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.

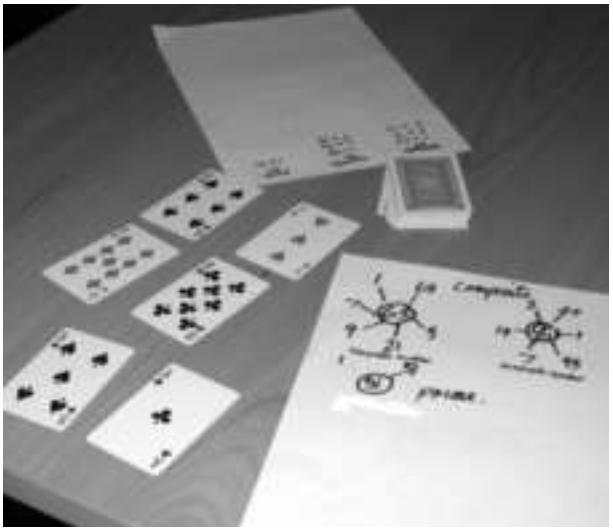
Part B

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:

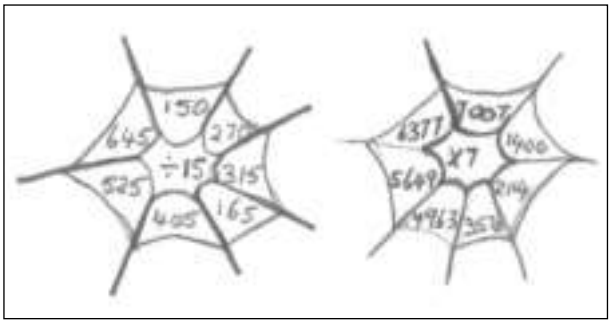
- can you explain the best buy? Why is it the best buy?
- how did you work it out?
- is there a better strategy you could use to work it out?

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

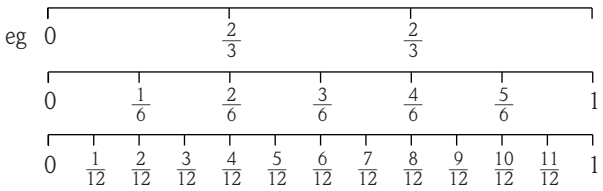
WM Working Mathematically Outcomes

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

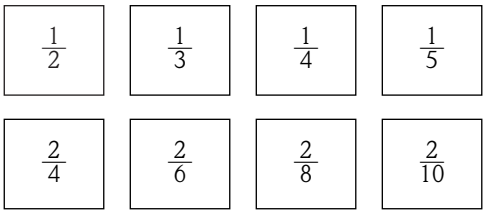
Students are given 'mystery fraction cards' with clues to solve.

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.

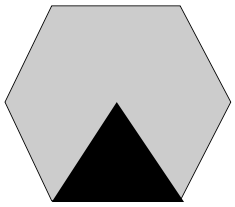
Students are encouraged to discuss the correct placement of the cards and why some cards need to be placed on top of other cards.

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.

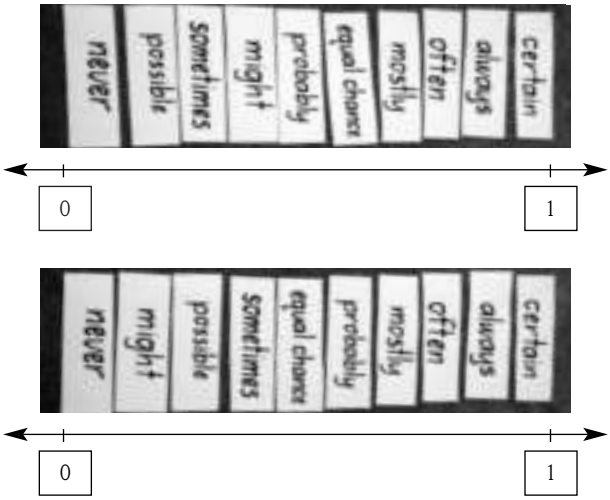
Students design a mini lotto game that increases the chance of a certain number being drawn. They then discuss the chance of each number occurring eg 5 has a 50% chance of being drawn because half the balls are numbered 5 while 2 has no chance of being drawn because none of the balls are numbered 2.

