

Summary of students' performance by the end of Grade 7

Reasoning and problem solving

Students represent and interpret routine and non-routine mathematical problems in a range of contexts, changing from one representation to another as appropriate. They choose and use appropriate mathematical techniques and tools to solve problems, including ICT. They present and explain their solutions and conclusions in the context of the original problem, orally and in writing. They reason logically to establish the truth of a statement. They make general statements using words and symbols.

Number and algebra

Students calculate accurately with whole numbers, decimals, fractions and percentages using mental, written and calculator methods. They solve a range of routine and non-routine problems. They estimate and round answers, checking results to see if they are reasonable. They know the order of operations and use brackets appropriately. They find positive and negative square roots and order, add, subtract, multiply and divide positive and negative numbers, using the symbols $<$, \leq , $>$, \geq , $=$, \neq correctly. They calculate with fractions using the four operations, including combined operations for addition and subtraction. They know which number to consider as 100%, or a whole, in problems involving comparisons, and use this to evaluate one number as a fraction or percentage of another. They understand and use the equivalences between fractions, decimals and percentages, calculate using ratios, and use the unitary method to solve problems involving direct proportion. They describe mathematical situations by using words, symbols and diagrams. They express in symbolic form and use formulae involving up to two operations, simplify and evaluate linear expressions, and construct and solve linear equations with integer coefficients. They find the rule for the next term or the n th term in a linear sequence that relates to a spatial pattern. They use coordinates in all four quadrants to plot the graphs of simple linear functions.

Geometry and measures

Students identify alternate, supplementary and corresponding angles and know angle properties related to diagonals of squares, rectangles, parallelograms and rhombuses. They use these and other properties to find the values of unknown angles in geometric figures. They use a ruler and compasses to construct angle bisectors and perpendicular bisectors and, together with a protractor, to construct simple geometric figures from given data. They identify and describe properties of solid shapes, and recognise their nets. They use a range of measurements, including rate and speed, to solve problems. They choose suitable units to make estimates of measurements. They find the area of trapeziums and other rectilinear figures. They know common estimates for π and apply formulae to estimate the circumference and area of a circle.

Data handling

Students answer questions by constructing, analysing and drawing conclusions from tables, pictograms, bar charts and line graphs drawn on paper or generated using ICT. They interpret pie charts. They compare different representations of the same set of data. They understand and use the probability scale from 0 to 1, and find probabilities of single events in simple contexts. They know that the total probability of all mutually exclusive outcomes is 1 and use this to solve problems.

Content and assessment weightings for Grade 7

The mathematics standards for Grades K to 9 are grouped into four strands: reasoning and problem solving; number and algebra; geometry and measures; and data handling.

The reasoning and problem solving strand cuts across the other three strands and should be integrated with them in teaching and assessments. For Grade 7, about 60% of the teaching and assessment of each of the other three strands should be devoted to reasoning and problem solving.

For Grades 7 to 9, the proportion of algebra in the number and algebra strand increases as the proportion of number decreases, and so is shown separately in the table below. The weightings of the content strands relative to each other are as follows:

	Number	Algebra	Geometry and measures*	Data handling
Grade 7	30%	25%	27.5%	17.5%
Grade 8	25%	30%	27.5%	17.5%
Grade 9	15%	40%	27.5%	17.5%

* including trigonometry in Grade 9

The standards are numbered for easy reference. Those in shaded rectangles, e.g. 1.2, are the performance standards for all students. The national tests for mathematics will be based on these standards.

Grade 7 teachers should review and consolidate Grade 6 standards where necessary.

Reasoning and problem solving

By the end of Grade 7, students represent and interpret routine and non-routine mathematical problems in a range of contexts, changing from one representation to another as appropriate. They choose and use appropriate mathematical techniques and tools to solve problems, including ICT. They present and explain their solutions and conclusions in the context of the original problem, orally and in writing. They reason logically to establish the truth of a statement. They make general statements using words and symbols.

Key standards

Key performance standards are shown in shaded rectangles, e.g. **1.2**.

Cross-references

Standards are referred to using the notation RP for reasoning and problem solving, NA for number and algebra, GM for geometry and measures and DH for data handling, e.g. standard NA 2.4.

Examples of problems

The examples of problems in italics are intended to clarify the standards, not to represent the full range of possible problems.

Students should:

1 Use mathematical reasoning to solve problems

- 1.1** Model or represent mathematical problems from a range of contexts, changing from one representation to another as appropriate.

What number goes in the box to make this equation true?

