High rollers 2

Where are they now?

Students are able to form equal groups and find the total by counting by ones.

Where to next?

Students use skip counting or repeated addition to determine the total of the groups.

Allow the students to discuss ways of dealing with any single units left over from each group.

Syllabus outcomes

DS2.1: Gathers and organises data, displays data using tables and graphs, and interprets the results

NS1.3: Uses a range of mental strategies and concrete materials for multiplication and division

NS2.5: Describes and compares chance events in social and experimental contexts

WMS2.3: Uses appropriate terminology to describe, and symbols to represent, mathematical ideas.

CMIT reference

Building multiplication and division through equal grouping and counting: level 3 and 4

How?

Organise the students into groups and provide each group with a die. Each student in the group takes a turn to roll the die. The group records the number of times each number is rolled using tally marks. Continue until the die has been rolled a nominated number of times. Have the group then transfer the information onto a whole class picture graph, where groups of five are represented by a single symbol. Have the class use skip counting, repeated addition or recall of facts to determine how many times each number was rolled.

Variations

Transfer the tally marks to ten-frames and count in multiples of ten.

Before commencing to roll the die, ask the students to predict the outcome after a nominated number of rolls and then compare the results to the actual number rolled.

Why?

These activities allow the student to be removed one step from direct use of concrete materials and counting by ones. Here the symbols act as markers for the student to keep track of the groups as they count the multiples.

Jelly bean pans

Where are they now?

Students are able to form equal groups and find the total by counting by ones.

Where to next?

Students use skip counting or repeated addition to determine the total of the groups.

This activity may also be used to develop place value concepts.

Syllabus outcomes

DS2.1: Gathers and organises data, displays data using tables and graphs, and interprets the results

NS1.1: Counts, orders, reads and represents two- and three-digit numbers

WMS1.2: Uses objects, diagrams, imagery and technology to explore mathematical problems

CMIT reference

Building multiplication and division through equal grouping and counting: level 3 and 4

Building place value through grouping: level 0 and 1

How?

Present students with a large jar of jelly beans, beads, plastic teddies or other small objects and a pile of patty pans. Instruct the students to fill each patty pan with ten jelly beans, or similar object, until all have been removed from the jar. Keep a tally of any left over jelly beans. The objects may now be removed from the patty pans. Use the empty patty pans to form a picture graph. Encourage the students to count by tens and add on remaining units to determine the total. The students could determine a way of representing any remaining units using the patty paper.

Variation

To encourage off-the-decade counting, begin the count from the single units and add "ten" for each patty pan.

Why?

These activities allow the student to be removed one step from direct use of concrete materials and counting by ones. Here the symbols act as markers for the student to keep track of the groups as they count the multiples.

Fractured fairy tales

Where are they now?

Students are able to form equal groups and find the total by counting by ones.

Where to next?

Students use skip counting or repeated addition to determine the total of the groups.

Syllabus outcomes

DS2.1: Gathers and organises data, displays data using tables and graphs, and interprets the results

NS1.1: Counts, orders, reads and represents two- and three-digit numbers

WMS1.2: Uses objects, diagrams, imagery and technology to explore mathematical problems

WMS2.1: Asks questions that could be explored using mathematics in relation to Stage 2 content

CMIT reference

Building multiplication and division through equal grouping and counting: level 3 and 4

Building place value through grouping: level 0 and 1

How?

Pose open questions to the students such as:

- Little Bo Beep has lost her sheep. How many were there?
- How many rats followed the Pied Piper?
- How many "hundreds and thousands" on a piece of fairy bread?
- How many sultanas in a kilogram pack?

Have the students represent the answer as a picture graph. Other students could then read the graph and determine the total. Compare the results.

Variation

Students pose their own problems.

Why?

These activities allow the student to be removed one step from direct use of concrete materials and counting by ones. Here the symbols act as markers for the student to keep track of the groups as they count the multiples.

How do I know?

Where are they now?

Students use the row structure repeatedly to measure area and count the total number of units by counting in multiples.

Where to next?

Students use a row and column structure to measure area and use a variety of counting strategies that do not rely on visual material to determine the total number of units.

Model various counting strategies for multiplication such as skip counting, repeated addition or recalling number facts.

