



Level 2 Functional Skills in Mathematics

Teaching Guidance
Version 1.1 - November 2024



Our specification is published on our website (www.tquk.org). We will let centres know in writing about any changes to the specification. We will also publish changes on our website. The definitive version of our specification will always be the one on our website, this may differ from printed versions.

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General Information - Disclaimer

This **Teaching Guidance** will help you plan by providing **Examples** of the content of the specification.

It is not, in any way, intended to restrict what can be assessed in the question papers based on the specification.

Contexts

UPS questions at Level 2 will normally have no context or a very limited but familiar context and will require minimal reading demand.

Each problem-solving question will involve, as far as is reasonably possible, a familiar but realistic problem based on an equally familiar topic.

Assumed knowledge

Functional Skills Level 2 assumes all the knowledge from Functional Skills Level 1.

Command words

The following command words are the ones we will generally use. For specific purposes we may use other command words.

- **Work out:** this will be the usual instruction when one or more calculations are required to get to the required answer.
- **Calculate:** this will be used when the learner is expected to use a calculator to carry out a given calculation.

Questions may also include the commands:

- **Show how you decide:** When the question requires the learner to make a decision e.g. Is Alex correct? Which Shop is the Cheapest. Show how you decide means, for example, if Alex is correct and answer of just “Yes” would not achieve any marks without supported working.
Show your working: A correct answer with no working would not achieve full marks. Working needs to be seen.

1

Using numbers and the number system

Level 2 - using numbers and the number system – *whole numbers, fractions, decimals and percentages*

In this area (identified as UN in our materials), the Department for Education's guidance¹ expects learners at Level 2 to:

- are expected to be able to use numbers of any size
- read, write and make use of positive and negative integers of any size
- use, order and compare integers, fractions, decimals, percentages and ratios as well as recognise the value of a digit in any whole or decimal number
- use numerical and spatial patterns for a purpose and calculate with, and convert between, numbers written as fractions, decimals, percentages and ratios.

UN1

Read, write, order and compare positive and negative numbers of any size

Teaching Guidance

Learners should be able to:

- read a positive number value in number form and write it in words
- read a positive value in word form and write it in number form
- compare numbers and know which is the smallest or largest
- order a list of numbers
- compare and interpret numbers in context.

[GCE Link – N1](#)

Notes

This section deals with number values only.

Numbers used in contexts are likely to be less than one million, as numbers greater than one million cannot be used in calculations.

¹ Department for Education Subject content functional skills: mathematics, published February 2018

Examples

- 1 Write three billion in numbers.
- 2 Write 13 000 000 000 in words.
- 3 Put these numbers in order starting with the lowest:
1 025 600 -102 560 -85 956 1 102 560
- 4 Write 3 806 265 in words.
- 5 Put these numbers in order starting with the lowest:
-102 498 1 200 956 1 204 812 -82 548 1 024 812
- 6 Put these numbers in order starting with the lowest:
-865 -811 -820 -814

UN2

Carry out calculations with numbers up to one million including strategies to check answers including estimation and approximation

Teaching Guidance

Learners should be able to:

- add, subtract or multiply numbers up to one million with or without a calculator
- divide a number up to one million by another number up to one million with or without a calculator
- round numbers to the nearest 5, 10, 50, 100, 500, 1000 etc
- estimate a solution by using rounded values
- check that a given solution is sensible by using rounded values.

Examples

- 1 Work out $205\,983 + 826\,148$
- 2 Round 39.4528 to the nearest whole number.
Use your rounded number to **estimate** the answer to 39.4528×2
Show your working.
- 3 Round 2.1457 to one decimal place.
Use your rounded value to **estimate** the answer to $50\,000 \times 2.1457$.
Show your working.
- 4 Round the numbers in the calculation below to check the answer.

$$\begin{array}{r} 24.75 \\ 75.198 \end{array} \times 100 = 32.9131\dots$$
Show your working.