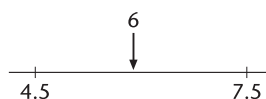
$$32.45 \times \square = 253.11$$

The number 6 is halfway between 4.5 and 7.5.

Fill in the missing numbers below.

The number 6 is halfway between 2.8 and

The number 6 is halfway between -12 and



- 1.2** Choose and use appropriate mathematical techniques and tools to solve a problem, including ICT.

Use your calculator to explore these calculations:

$$7 \times 9, 7 \times 99, 7 \times 999, \dots$$

Predict the answer to 7×9999999 .

Explore $9 \times 9, 9 \times 99, 9 \times 999, \dots$

Find a general rule.

7×9	63
7×99	693
7×999	6993
7×9999	69993

In Class 7, 80% of the students like dates.

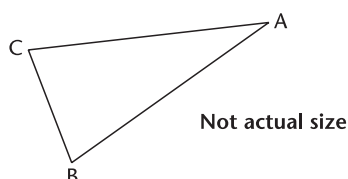
75% of the students who like dates also like chocolate.

In Class 7, what percentage of the students like both dates and chocolate?

Triangle ABC is isosceles and has a perimeter of 20 centimetres.

Sides AB and AC are each twice as long as BC.

Calculate the length of the side BC.



1.3 Present and explain solutions and conclusions in the context of the original problem, orally and in writing.

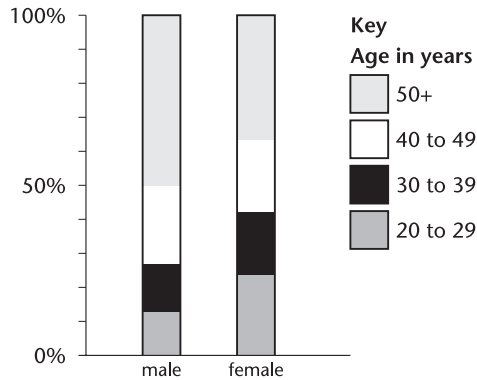
Which is larger, $\frac{1}{3}$ or $\frac{2}{5}$? Explain how you know.

A teacher needs 220 booklets.

The booklets are in packs of 16.

How many packs must the teacher order?

A newspaper prints a graph predicting what the ages of teachers will be in 6 years time. It says that the total number of male teachers will be about the same as the total number of female teachers.



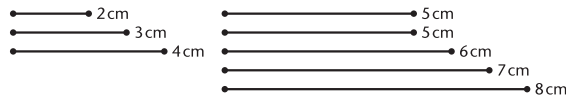
Asif says: 'Generally, male teachers will tend to be younger than female teachers.'

Is he correct? Circle YES or NO.

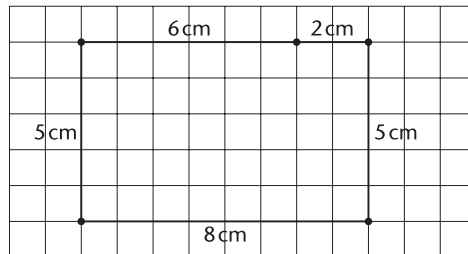
Explain how you know.

1.4 Use logical reasoning to establish the truth of a statement.

Huda has these eight rods.



She can use five of her rods to make a rectangle.



Huda can make a square with all eight of her rods.

Show how she can do this.

1.5 Make general statements using words and symbols.

P stands for a multiple of 3.

Q stands for a different multiple of 3.

Tick (✓) each statement to show whether it is always true, sometimes true or never true.

	always true	sometimes true	never true
The sum of P and Q is a multiple of 6.			
The difference between P and Q is a multiple of 3.			
The product of P and Q is a multiple of 9.			

Number and algebra

By the end of Grade 7, students calculate accurately with whole numbers, decimals, fractions and percentages using mental, written and calculator methods. They solve a range of routine and non-routine problems. They estimate and round answers, checking results to see if they are reasonable. They know the order of operations and use brackets appropriately. They find positive and negative square roots and order, add, subtract, multiply and divide positive and negative numbers, using the symbols $<$, \leq , $>$, \geq , $=$, \neq correctly. They calculate with fractions using the four operations, including combined operations for addition and subtraction. They know which number to consider as 100%, or a whole, in problems involving comparisons, and use this to evaluate one number as a fraction or percentage of another. They understand and use the equivalences between fractions, decimals and percentages, calculate using ratios, and use the unitary method to solve problems involving direct proportion. They describe mathematical situations by using words, symbols and diagrams. They express in symbolic form and use formulae involving up to two operations, simplify and evaluate linear expressions, and construct and solve linear equations with integer coefficients. They find the rule for the next term or the n th term in a linear sequence that relates to a spatial pattern. They use coordinates in all four quadrants to plot the graphs of simple linear functions.