Syllabus outcomes

MS2.2: Estimates, measures, compares and records the areas of surfaces in square centimetres and square metres

NS2.3: Uses mental and informal written strategies for multiplication and division

WMS2.5: Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 2 content

CMIT reference

Count Me Into Measurement: Area 3.1

Building multiplication and division through equal grouping: level 3, 4 and 5

How?

Provide the students with a variety of cardboard rectangles and a sheet of grid paper. Have the students place the rectangles on top of the grid paper and use the grid structure to determine the total number of units covered by the rectangle. Have the students share their results with others and explain how they determined the total. Discuss with the students why grid paper is useful for measuring and if they could suggest other things to use to help them measure area.

Why?

Students need to be able to visualise and use the spatial grid structure to effectively understand *area* concepts.

Provide the students with paper to record their solutions. Use these recordings as models for recording thinking.

Using nets 2

Where are they now?

Students use the row structure repeatedly to measure area and count the total number of units by counting in multiples.

Where to next?

Students use a row and column structure to measure area and use a variety of counting strategies that do not rely on visual material to determine the total number of units.

Discuss with the students that this practical form of measurement will be approximate and the accuracy will depend on the measuring instrument and the experience of the person who is measuring.

Syllabus outcomes

MS1.2: Estimates, measures, compare and records areas using informal units

NS2.3: Uses mental and informal written strategies for multiplication and division

WMS2.2: Selects and uses appropriate mental or written strategies, or technology, to solve problems

CMIT reference

Count Me Into Measurement: Area 3.1

Building multiplication and division through equal grouping: level 3, 4 and 5

How?

Provide the students with a selection of packages that they can open to form a net. Each student will also need a small cardboard square. Have the students use the square to determine the number of units that are needed to make a row across the net and the number needed to make a column. Encourage the students to mark a line at the end of each unit. Have the students then use the row and column structure to determine the total number of units needed to cover the net. The students may need to be reminded to add any single units needed to completely cover the area. Have the student use multiple counting, repeated addition or recall known facts to determine the number of units needed to cover the rectangle and count on the additional units.

Why?

Students need to be able to visualise and use the spatial grid structure of grids to effectively understand *area* concepts.

Have the students draw the 3D shapes showing the rows and layers of units.

How many more?

Where are they now?

Students use the row structure repeatedly to measure area and count the total number of units by counting in multiples.

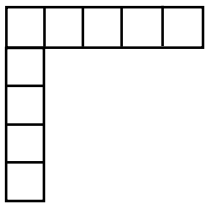
Where to next?

Students use a row and column structure to measure area and use a variety of counting strategies that do not rely on visual material to determine the total number of units.

TP

Students may need guidance in forming the row and column structure. Discuss how one square will be used as the first square in the row as well as the first square in the column, and why.

e.g.



Syllabus outcomes

MS1.2: Estimates, measures, compare and records areas using informal units

NS2.3: Uses mental and informal written strategies for multiplication and division

WMS2.2: Selects and uses appropriate mental or written strategies, or technology, to solve problems

CMIT reference

Count Me Into Measurement: Area 3.1

Building multiplication and division through equal grouping: level 3, 4 and 5

How?

Provide the students with square tiles and two dice. Have the students take turns to roll the dice. The students then collect a corresponding number of tiles and form a row equal to one of the rolled numbers and a column equal to the other rolled number. The students then need to determine the number of additional tiles needed to make a "mat" from the tiles. Encourage the students to use the row and column structure to determine how many additional tiles are needed. Have the students share their solutions.

Variation

Replace the tiles with cubes.

Why?

Students need to be able to visualise and use the spatial structure of grids to effectively understand *area* concepts.

What's in the box?

Where are they now?

The student is able to generate static visual images of shapes and objects in a variety of orientations.

Where to next?

The student is able to mentally modify images of shapes and objects.

Syllabus outcomes

SGS2.1: Makes, compares, describes and names three-dimensional objects, including pyramids, and represents them in drawing

WMS2.4: Checks the accuracy of a statement and explains the reasoning used

CMIT reference

Count Me Into Space: Part-whole relationships, pattern and dynamic imagery strategies

How?

Conceal a variety of objects such as assorted tissue boxes, balls and containers inside a box. Select an object in the box and lift it up within the box to reveal part of the object to the students. Ask the students to name what the three-dimensional object could be and explain why. Continue to reveal part of the object and repeat questioning. Repeat with various 3D objects such as prisms, pyramids, cylinders, cones and spheres.