UN3

Evaluate expressions and make substitutions in given formulae in words and symbols

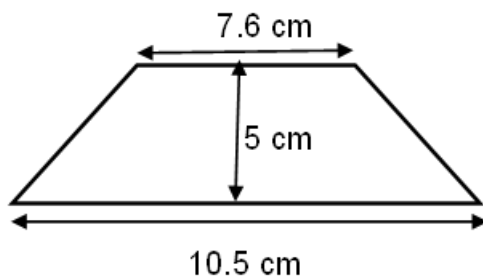
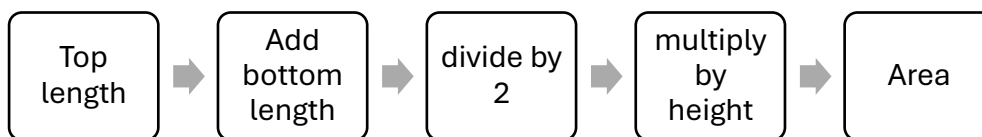
Teaching Guidance

Learners should be able to:

- substitute values into an algebraic expression
- use formulae given as a series of instructions in words
- use algebraic formulae.

Examples

- 1 Use this formula to work out the area of the shape shown below:



- 2 Use this formula to convert 60° Fahrenheit (°F) into degrees Celsius (°C).

$$C = \frac{5(F - 32)}{9}$$

Where:

C = temperature in Celsius (°C)

F = temperature in Fahrenheit (°F)

UN4

Identify and know the equivalence between fractions, decimals and percentages

Teaching Guidance

Learners should be able to:

- convert between fractions, decimals and percentages
- use a decimal multiplier when working out a percentage of an amount
- use a decimal multiplier when increasing an amount by a percentage
- use a decimal multiplier when decreasing an amount by a percentage.

Examples

1 Harper wants to go on holiday.

Harper finds two offers for the same holiday on different websites:

Website A

38% off

Website B

$\frac{3}{8}$ off

Which offer gives the bigger discount?

Show how you decide.

2 Write this fraction:

$$\frac{29}{40}$$

a) as a decimal

b) as a percentage.

- 3 Keegan wants to buy a new fridge.

They see these two offers online:

<p>Fridge A</p> <p>$\frac{1}{8}$ off original price</p>
--

<p>Fridge B</p> <p>18% off original price</p>

Both fridges have the same original price.

Keegan wants to buy the cheaper fridge.

Which fridge should Keegan buy?

Show how you decide.

- 4 Write 0.86:

a) as a fraction

b) as a percentage.

UN5**Work out percentages of amounts and express one amount as a percentage of another****Teaching Guidance**

Learners should be able to:

- work out any percentage of an amount with or without a calculator
- express one amount as a percentage of another.

Examples

- 1 Lee wants to buy a new computer for £1390
If Lee uses a payment plan, the price of the computer increases by 12.5%
How much money will Lee pay in total for the computer using the payment plan?
- 2 140 people were asked if they could speak a second language.
126 people said yes.
What percentage of the total number of people said yes?
- 3 A sports company sells red and blue tennis rackets.
343 980 customers bought tennis rackets last year in total.
51 597 of these customers bought red tennis rackets.
What percentage of customers bought blue tennis rackets?
- 4 Jordan goes out for lunch.
The bill comes to £20
Jordan wants to leave extra money as a tip.
The extra money is 18% more than the bill.
What is the total amount that Jordan will pay?

UN6

Calculate percentage change (any size increase and decrease), and original value after percentage change

Teaching Guidance

Learners should be able to:

- express an increase or decrease in an amount as a percentage of that amount
- work out an original amount given the new amount and the percentage increase or decrease.

Examples

- 1 3480 people visited a museum in July.

5150 people visited the same museum in August.

Calculate the percentage change in the number of people from July to August.

- 2 Taylor books a holiday.

The next day, their friend books the same holiday for £690 **after** receiving a 4% discount.

How much more did Taylor pay for the holiday?

- 3 Alex bought a car for £5000 and later sold the car for £3400.

Work out the percentage decrease in the value of the car.

- 4 Kim buys a laptop in a sale for £348.50 after receiving an 18% discount.

Work out the original cost of the laptop.

UN7

Order, add, subtract and compare amounts or quantities using proper and improper fractions and mixed numbers

Teaching Guidance

Learners should be able to:

- convert between improper fractions and mixed numbers
- add or subtract fractions and mixed numbers
- order a list of proper fractions and/or improper fractions and/or mixed numbers.

Examples

1 Put these fractions in order starting with the lowest:

$$\frac{6}{7} \quad \frac{6}{5} \quad \frac{8}{7} \quad \frac{36}{35}$$

2 Work out:

$$\frac{3}{20} + \frac{17}{15}$$

Give your answer as an improper fraction.

3 Work out:

$$5\frac{1}{3} + 4\frac{1}{5}$$

Give your answer as a mixed number.

- 4 Taylor buys a piece of wood to make a photo frame.