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

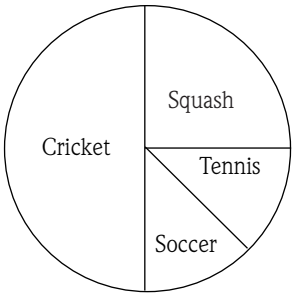
Students use the Internet to find the population of ten countries. They graph their findings using an appropriate scale to represent large numbers. Students are encouraged to represent the data using different types of graphs and discuss the advantages and disadvantages of each representation.

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.

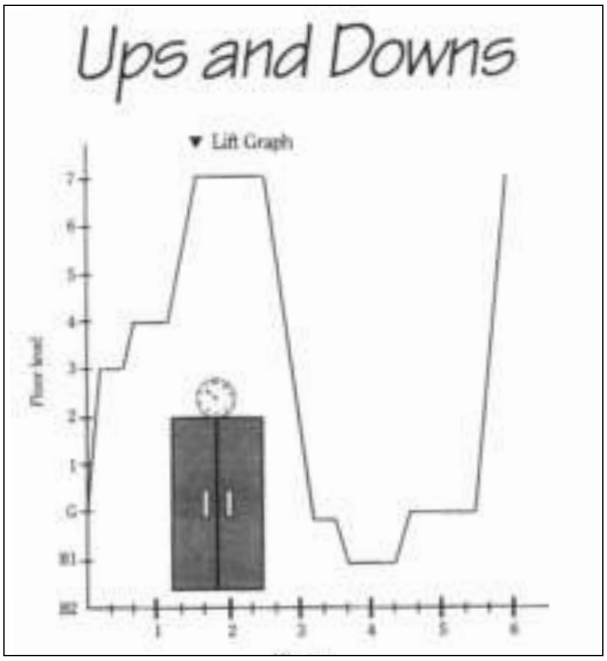
Ups and Downs

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:

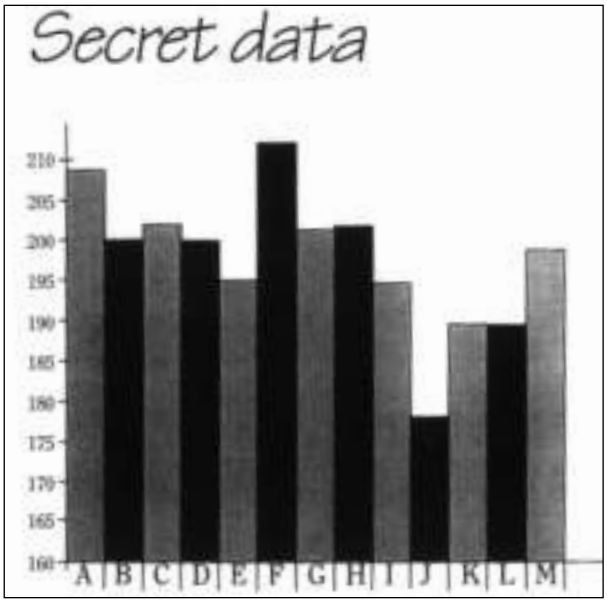
- what sort of information is represented?
- why do you think the information is represented in this way?
- how can it be represented differently?
- what questions can we ask?
- what information is best represented by line graphs, column graphs, picture graphs, sector graphs, tables?

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

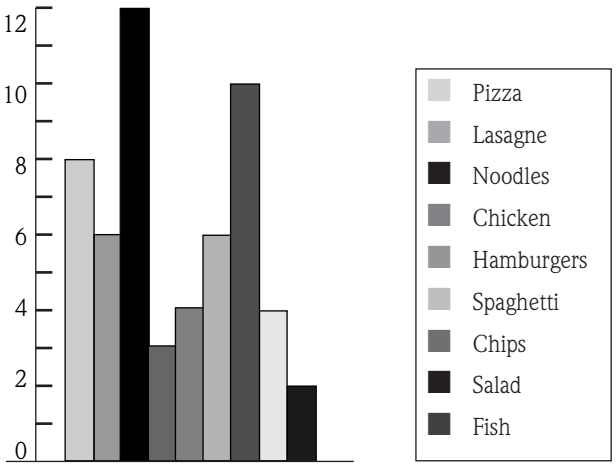
Students survey the class on their favourite sport, food, colour, number, etc. Students determine what type of graph is the best to display the set of data and use the data to draw their graph on a computer. Students share and compare graphs.