Variation

Replace the 3D object with a 2D shape and place on an overhead projector, partially covered. Gradually reveal part of the shape and question the students as to what shape it might be and why.

Why?

Students need to explore shapes to help them develop strong concept images that focus on properties that make up the shape, such as angles, sides and faces.

Moving 3D objects

Where are they now?

The student is able to generate static visual images of shapes and objects in a variety of orientations.

Where to next?

The student is able to mentally modify images of shapes and objects.

Syllabus outcomes

SGS2.1: Makes, compares, describes and names three-dimensional objects, including pyramids, and represents them in drawing

WMS2.4: Checks the accuracy of a statement and explains the reasoning used

CMIT reference

Count Me Into Space: Orientation and motion, pattern and dynamic imagery strategies

How?

Select a square pyramid from a set of geometric solids. Show the solid so that it is on its base to the students. Ask the students to draw the shape they will see if you were to push the pyramid over so that the point lands away from them. Have the students share their drawings and explain their reasoning before checking by moving the solid. Repeat the activity using other solids and appropriate instructions.

Variation

Organise the students into pairs and have them complete the activity.

Why?

Students need to explore shapes to help them develop strong concept images that focus on properties that make up the shape, such as faces and angles.

Time to shape up!

Where are they now?

The student is able to generate static visual images of shapes and objects in a variety of orientations.

Where to next?

The student is able to predict changes to shapes and objects by mentally visualising and modifying the image of the shape.

Syllabus outcomes

SGS2.2a: Manipulates, compares, sketches and names two-dimensional shapes and describes their features

SGS2.2b: Identifies, compares and describes angles in practical situations

WMS2.5: Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 2 content

CMIT reference

Count Me Into Space: Orientation and motion, pattern and dynamic imagery strategies

How?

Show a round clock face to the students and ask them to imagine what shape would be drawn if you drew a line starting at the 12 and going to 3, 6, 9 and back to 12. Have the students suggest other numbers that could be used to form squares or rectangles on the clock face.

Variations

Have the students draw the shapes that would be formed in the same orientation as represented on the clockface.

Find other shapes that can be drawn on the clock. For example start at a number and count by twos or fours.

Trace the shape on the clock using fingers if the students are having difficulty visualising shapes.

Why?

Students need to explore shapes to help them develop strong concept images that focus on properties that make up the shape, such as angles and sides.

Rolling boxes

Where are they now?

The student is able to generate static visual images of shapes and objects in a variety of orientations.

Where to next?

The student is able to mentally modify images of shapes and objects.

Syllabus outcomes

SGS2.2a: Manipulates, compares, sketches and names two-dimensional shapes and describes their features

WMS2.5: Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 2 content

CMIT reference

Count Me Into Space: Orientation and motion, pattern and dynamic imagery strategies

BLM

Rolling boxes, page 241

How?

Collect a variety of cardboard boxes. Place a symbol in a corner or along an edge on one face of each box. Hold up one of the boxes so that the students can see the face displaying the symbol. Ask the students to draw the shape of the face if it was rotated a quarter turn to your left and to draw where the symbols would now be on the face. Share and discuss the students' drawings. Repeat the process, turning the box another quarter turn. Continue for one or two more rotations then use a different shaped box or container.

Variation

After having experience with the above activity, provide the students with a copy of the *Rolling boxes* worksheet and ask them to draw where the symbols would be on the boxes if they were rotated a quarter turn each time.

Why?

Development of visual images helps students focus on the properties of 2D shapes and 3D objects.

Pattern block angles

Where are they now?

The student recognises shapes in different orientations and proportions and checks by physical manipulation of materials.

Where to next?

The student is able to use the relationship between parts of shapes.

Syllabus outcomes

SG2.2b: Identifies, compares and describes angles in practical situations

WMS2.2: Selects and uses appropriate mental or written strategies, or technology, to solve problems

CMIT reference

Count Me Into Space: Part-whole relationships:

pictorial imagery strategies

pattern and dynamic imagery strategies

How?