Students should:

2 Calculate efficiently with whole numbers and decimals and apply these skills to solve problems

- 2.1** Use the symbols $<$, \leq , $>$, \geq , $=$, \neq correctly to compare numbers or expressions.

Explain why $8 < \sqrt{70} < 9$.

- 2.2** Round whole numbers to any given power of 10, and decimals, including measures, to the nearest whole number or given decimal place; use the approximation sign \approx .

Circle the number below that is closest in value to 0.1.

0.01 0.05 0.11 0.2 0.9

A family uses about 6000 litres of water per week.

Approximately how many litres of water do the family use each year?

A. 30 000 B. 240 000 C. 300 000 D. 2 400 000 E. 3 000 000

- 2.3** Multiply and divide integers and decimals by 0.1, 0.01, 0.001.

- 2.4** Use and explain mental methods to add, subtract, multiply and divide whole numbers and decimals in simple cases.

Circle the two numbers that add up to 1.

0.1 0.65 0.99 0.45 0.35

Calculate $15.05 - 14.84$.

Khalid knows that $137 \times 28 = 3836$.

Explain how he can use this information to work out 138×28 .

Use of ICT

Function graph plotters, graphics calculators and spreadsheets help to explore ideas in number and algebra.

Rounding

Include rounding answers to calculations.

2.5 Use and explain written column methods (algorithms) to:

- multiply by a decimal with up to two decimal places, understanding where to position the decimal point by considering equivalent fractions;
e.g. $0.13 \times 0.7 = 0.091$, since $\frac{13}{100} \times \frac{7}{10} = \frac{91}{1000}$
- divide by a decimal with up to two decimal places by transforming the calculation to one with an integer divisor.
e.g. $2.6 \div 0.14 = 260 \div 14$

2.6 Consolidate adding and subtracting decimals with up to three places.
e.g. calculate $2.201 - 0.75$.

2.7 Know the order of operations and work out the value of expressions containing more than two terms.

2.8 Use brackets to show which operation to perform first when writing expressions containing more than two terms.

2.9 Use a scientific calculator, including the memory, for calculations with whole numbers and decimals, including combined operations, working efficiently, interpreting the display and rounding answers in the context of the problem. (See also NA 4.7.)

Use a calculator to work out $49.3 \times (2.06 + 8.5)$.

What number goes in the box?

$$404.09 \div \square = 8.5$$

A shop sells sheets of sticky labels.

On each sheet there are 36 rows and 18 columns of labels.

How many labels are there altogether on 45 sheets?

2.10 Check answers for accuracy by using inverse operations.

2.11 Check answers for reasonableness by using an estimate based on approximations and by considering the context of the problem.

In a country there are sixty-six point eight million people.

51.5% of them are female.

How many females are there to the nearest million?

2.12 Round answers to calculations to a given degree of accuracy, or to a degree of accuracy appropriate to the context of the problem.

Every day a machine makes 100 000 paper clips which go into boxes.

A full box contains 120 paper clips.

How many boxes can be filled using 100 000 paper clips?

2.13 With and without a calculator, solve routine and non-routine problems involving whole numbers, decimals, money or measures.

Write the missing digits.

$$323 \times \square 7 = 15\ 18\square$$

In a discus throwing competition, the winning throw was 61.60 m long.

The second-place throw was 59.72 m long.

How much longer was the winning throw than the second-place throw?

A rubber ball rebounds to half the height it drops.

The ball is dropped from a rooftop 18 m above the ground.

What is the total distance travelled by the time the ball hits the ground the third time?

- A. 31.5 m B. 40.5 m C. 45 m D. 63 m

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Written column methods

The word *algorithm* is derived from the name of the mathematician Abu Ja'far Muhammad ibn Musa al-Khwarizmi, c. 780–850.

Calculations

Exclude tedious calculations when use of a calculator is not allowed.

Problems

Include combined operations.

3 Calculate with positive and negative numbers and evaluate powers and roots

3.1 Represent, compare and order positive and negative numbers using words and models, including a number line.

3.2 Add, subtract, multiply and divide positive and negative numbers and solve problems involving them.

Sharifa makes a sequence of numbers starting with 100. She subtracts 45 each time.

Write the next two numbers in the sequence.