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.

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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?

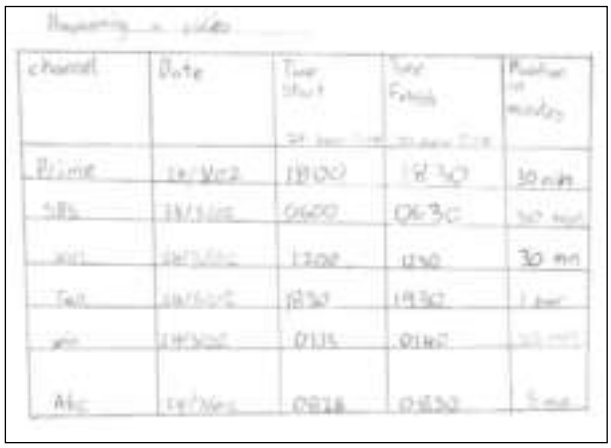
Extension: Students use the Internet to research different time zones.

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

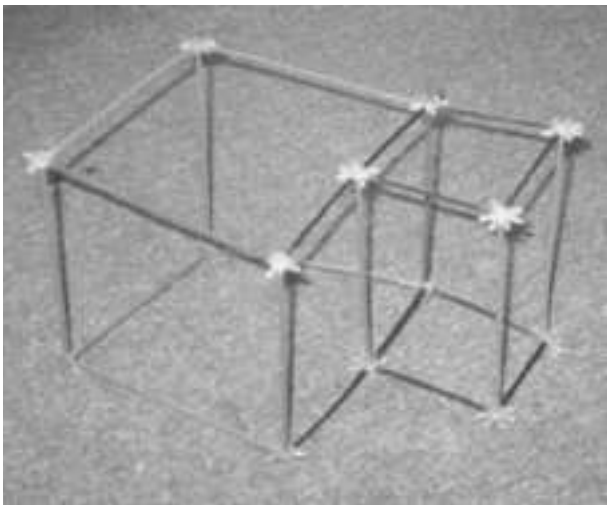
Students learn about

- 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.

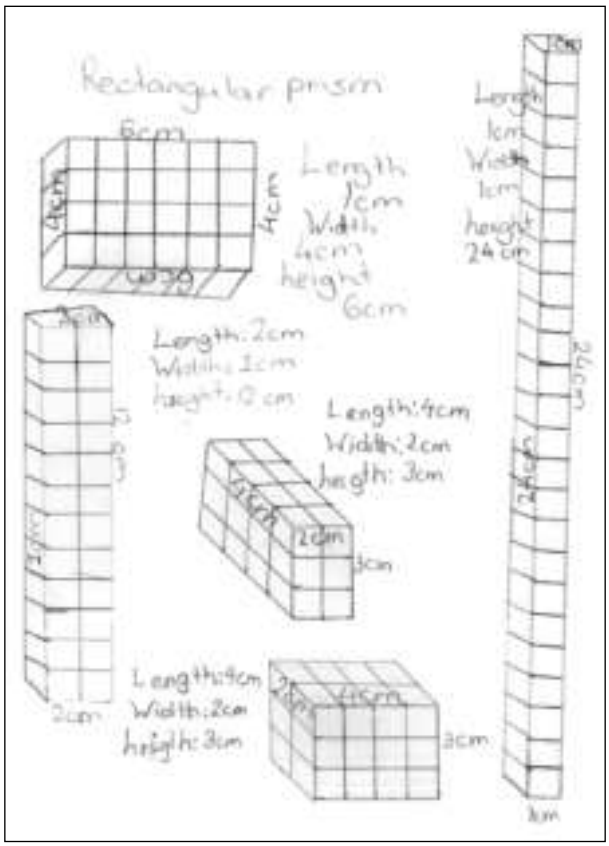
Barrier Game

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.

