible questions include:

- where is the ball rolled from to create the smallest angle?
- where is the ball rolled from to create the largest angle?
- what is the smallest angle that can be made?
- what is the largest angle that can be made?

Extension: Students record results by measuring the angles produced.

Protractors

Students are shown how to use protractors to measure angles in degrees. The teacher ensures that students are aware of:

- the scale around the edge
- the point on the protractor to be aligned with the vertex of the angle to be measured
- the reason for two sets of numbers
- the largest angle that can be measured
- the need to line up an arm of the angle being measured with the zero degree line on the protractor, not its bottom edge.

In pairs, one student estimates the size of an angle and the other student checks the estimate by measuring with the protractor.

Extension: Students replicate angles in the room using geostrips. They then copy the angles onto paper and estimate and measure the angles.

Measuring Angles in Two-dimensional Shapes

Students are provided with a variety of two-dimensional shapes. Using a protractor, they measure the angles within the shapes.

Possible questions include:

- how did you measure the angles?
- using your knowledge of angle properties of two-dimensional shapes, what do you expect your measurements to show?
- how can you record your measurements?
- how can you classify the angles you have found?
- how can you classify the shapes according to their angles?
- how can you compare the shapes by their angles?

WM Kicking a Goal

A small goal is created on an asphalt area using witches' hats. Students place a ball in front of the goal. They draw the angle created in chalk on the asphalt, using the ball as the vertex and the goal posts as the ends of the arms. They then measure and record the angle created, using the teacher's protractor. Students try to score a goal from that position. Students repeat the activity from other positions in front of the goal, drawing, measuring and recording the angle created in each new position.

Possible questions include:

- where were the angles smaller? Why?
- how did the size of the angle affect the ease of scoring a goal? Why?
- if you moved the ball closer or further away from the goal line, did it change the size of the angle? How? Why?
- how would the presence of a goal-keeper affect the angles created?

Results could be recorded in a table using a computer.

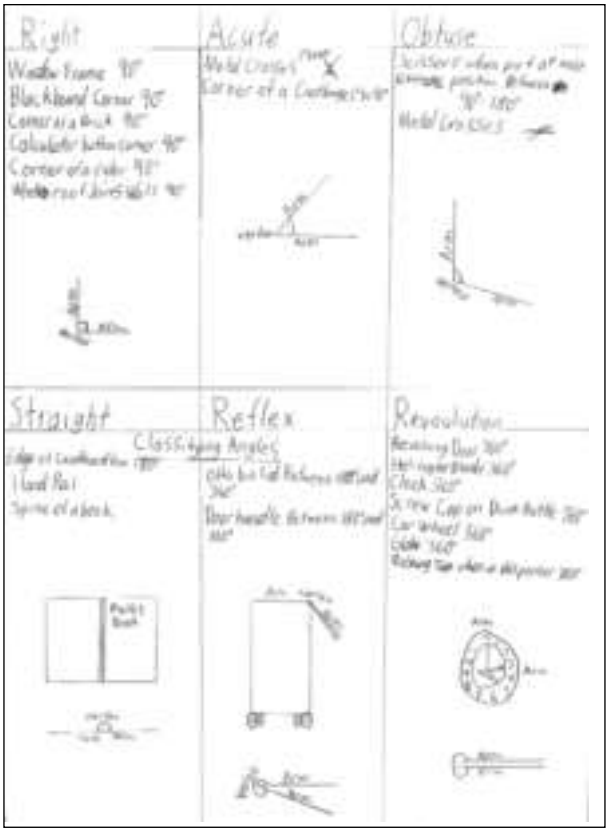
Classifying Angles

Students identify, record and classify angles in the environment using the terms 'right', 'acute', 'obtuse', 'straight', 'reflex' and 'revolution'. In pairs, students describe the angles they have classified eg the angles are all obtuse because they are greater than 90° but smaller than 180°. Students draw each type of angle and label the vertex and arms.

This activity could be extended so that students could estimate the size of each angle in the environment and then check by measuring.