100 55 10 □ □

Using negative numbers only, fill in the missing numbers in the boxes.

$$\square - \square = 5$$

$$\square - \square = -5$$

3.3 Evaluate mentally positive integer powers of whole numbers, and positive and negative square roots of perfect squares to 144; use the square root sign $\sqrt{\quad}$; establish upper and lower bounds for square roots of numbers to 100.

Look at the numbers below. Which is the largest? Which is equal to 9^2 ?

1^6 2^5 3^4 4^3 5^2 6^1

If $\sqrt{81} < n < \sqrt{144}$, then n could be which of the following numbers?

A. 9 B. 11 C. 12 D. 13

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3.4 Use the x^2 , \sqrt{x} and x^y keys of a scientific calculator.

4 Calculate with fractions and use them to solve problems

4.1 Convert terminating decimals to fractions, expressing them in their simplest form.

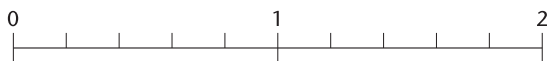
Write 0.28 as a fraction reduced to its lowest terms.

4.2 Convert fractions to decimals, using division or a scientific calculator, and represent them on a number line.

4.3 Order fractions by creating a common denominator or by converting them to decimals.

4.4 Relate operations with fractions to situations and models (e.g. relate the multiplication of one fraction by another to rectangular areas).

Add $\frac{6}{10}$ and $\frac{6}{5}$. Use an arrow (\downarrow) to show the result on the number line.



4.5 Use mental methods to find a fraction of a number or quantity, and to compare, add, subtract, multiply and divide proper fractions in simple cases.

4.6 Use written methods to add, subtract, multiply and divide mixed numbers, including combined operations for addition and subtraction.

Calculate $\frac{8}{35} \div \frac{4}{15}$.

4.7 Use the fraction key on a scientific calculator to calculate with fractions.

4.8 Solve problems involving the use of fractions in a range of contexts.

Positive and negative numbers

Include mental calculations.

Powers and roots

Exclude laws of indices.

Converting decimals to fractions

Exclude recurring decimals.

Scientific calculator

See also NA 2.9.

5 Calculate percentages and use them to solve problems

- 5.1 Find fraction, decimal and percentage equivalents.
- 5.2 Estimate and calculate a given percentage of a quantity.
- 5.3 Express one quantity as a percentage of another.
- 5.4 Find the whole, given a percentage part.

40% of a class of students own a bicycle.

If 16 students own a bicycle, how many students are there in the class?

- 5.5 Calculate the outcome of a percentage increase or decrease, and find a percentage profit or loss, given the cost price and selling price.

A small bottle of fruit juice holds 450 ml.

A large bottle of fruit juice holds 35% more than the small bottle.

How much fruit juice will the large bottle hold?

- 5.6 Use mental methods to work out calculations of percentages in simple cases.
- 5.7 Solve routine and non-routine problems involving percentages, including with a calculator.

6 Use ratios and proportions to solve problems

- 6.1 Relate ratios to fractions; given a ratio:

- express one value as a fraction of another;
- state how many times larger one value is than another.

What is the ratio of the side of a square to its perimeter?

A. $\frac{1}{1}$ B. $\frac{1}{2}$ C. $\frac{1}{3}$ D. $\frac{1}{4}$

- 6.2 Identify and find equivalent ratios and reduce a ratio to its lowest terms.
- 6.3 Divide a quantity in a given ratio to show the relative sizes of two or more quantities.
- 6.4 Find the ratio of two or more quantities.

2½ cartons of apple juice and 1½ cartons of orange juice are poured into a big jug.

What is the ratio of apple juice to orange juice in the jug?

- 6.5 Compare two ratios.

Fruit drink A is made from 1 part orange juice and 9 parts pineapple juice.

Fruit drink B is made from 1 part orange juice and 4 parts pineapple juice.

Which has more orange juice, 1 litre of fruit drink A or 1 litre of fruit drink B?

- 6.6 Solve problems involving ratios.

Class 7 has 12- and 13-year-old students.

There are 28 students in the class.

The ratio of 13-year-old students to 12-year-old students is 4 : 3.

How many 13-year-old students are in the class?

Purple paint is made by mixing 3 parts of blue paint and 2 parts of red paint.

For 25 litres of purple paint, how many litres of blue paint do you need?

- 6.7 Use the unitary method to solve problems involving direct proportion.

Assume that one British pound (£) is worth QR 4.50.

In London, a magazine costs £3.50.

In Doha, the same magazine costs QR 15.50.

In which city is the magazine cheaper, London or Doha?

Problems

Include sales discount, sales tax, service charge. Discuss Islamic alms.