Provide the students with pattern blocks. Remove the hexagonal blocks. Instruct the students to draw a central dot on a piece of paper. The students then choose to investigate one of the pattern blocks. Using as many of the one type of block as needed, have the students place the same type of "corner" of each pattern block on the dot, ensuring the pattern blocks fit next to each other without any gaps or overlaps. The students should place enough blocks on the paper until they are able to form a straight line going through the dot. Have the students then draw radiating lines from the dot where additional blocks would be placed to complete one revolution around the dot. Remove the blocks and draw in all of the radiating lines.

Have the students share their discoveries and try to describe the angles. This description does not have to be in terms of degrees.

Variation

Tell the students that some angles on the pattern blocks cannot be joined together to make a straight line. (Note: If the angle is greater than 90º.) Ask them to discover which ones. They will still be able to draw the radiating lines to go around the dot.

Why?

Students need to develop the language to describe angles. They also need to be able to analyse the parts, such as corners, that make up a shape.

Rectangle count-up

Where are they now?

The student recognises shapes in different orientations and proportions and checks by physical manipulation of materials.

Where to next?

The student is able to use the relationship between parts of shapes.

Remind the students that a square is a type of rectangle and that rectangles can be placed together to form other rectangles.

Syllabus outcomes

SGS2.2a: Manipulates, compares, sketches and names two-dimensional shapes and describes their features

WMS2.5: Links mathematical ideas and makes connections with, and generalisations about, existing knowledge and understanding in relation to Stage 2 content

PAS2.1: Generates, describes and records number patterns using a variety of strategies and completes simple number sentences by calculating missing values

CMIT reference

Count Me Into Space: Part-whole relationships:
pattern and dynamic imagery strategies

BLM

Rectangle count-up, page 242

How?

Provide the students with a copy of the *Rectangle count-up* worksheet and ask them to determine the number of rectangles on the top diagram. Have the students explain or write how they know they have found all of the rectangles. Show the students the second diagram and repeat the questioning. Ask the students to extend the pattern on the diagram and determine the number of rectangles. Discuss number patterns and ask the students to predict how many rectangles there would be if the pattern was extended again. Share results.

Why?

Development of visual images and part-whole knowledge helps students focus on the properties of 2D shapes.