Possible questions include:

- were some of your estimations closer than others?
- why do you think this was?



WM Rotating Graphics

Students use a software package to rotate a graphic through 90° about a particular point and describe what happened. Students predict what will happen when the graphic is rotated through 180°. The process is repeated for other angles. Students rotate the graphic through an angle about a different point. They predict what will happen.

Extension: Students create a pattern by repeatedly rotating a graphic about a specific point.

Constructing Angles

In pairs, students draw ten different angles for each other. Students then measure, label and order their partner's drawings.

Angling

In pairs, students take turns to nominate the size of an angle eg 50°. Both students estimate and draw an angle of the nominated size. Students use a protractor to measure their partner's angle. The student whose angle is closer to the nominated measurement is the winner.

Variation: Students create two sets of cards, one with a range of angles drawn on them and the other with the measured size of the angles. They play a concentration game with the cards.

Angles in the Environment

Students collect a variety of pictures that show various angles eg buildings, football fields, aerial views. They identify angles in the pictures, trace them onto overhead transparencies and then describe them.

Possible questions include:

- what strategies did you use to describe your angles?
- did you discover anything about the type of angles identified?

Variation: Students measure the angles traced and record their findings.

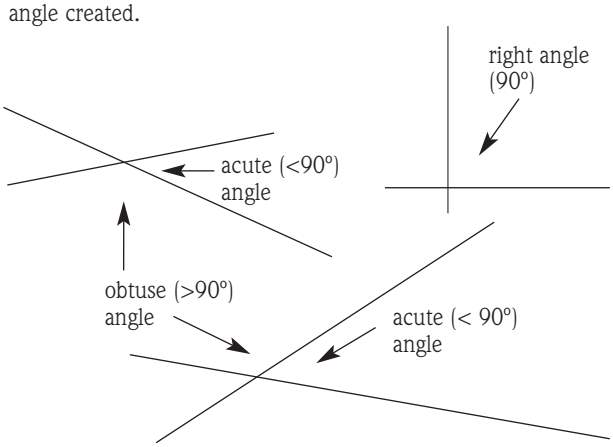
Angles with Invisible Arms

Students go on a hunt to identify angles with invisible arms eg door opening, rotation of door handle, rebounds. Students share and explain their findings with the class. Students make a class list of the angles identified.

WM Angles at Intersecting Lines

The teacher identifies different angle types created by intersecting lines in the environment eg doorframes. Students then identify any other angles created by intersecting lines that they can see.

Students draw intersecting lines on the computer and label the angle created.



Resources

protractor, pencils, paper, two-dimensional shapes, soccer and tennis balls, witches' hats

Language

vertex, right angle, acute angle, obtuse angle, reflex angle, straight angle, revolution, protractor, rotations, rebounds, degrees, intersecting lines

Links

PDHPE

6.10 Position

Strand – Space and Geometry

Syllabus Content p 137

SGS3.3

Uses a variety of mapping skills

Key Ideas

Interpret scales on maps and plans

Make simple calculations using scale

WM Working Mathematically Outcomes

Questioning	Applying Strategies	Communicating	Reasoning	Reflecting
Asks questions that could be explored using mathematics in relation to Stage 3 content	Selects and applies appropriate problem-solving strategies, including technological applications, in undertaking investigations	Describes and represents a mathematical situation in a variety of ways using mathematical terminology and some conventions	Gives a valid reason for supporting one possible solution over another	Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 3 content

Knowledge and Skills

Students learn about

- finding a place on a map or in a directory, given its coordinates
- using a given map to plan or show a route
  eg how to get to the local park
- drawing and labelling a grid on a map
- recognising that the same location can be represented by maps or plans using different scales
- using scale to calculate the distance between two points on a map
- locating a place on a map which is a given direction from a town or landmark
  eg locating a town that is north-east of Broken Hill
- drawing maps and plans from an aerial view

Working Mathematically

Students learn to

- use coordinates in simulation software and spreadsheets (*Applying Strategies*)
- interpret scales on maps and plans (*Applying Strategies, Reflecting*)
- give reasons for using a particular scale on a map or plan (*Reasoning*)
- use street directories, including those accessed on the Internet, to find the route to a given place (*Applying Strategies*)
- describe the direction of one place relative to another
  eg Perth is west of Sydney
  (*Applying Strategies, Communicating*)

Learning Experiences and Assessment Opportunities

Coordinates

Students are given a map with grid references. The teacher models questions such as:

- what town is at G3?
- what feature is located at D4?
- what are the coordinates of Smith Street?