Ratios and fractions

Include writing $x : y = a : b$

as $\frac{x}{y} = \frac{a}{b}$.

Direct proportion

Include currency conversions, and scales.

Here is a recipe for strawberry ice cream for 8 people.

0.5 litre cream
1 kg strawberries
250 g sugar

Faraj makes enough strawberry ice cream for 12 people.

How much cream does he use?

Najib makes strawberry ice cream using 2.5 kg strawberries.

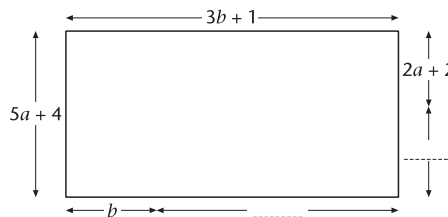
How much sugar does he use?

7 Write, simplify and evaluate linear expressions and solve linear equations

7.1 Write simple linear expressions and formulae to model a situation.

Write an expression for each missing length in this rectangle.

Write each expression as simply as possible.



7.2 Simplify algebraic expressions with one or two variables by collecting like terms and multiplying a single term over a bracket.

m represents a positive number.

Which of these is equivalent to $m + m + m + m$?

A. $m + 4$ B. $4m$ C. m^4 D. $4(m + 1)$

Write each expression in its simplest form.

$$7 + 2t + 3t$$

$$b + 7 + 2b + 10$$

$$(3d + 5) + 4(d - 2)$$

$$3m - (-m)$$

7.3 Evaluate formulae and linear expressions by substituting integers for letters and using the correct order of operations.

n stands for a number.

Complete this table of values.

n	$5n - 2$
20	
	38

$p = qr$. If $p = 12$, and $q = 3$, then r is equal to:

A. $\frac{3}{4}$ B. 3 C. 4 D. 12 E. 36

7.4 Solve linear equations or inequalities with integer coefficients (unknown on one or both sides, including brackets), and verify the solution.

Find y if $2(y - 3) = 16$.

Find x if $10x - 15 = 5x - 10$.

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7.5 Solve problems by writing and solving linear equations.

The perimeter of a rectangular swimming pool is 116 metres.

The length of the swimming pool is 22 metres longer than the width.

What is the width of the swimming pool?

Ali thinks of a number. He says: 'Multiplying my number by 2 and then adding 5 gives the same answer as subtracting my number from 23.'

What is Ali's number?

Algebra

The book *Hisab al-jabr w'al-muqabala* is the most famous of al-Khwarizmi's works. The word *algebra* is derived from the title. The book is about 'what is easiest and most useful in arithmetic, such as men constantly require in cases of inheritance, legacies, partition, lawsuits, and trade, and in all their dealings with one another, or where the measuring of lands, the digging of canals, geometrical computations, and other objects are concerned'. The section on algebra was the first of its kind, although the algebra was done entirely in words with no symbols used.

Linear equations

Include the forms

$$ax = b + cx + d$$

$$a(x + b) = c$$

$$ax + b = cx + d$$

Include solving a linear equation by inverse operations, and by transforming both sides in the same way.

8 Generate sequences and plot graphs of functions

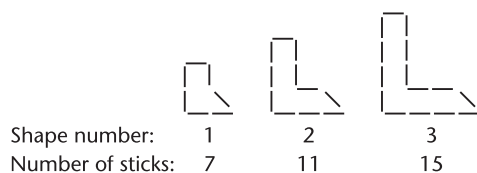
- 8.1** Extend and find missing terms in numeric or geometric patterns or sequences using words, diagrams or symbols (term-to-term or position-to-term rules).

*Some number chains start like this: $1 \rightarrow 5 \rightarrow$
Show three different ways to continue this number chain.
For each of your chains, write down the next three numbers.
Then write down the rule you are using.*

- 8.2** Use the [ANS] and [ENTER] keys on a graphics calculator to generate term-to-term and position-to-term sequences.

- 8.3** Generalise the relationship between one term of a sequence and the next, or between the number of the term and the term, using words or symbols.

Here is a pattern of L-shapes made with sticks.



The rule is: 'Find the number of sticks for a shape by first multiplying the shape number by 4, then adding 3.'

Work out the number of sticks for the shape that has shape number 10.

Aisha uses 59 sticks to make an L-shape in this pattern.

What is its shape number?

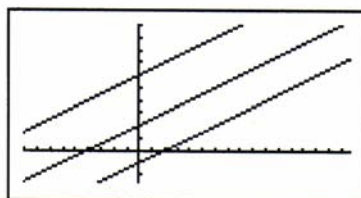
Write a formula to work out the number of sticks for any L-shape.