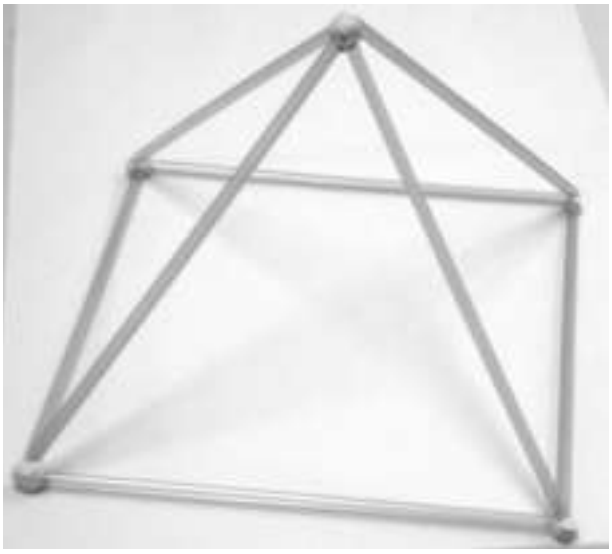
Possible questions include:

- 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?'

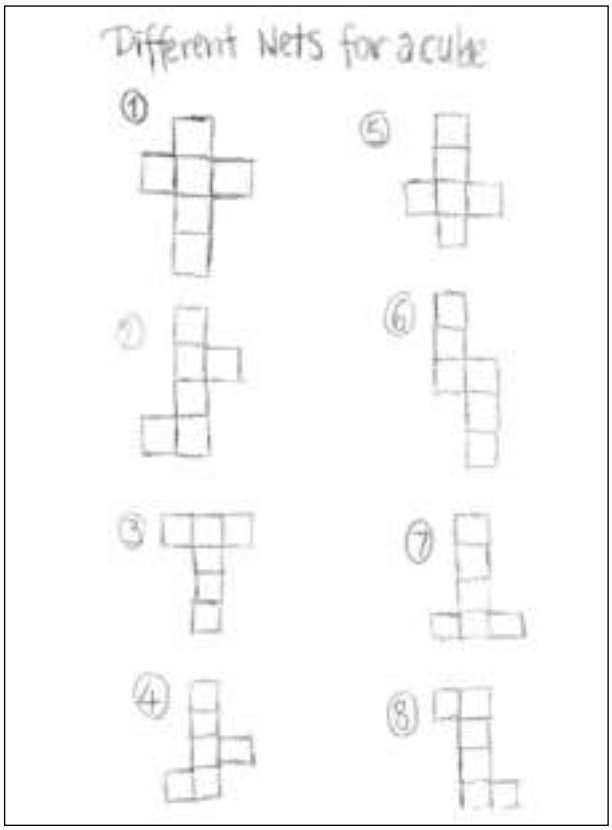
Variation: Students make 'What Object am I?' booklets.

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

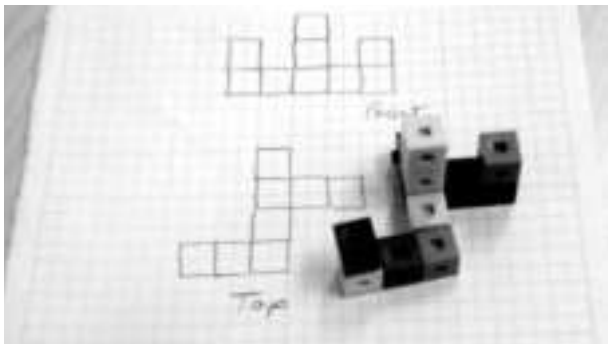
Students draw the school building showing perspective. They discuss their work and reflect on how they could improve their drawing.

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
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 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.

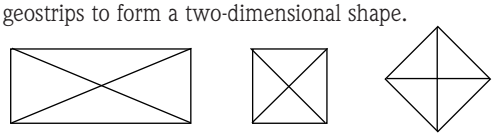
Circles

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?