Students then write a variety of questions related to the map using coordinates.

WM The Best Route

Students are given a scaled map of their suburb or a section of a city and are asked to locate two points of interest. On the map, students show the shortest or best route between the two points. Students write a description of the route using grid references, compass directions and the approximate distance travelled.

Variation: On a large map of the local area, all students plot their home and the route they use to get to school. They then write a description of their route.

Enlarge Me/Reduce Me

Students are given a simple map, with a scale, covered by a two-centimetre grid. On a separate piece of paper they draw a four-centimetre grid and copy the map. They then draw a one-centimetre grid and copy the map.

Possible questions include:

- did doubling/halving the size of the grid double/halve the scale? Why?
- did doubling/halving the size of the grid double/halve the size of the map? Why?
- how could you use this method to enlarge/reduce a smaller section of the map?

WM Paper Rounds

In pairs, students are given a street directory of the local area. The teacher gives them the addresses of the places where they will start and finish their paper delivery and students use coordinates to find these places. They design a route for effective delivery of the papers and calculate the distance travelled using the scale.

Possible questions include:

- how long is your route?
- can you devise a shorter route?

WM Spreadsheet Designs

Students plot coordinates on a spreadsheet to create a picture or pattern. They write a list of instructions using coordinates that describes their picture or pattern. Another student uses the coordinates to reproduce the picture or pattern.

WM Distance and Direction

Students use the scale on a map of NSW and the compass rose to find a town eg 300 km NE of Broken Hill, 270 km SW of Ballina. Students are encouraged to create their own cards with distance, direction and starting place on one side and the town on the back. They then swap cards with other students in the class.

Variation: Students source maps on the Internet and write a new set of cards using direction, distance and starting point. They swap with a partner who locates the town or point of interest.

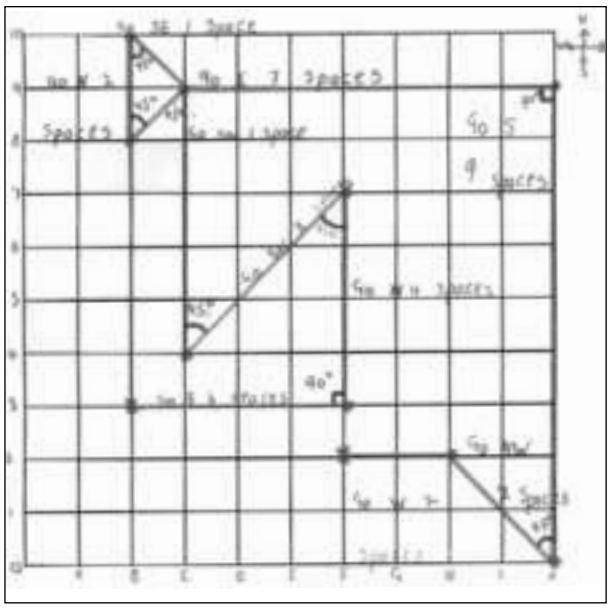
Degrees and Robots

Students start by facing north and then are instructed to face east.

Possible questions include:

- what angle have you turned through?
- how many degrees is this?

Students are encouraged to discuss the angles between other compass points. Students could use this knowledge to play 'Robots'. In pairs, students label grid paper using the same coordinates and a scale. Student A gives directions while Student B is the robot eg Student A says 'Face East, go forward 3 paces, turn 90° to the right, go forward 4 paces, turn 180°, ….' At each instruction Student B tells Student A which direction they are facing. Student B draws the route onto their grid paper. Students compare routes.