Use S for the number of sticks and N for the shape number.

Explain why the number of sticks for a shape increases by 4 from one shape to the next.

- 8.4** Use coordinates in all four quadrants to plot graphs of $y = mx + c$, on paper and using ICT.

Suggest possible equations for these straight line graphs.



- 8.5** Use a straight line graph to estimate the value of y given the value of x , and vice versa; identify intercepts on axes.

Does the point (25, 75) lie on the straight line $y = 3x$? Explain how you know.

The straight line $y = 4x + 2$ crosses the y -axis at point A and the x -axis at point B.

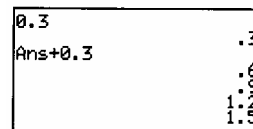
Write the coordinates of each of the points A and B.

Sequences

Include the sequence of square numbers, and powers of 2 and 10.

ICT opportunity

Investigate patterns using a spreadsheet or a graphics calculator.



ICT opportunity

Use graph plotting software or a graphics calculator.

Geometry and measures

By the end of Grade 7, students identify alternate, supplementary and corresponding angles and know angle properties related to diagonals of squares, rectangles, parallelograms and rhombuses. They use these and other properties to find the values of unknown angles in geometric figures. They use a ruler and compasses to construct angle bisectors and perpendicular bisectors and, together with a protractor, to construct simple geometric figures from given data. They identify and describe properties of solid shapes, and recognise their nets. They use a range of measurements, including rate and speed, to solve problems. They choose suitable units to make estimates of measurements. They find the area of trapeziums and other rectilinear figures. They know common estimates for π and apply formulae to estimate the circumference and area of a circle.

Students should:

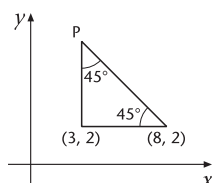
9 Identify properties of and relationships in geometric shapes

Angles, shapes and geometric reasoning

9.1 Identify, sketch, label and describe angle, side, diagonal and symmetry properties of plane shapes:

- triangles (isosceles, equilateral, right-angled, acute- and obtuse-angled scalene triangle);
- quadrilaterals (square, rectangle, parallelogram, rhombus, trapezium, kite);
- polygons (pentagon, hexagon, octagon, decagon).

What are the coordinates of vertex P?



A quadrilateral must be a parallelogram if it has:

- A. one pair of adjacent sides equal
- B. one pair of parallel sides
- C. a diagonal as an axis of symmetry
- D. two adjacent angles equal
- E. two pairs of parallel sides

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9.2 Calculate unknown angles in geometric figures, involving:

- angles in a straight line, around a point or vertically opposite angles;
- corresponding, alternate and supplementary angles;
- side or angle properties of isosceles, equilateral, right-angled and scalene triangles, including the angle sum and exterior angle properties;
- angle properties of squares, rectangles, parallelograms and rhombuses, including angle properties related to their diagonals;
- angle bisectors and perpendicular bisectors.

Use of ICT

Geometry is enhanced with use of a dynamic geometry system, or DGS, which provides an interactive means for investigating results that can then be shown to be true.

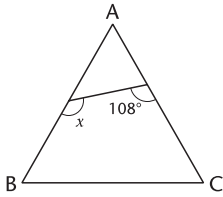
Plane shapes

Include these terms: *plane; acute, obtuse, reflex, base angles; interior, exterior angles; vertex/vertices, diagonal, perpendicular, parallel, hypotenuse, bisector; regular/irregular polygon.*

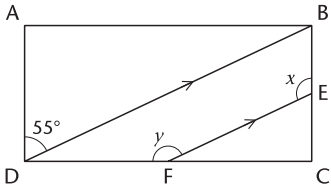
Unknown angles

Exclude the need for extra construction lines.

Triangle ABC is equilateral. Calculate the size of angle x.

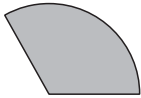


The shape ABCD is a rectangle. BD is parallel to EF. Calculate the sizes of the angles x and y.

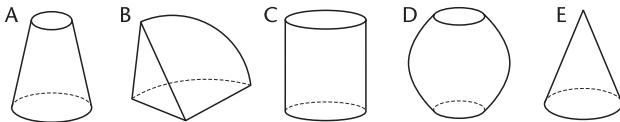


- 9.3** Identify solid shapes and describe their properties, including planes of symmetry; identify and sketch the nets of cubes, cuboids, prisms, pyramids and cones.

I cut a sector from a paper circle.