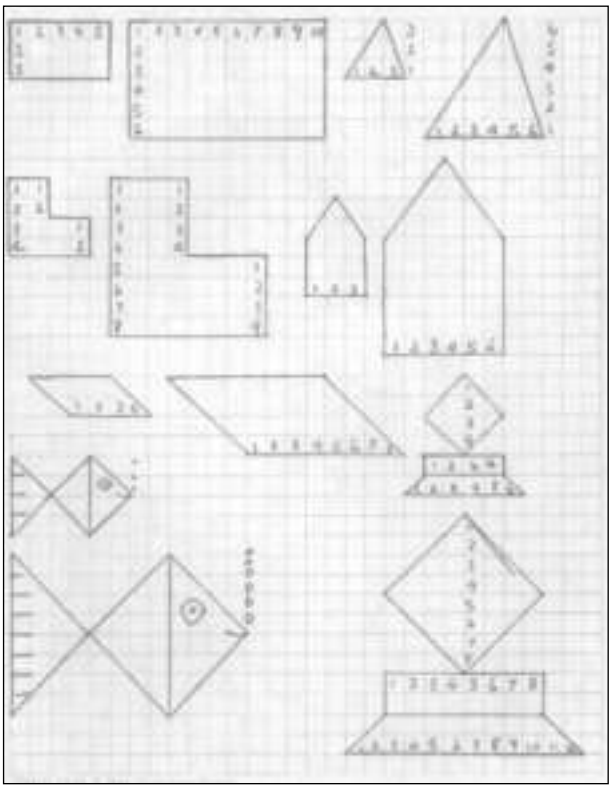
In groups, students draw their two-dimensional shapes complete with diagonals, and record their findings. The students' posters could be displayed.

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.

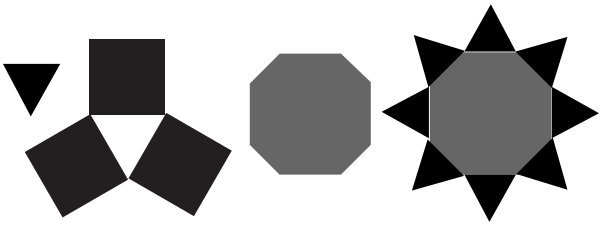
WM Rotational Symmetry

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?

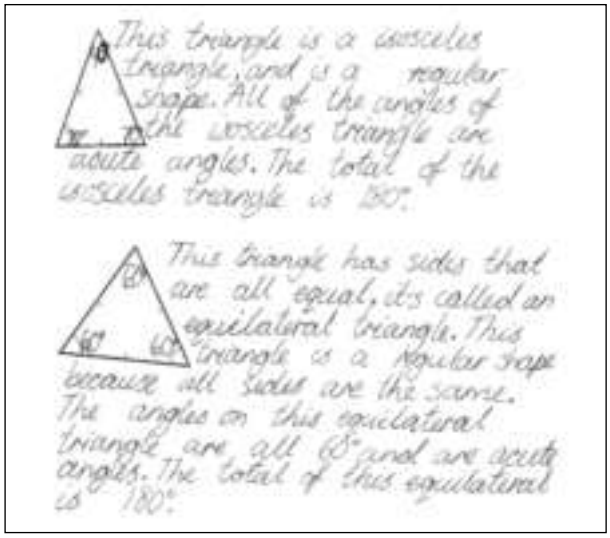
Students discuss their logos.

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.

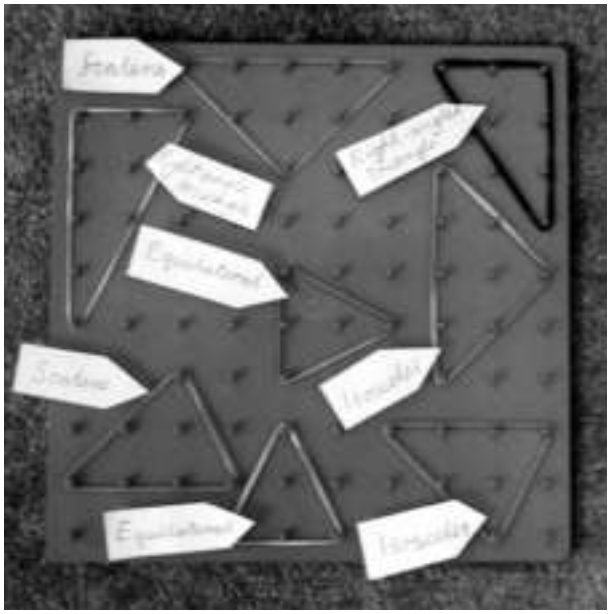
Variation: Students construct triangles using a variety of equipment eg set squares, protractors, rulers, templates. They then sort the triangles and describe their properties.