Forming groups blackline masters

Start with four

+1	+10
+100	−1
−10	−100

I have, I want, I need

I have I need I want

I have I need I want

I have I need I want

I have I need I want

Friends to 100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

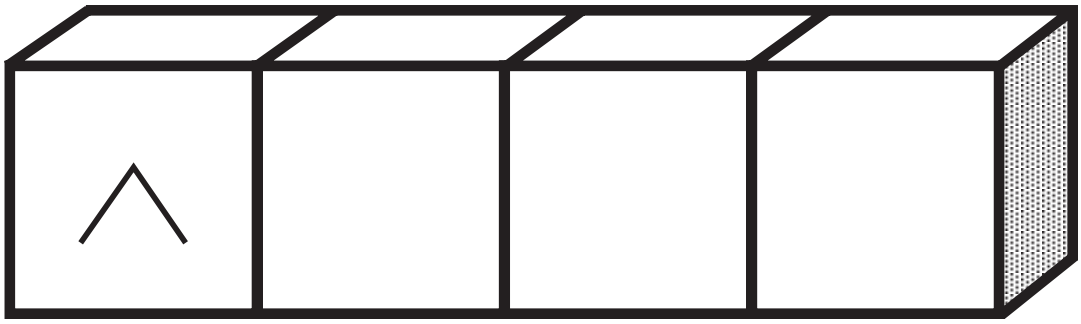
Double dice multi

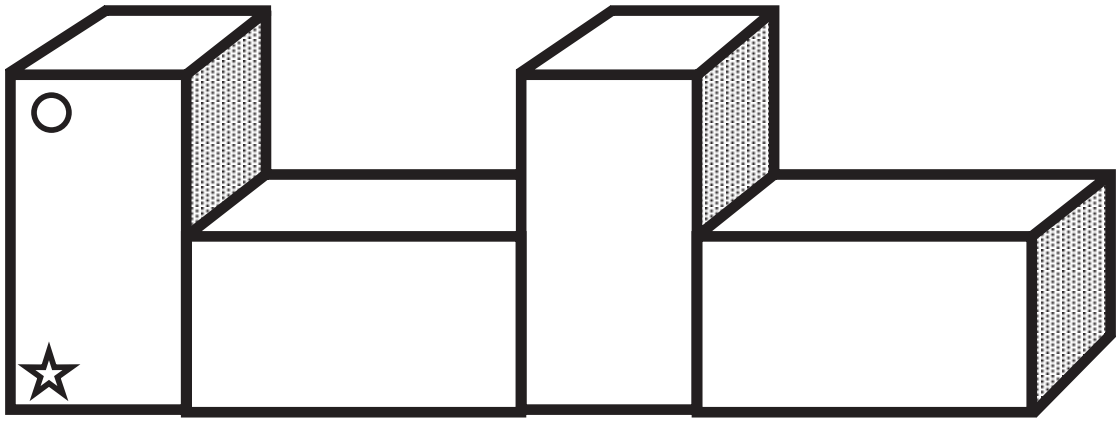
1	2	3
4	5	6
8	9	10
12	15	18

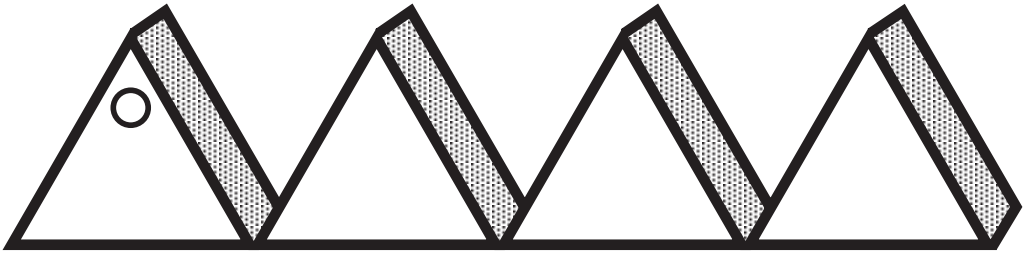
Triples plus 1

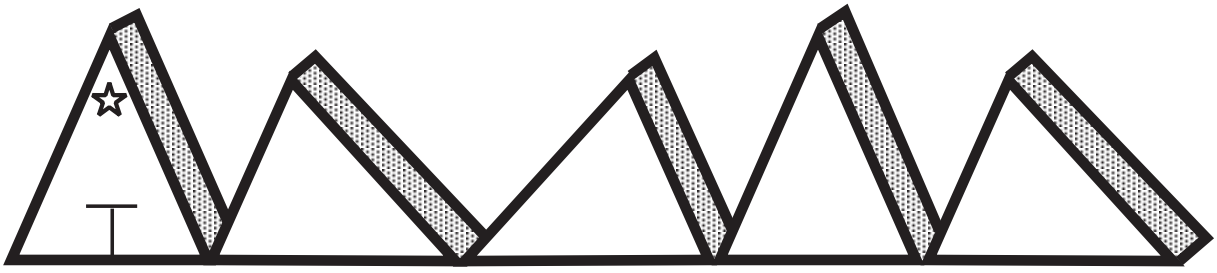
4	16	19	10
19	7	10	4
16	4	13	7
13	19	10	16