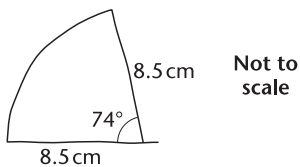
I join the two radii to make a 3-D shape. Which of the 3-D shapes below do I make?



Constructions

- 9.4** Use a ruler, set square, protractor and compasses to:
- measure and draw line segments and angles;
 - draw parallel and perpendicular lines;
 - construct rectangles of given dimensions;
 - draw circles and arcs, and use circles and arcs to construct Islamic patterns;
 - construct angle bisectors and perpendicular bisectors;
 - construct simple geometric figures from given data.

Here is a rough sketch of a sector of a circle.



Make an accurate full-size drawing of this sector.

- 9.5** Use ICT to generate and explore constructions.

3-D shapes

Include cubes, cuboids, prisms, cylinders, pyramids, cones and spheres.

Construction of figures

Include constructing triangles given three sides, or given a right angle, hypotenuse and side.

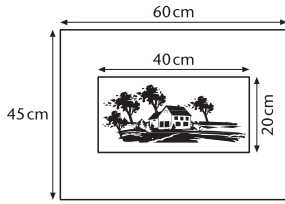
Using ICT

Use a dynamic geometry system (DGS).

10 Use a range of measures, including rate and speed, to solve problems

10.1 Calculate the area of triangles, rectangles, parallelograms, trapeziums and related shapes.

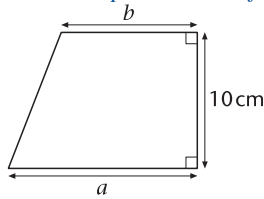
A rectangular picture is pasted on a sheet of white paper as shown.



What is the area of the white paper not covered by the picture?

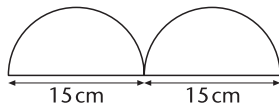
This trapezium has an area of 20 cm^2 .

Give three possible sets of values of a and b .



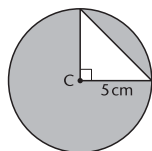
10.2 Name the parts of a circle; know common estimates for π , and formulae for the circumference and area of a circle, and use these to estimate the circumference and area of circles; use a calculator and the π key to work out decimal equivalents to appropriate degrees of accuracy.

This shape is made from wire. Each semicircle has a diameter of 15 cm.



Calculate the total length of the wire.

The diagram shows a right-angled triangle inside a circle of radius 5 centimetres.



Calculate the area of the shaded part of the diagram.

10.3 Estimate length, circumference/perimeter, area, volume, capacity, mass, time and angle in problem situations, choosing suitable units.

Which of these is closest to the mass of a hen's egg?

- A. 5g B. 50g C. 250g D. 500g

10.4 Understand and use measures of rate; solve problems involving calculating an average rate.

A person's heart beats 72 times per minute.

At this rate, about how many times does it beat in an hour?

- A. 420 000 B. 42 000 C. 4200 D. 420

TIMSS Grade 8

Circles

Include the terms *centre, circumference, radius, diameter, arc, sector, segment, chord, semicircle*.

Include giving the area or circumference in terms of π , e.g. area = $49\pi \text{ cm}^2$, and:

- the use of approximations such as $\pi \approx 3$, or $\pi \approx \frac{22}{7}$ to give estimates, e.g. area $\approx 150 \text{ cm}^2$;
- the use of the π key on a scientific calculator to work out decimal equivalents.

Rate and speed

Link to work in science.

- 10.5** Know that average speed = distance/time; solve problems involving calculating average speed, distance or time.

*Majed drove 55 km from Doha to Al Khor.
The journey took 75 minutes.
What was his average speed?*

*A goods train travels 300 km at an average speed of 40 km/h.
For how many hours does the train travel?*

*A truck travels for $2\frac{1}{2}$ hours at an average speed of 36 km/h.
How far does the truck travel?*

Average speed

Include distance–time graphs.

Data handling

By the end of Grade 7, students answer questions by constructing, analysing and drawing conclusions from tables, pictograms, bar charts and line graphs drawn on paper or generated using ICT. They interpret pie charts. They compare different representations of the same set of data. They understand and use the probability scale from 0 to 1, and find probabilities of single events in simple contexts. They know that the total probability of all mutually exclusive outcomes is 1 and use this to solve problems.