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?



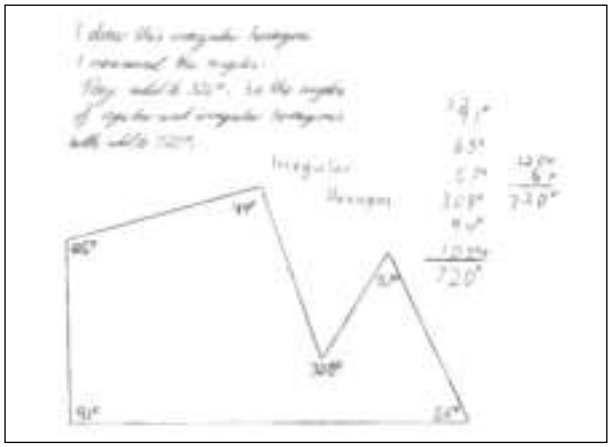
Drawing and Manipulating

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:

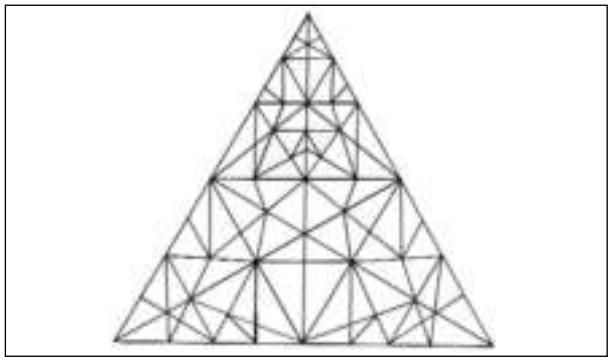
- what did you use to construct angles?
- how did you ensure angle, side and diagonal properties were correct?
- what did you use to construct circles?
- what is the difference between a regular and an irregular shape?

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.

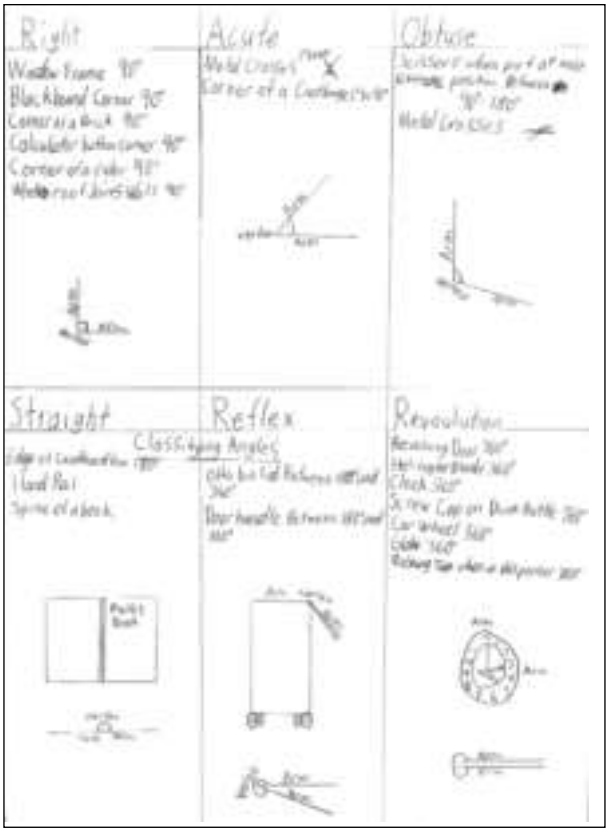
Classifying Angles

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.