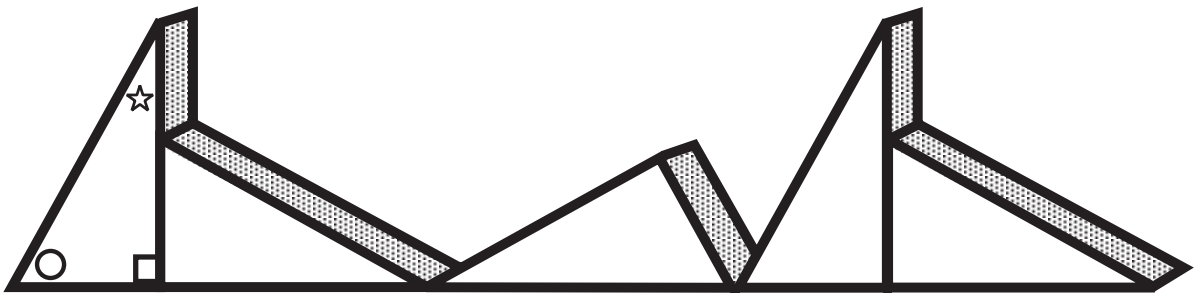
Rolling boxes



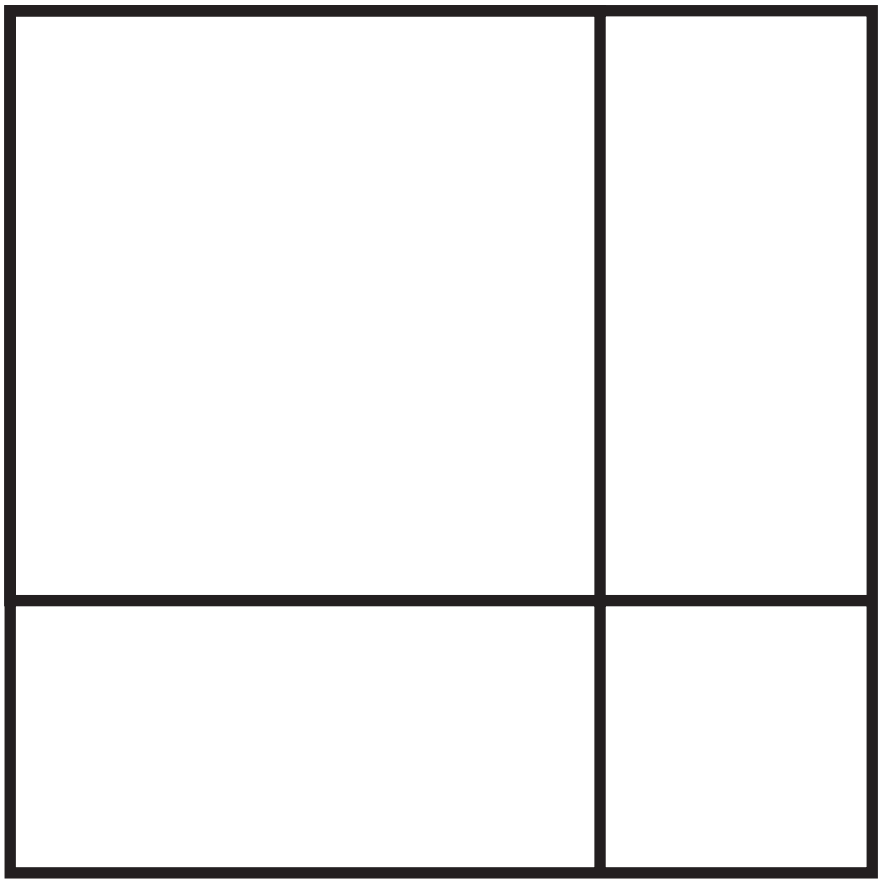


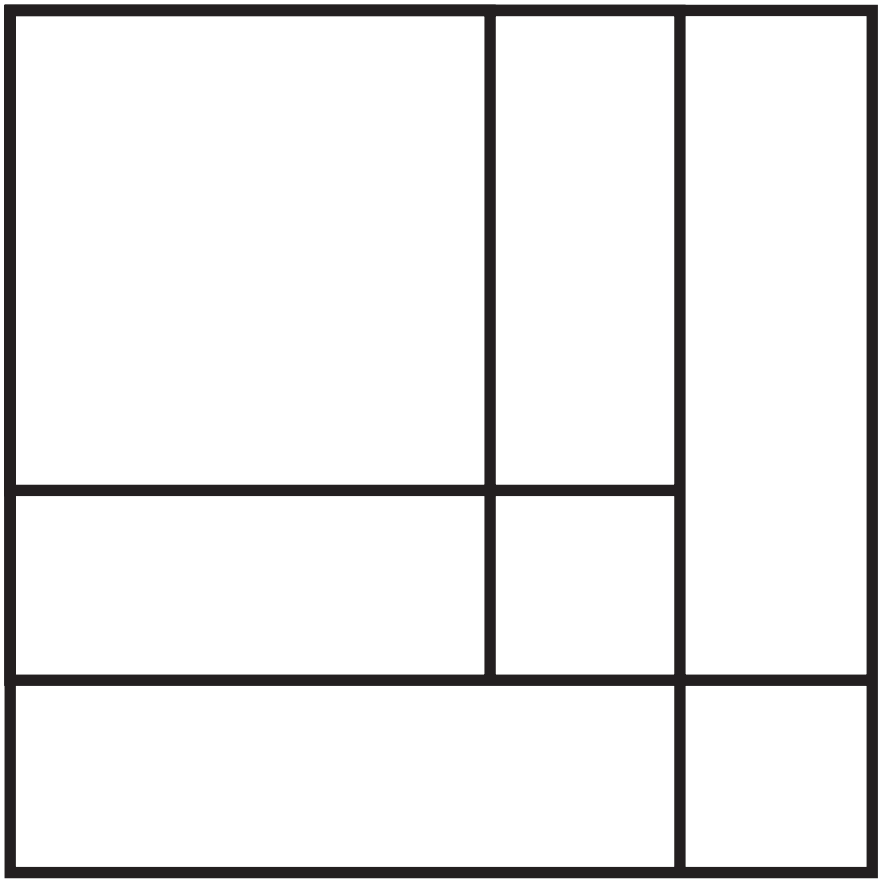




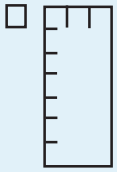


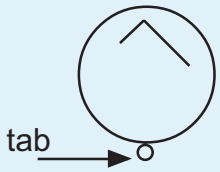
Rectangle count-up





Assessment tasks

Task	Student response	Assessment
Display the following cards **43 + 21** **37 + 19** **50 - 27** T: (For each card) *What is the answer to this? How did you work it out?*	Uses mental strategies to solve the addition and subtraction tasks.	Does the student use a jump or split method to solve the tasks? Does the student use other non-count-by-one strategies?
T: *Start from 24 and count by 100, i.e. adding 100 each time.*	Counts by 100s from 24 to 924	Can the student count forwards by 100s, off the 100?
T: *There are 12 biscuits and the children are given 2 biscuits each. How many children are there?*	Correctly solves the division task (how many groups) without the use of materials.	Does the student use a double count to keep track of the groups and the total? Other strategies used?
Show the student a unit square and a 7 x 3 rectangle.  T: *How many squares like this would you need to cover the rectangle completely?*	Calculates the total number of units needed to over the rectangle without having to use material.	Does the student: • count by ones • skip count the rows • use the row and column structure to find the total?

Task	Student response	Assessment
Show the student the following design on a cardboard circle.  Place another cardboard circle next to it so that the tabs match. Give the student two sticks. T: *Watch carefully and think about the design as I cover and turn these two circles.* Cover both circles and turn them 90º anticlockwise. T: *Build the design on your circle so that it will look like my design now.* If correct: T: *How did you know what to do?*	Quickly makes the design in the correct orientation without having to remove the cover.	Does the student make the design with the angle and position within 15º? When explaining how to build the design does the student refer to size of angles, relative position of the sticks and what happened to the sticks as the circle turned?

Maths bites