Aerial Photo

The teacher sources photographs of the local area from the Department of Lands. Students examine the aerial photographs.

Possible questions include:

- what natural features can you locate?
- what man-made features can you see?
- how do they look different?
- are there any distinctive features eg rivers, valleys?

Students investigate who uses aerial photographs and why they are used.

Students make a sketch of the aerial photographs, drawing main roads, buildings and distinctive features. They discuss and annotate their sketches.

Variation: Teachers or students source aerial photographs of unfamiliar locations either from the Department of Lands or the Internet and repeat the activity.

WM Follow My Directions

Students work in pairs with a barrier between them, each with the same map of the school or local area. Student A marks two landmarks on the map and gives the grid references for one of these to Student B. Student A describes the route taken between the two landmarks using directions, distances and grid coordinates while Student B marks in the route on their map. Students compare their routes and discuss the appropriateness of the given instructions. Students can then swap roles and repeat the activity.

Variation: Students could play Battleships on grid paper with coordinates.

House Plans

The teacher provides several examples of house plans. Students use the scale on the plans to determine the size of objects eg kitchen bench, livingroom, verandah.

The teacher sources house plans and perspective drawings from a builder and makes cards for students to match. Students shuffle the cards and match each plan to the perspective drawings.

Variations: Students could source plans off the Internet to compare and contrast different styles of houses and repeat the activity.

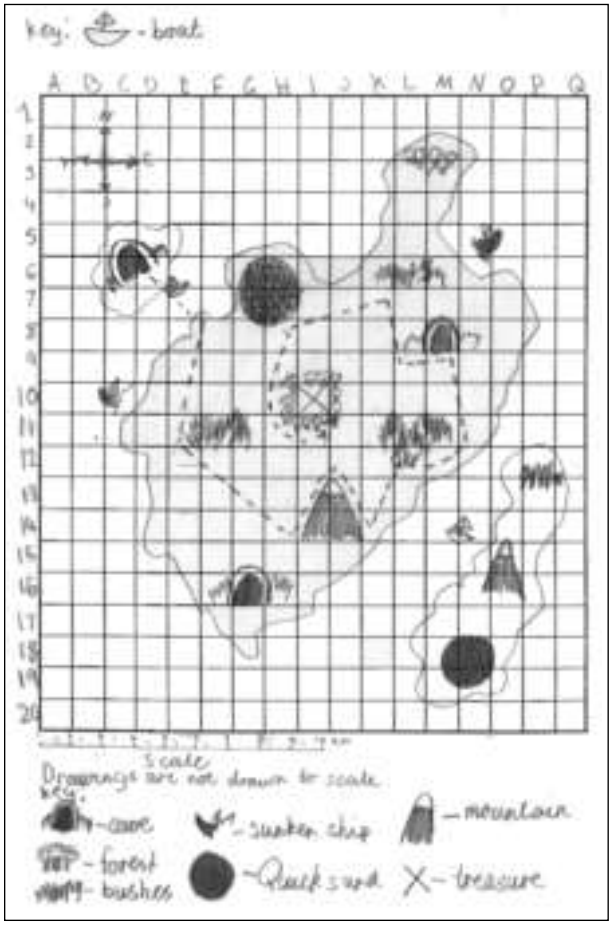
Orienteering

Students design and measure a simple orienteering course in the school grounds. They create a set of instructions on a map with a grid, a scale and compass directions to each place to be located. They give their instructions to another student to follow.

WM Treasure Island

Students draw a 'Treasure Island' map, creating a scale and compass rose, and imposing a grid and coordinates. They write a set of directions, using compass points and grid coordinates, to the location of a hidden treasure on their map. Students exchange maps and follow the directions to find the treasure. They are encouraged to comment on the scale used.

Variation: Students could reproduce their maps on a computer.



Resources

maps, house plans, compass, scaled map of local area and school, grid paper, street directory

Links

Two-dimensional Space

Length

Area

HSIE

Language

orienteering, direction, scale, compass, plan, directions, North, South, East, West, north-east, north-west, south-east, south-west, aerial view, atlas, locate