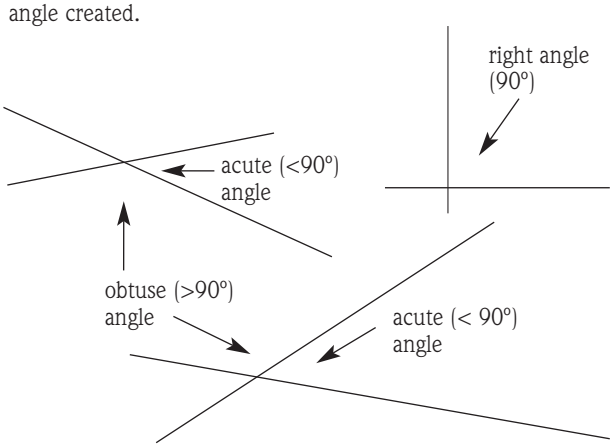
Angles with Invisible Arms

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.

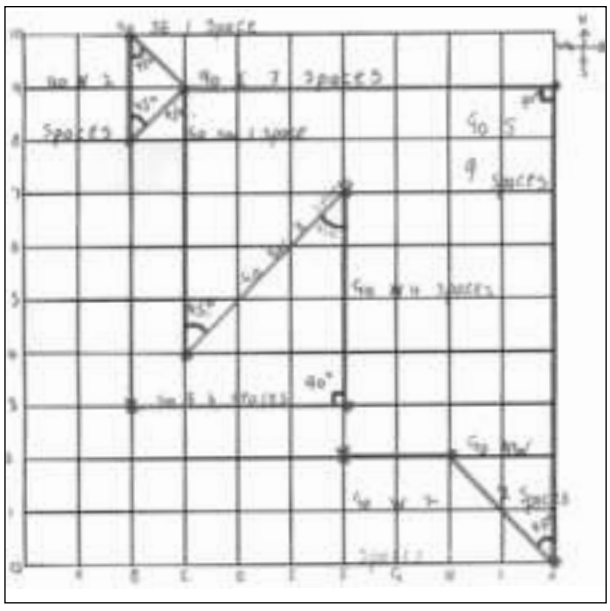
Degrees and Robots

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.

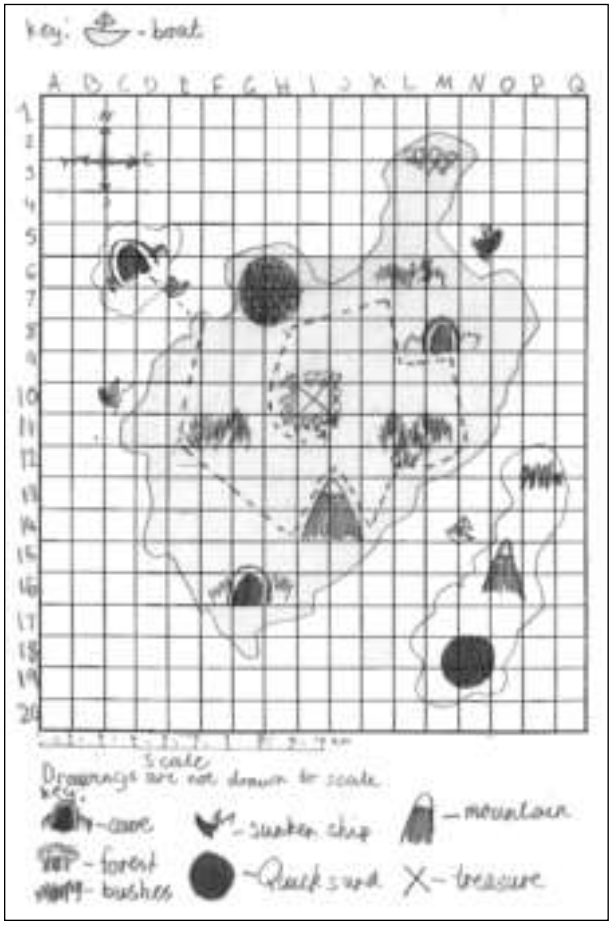
Orienteering

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