Using a calendar

- Choose a date from a calendar. Write it in a shortened form. For example, 12.6.99. Use the digits to make number sentences using the four operations. Such as 1+2+6+9+9 = 18.

- After completing the above activity, ask the students to find a date which they could use to make a nominated number. For example, find a date where the digits could be used to make the total 20.

- Look for number patterns going down the calendar, diagonally right and diagonally left. Ask the students why these patterns occur.

- Look at any four numbers that form a square on the calendar. Add the two numbers which go diagonally right and then the two going diagonally left. *What do you find? Does this work for all numbers that form a square?*

- State a number, say "12". Ask the student to find the "square" of four numbers that add to the stated number on both diagonals.

- Look at nine numbers on the calendar which form a 3 x 3 grid. *Can you see any patterns using these numbers?* Repeat using a 4 x 4 grid of numbers.

- Ask questions such as: *If there are 31 days, which month could it be?*

- Look at today's date. Use the number representing the day to write a list of "number stories". For example if the date is the 12th, students could record 2 x 6 = 12, 8 + 4 = 12, 3 x 4 = 12, 12 ÷ 6 = 2, double 6 = 12.

The following activity can be used as a whole class introduction to investigating number patterns on a calendar.

- Distribute numeral cards 1–31 and cards displaying the "days of the week" to the students. Pose a problem whereby the students have to place the cards in the correct row and column to complete a calendar. For example: *The only information I have is that the 13th is a Saturday. Now complete the calendar.* Ask the students with the "Saturday" card and the numeral card showing "13" to place their cards down on the floor first. Ask questions which will then allow each student to place his or her card down. For example, *Which number comes before "13"? Which number comes after "13"? Which number will be directly under "13" on the calendar? Where will number "1" go?* If a student makes an error, let the class discover the mistake and state how it should be corrected.