Students should:

11 Collect, process, represent and interpret data and draw conclusions

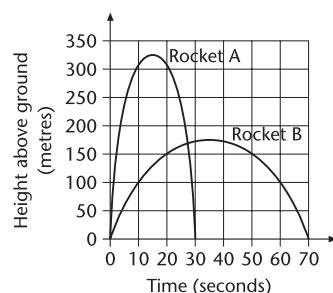
Statistics

- 11.1** Answer questions by collecting and classifying data, and constructing and interpreting:

- tables,
- bar charts and pictograms,
- line graphs,
- pie charts,

on paper and using ICT.

This graph shows how high two rockets go during their flight.



Estimate:

- how much higher rocket A reaches than rocket B;*
- the time after the start when the two rockets are at the same height;*
- how long rocket A was more than 200 m above the ground.*

Data handling and ICT

Data handling provides many opportunities to use spreadsheets and graph drawing packages to present tables, charts and graphs. The Internet is an excellent source of real data of interest to students.

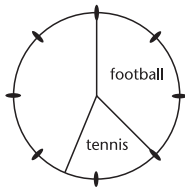
Graphs and charts

Exclude the construction of pie charts requiring calculation of angles.

Include both horizontal and vertical formats for pictograms and bar charts.

80 people were asked which sport they liked best.
 30 liked football.
 25 liked swimming.
 10 liked horse riding.
 15 liked tennis.

Complete the pie chart to show this information.



11.2 Compare different representations of the same set of data and determine which are the most useful for a given purpose.

11.3 Calculate the mean of a small set of data; find the mode, median and range; distinguish between the purposes for which these are used.

Sara has three number cards.
 The mode of the three numbers is 5.
 The mean of the three numbers is 8.
 What are the three numbers?

Ali played three games in a competition.
 His mean score was 3 points.
 His range was 4 points.
 What points might Ali have scored in his three games?

Which two numbers have a mean of 10 and a range of 8?

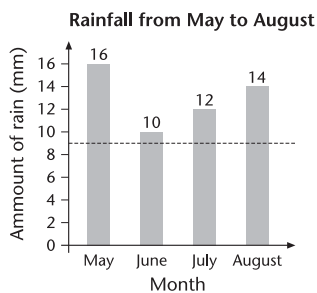
There are four people in Sharifa's family.
 Their shoe sizes are 4, 5, 7 and 10.
 What is the median shoe size in Sharifa's family?

The median of these five numbers is 12.

5 5 12 13 20

Write a set of four numbers that has a median of 12.

Here is a bar chart showing rainfall in New York.



There is a dotted line on the bar chart.
 Explain why it cannot show the mean rainfall for the four months.

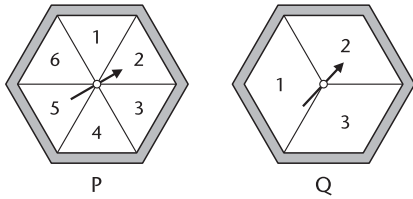
ICT opportunity

Compare representations using a spreadsheet and graph drawing package.

Probability

- 11.4** Judge the likelihood of an event as certain, more likely, equally likely, less likely, or impossible.

Here are two spinners, P and Q. Each one is a regular hexagon.

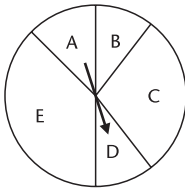


For each statement, put a tick (✓) if it is true or a cross (✗) if it is not true.

- Scoring 1 is more likely on P than on Q.
- Scoring 2 is more likely on P than on Q.
- Scoring 3 is as equally likely on P as on Q.

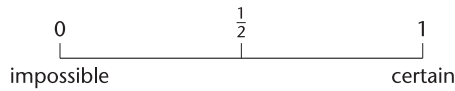
- 11.5** Use the probability scale, and represent probability as a fraction, proportion, decimal or percentage.

Here is a spinner.



Estimate the probability that the arrow stops in sector E.

Show this probability by putting a cross (✗) on the probability scale below.



- 11.6** Know that the total probability of all mutually exclusive outcomes is 1, and use this to solve problems.

In a box of potato chips there are cheese, chicken and plain packets.

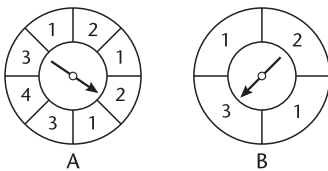
The probability of picking a chicken packet is 7 out of 10.

The probability of picking a cheese packet is 1 out of 5.

What is the probability of picking a plain packet?

- 11.7** Solve simple problems based on equally likely outcomes for a single event.

Here are two spinners. Each outcome on each spinner is equally likely.



What is the probability of spinning a 4 on spinner A?

Write your answer as a fraction.

On which spinner is it more likely to get a 1?

Give a reason for your answer.