Taylor uses:

- $\frac{2}{3}$ of the wood for one part of the frame
- $\frac{1}{5}$ of the wood for another part.

What fraction of the wood is left over?

- 5 A company gives its staff 6 pizzas to share.

Each pizza is cut into 8 slices.

On the first day, the staff eat 3 whole pizzas and 5 additional slices.

On the next day, they eat another 10 slices of pizza.

How much pizza is left after the second day?

Give your answer as a mixed number.

UN8

Express one number as a fraction of another

Teaching Guidance

Learners should be able to:

- write one number as a fraction of another
- write one number as a fraction of another in its simplest form.

Notes

We would not expect students to express one number as a fraction of another when the fraction was greater than 1

Examples

- 1 At football training, a footballer has 56 shots at goal and scores 42 times.

The football coach thinks that the footballer scored $\frac{7}{8}$ of the shots.

Has the coach worked out the correct fraction?

Show how you decide.

- 2 Chen sells cakes.

The table below shows the ingredients in one cake:

Ingredient	Grams
Flour	275
Sugar	200
Baking powder	5

A customer wants to know what fraction of the cake sugar is.

Chen tells the customer $\frac{7}{12}$

Is this correct?

Show how you decide.

- 3 Work out 12 as a fraction of 60
- Give your answer in its simplest form.

UN9**Order, approximate and compare decimals****Teaching Guidance**

Learners should be able to:

- order a list of decimals to any number of decimal places
- approximate a decimal so that it can be used to estimate an answer to a calculation
- Round a decimal of 4 decimal places or more to either 3dp, 2dp, 1dp or a whole number.
- compare the proximity of two or more decimal values to another value.
- know that in context some answers need to be rounded up and some need to be truncated (for example, if 4.2125 buses are needed, the answer is that 5 buses are needed).

Examples

- 1 Put these numbers in order starting with the lowest:

0.77 0.701 0.72 0.707 0.077

- 2 Put these numbers in order starting with the lowest / highest.

0.149 0.24 0.3243 0.4

UN10**Add, subtract, multiply and divide decimals up to three decimal places****Teaching Guidance**

Learners should be able to:

- add or subtract decimals up to 3 decimal places without a calculator
- multiply or divide decimals up to 3 decimal places without a calculator

Notes

Decimals up to 2 decimal places are covered in Level 1. In such cases, at least one decimal must be to 3 decimal places.

Examples

- 1 Work out 2.5×3.462
- 2 Charlie buys a length of wood equal to 3.6 metres (m).
Charlie cuts off a length of 1.125 metres (m).
Work out how much wood Charlie has left.
Give your answer in metres (m).
- 3 Work out $9.028 - 0.17$
- 4 Work out $24.108 \div 4$
- 5 Work out $1.324 + 2.206 + 14.75$
- 6 Work out $0.238 + 0.05$
- 7 Work out 4.002×3.5
- 8 Work out 0.8×0.222
- 9 Work out 4.002×3.5
- 10 Work out $0.872 + 0.15$
- 11 Work out 2.205×4

UN11

Understand and calculate using ratios, direct proportion and inverse proportion

Teaching Guidance

Learners should be able to:

- divide a value in ratio (with up to three parts)
- given a ratio and one value, work out the other value and/or the total
- use direct proportion numerically to solve problems
- use proportion to solve best buy problems
- use inverse proportion numerically to solve problems.

Notes

We will only expect students to answer proportion questions numerically. We will not expect students to write or interpret proportion equations. We could, of course, present such an equation as a formula to be used as we could any other formula.

Examples

- 1 Harrison needs their new house to be painted within 8 days.

3 painters will take 5 days to paint the house.

Unfortunately, one painter is unavailable.

Will 2 painters be able to paint the house in time?

Show how you decide.

- 2 Some friends are planning a hike.

The total distance of the hike is 105 kilometres (km).

The hiking route is divided into Sections A, B and C in the ratio 3 : 7 : 11

One friend thinks that Section B is 40 kilometres (km) longer than Section A.

Is this correct? **Show how you decide.**

- 3 Ali is painting a room sea green.

Sea green is made from mixing blue paint and yellow paint in the ratio 5 : 2

The area to be painted is 65.8 m²

Both blue and yellow paint are sold in 1 litre tins.

A litre of paint covers 12 m^2

How many tins of each colour paint will Ali need to buy?

Show your working.

- 4 Hayden is organising activities for 80 students going on a school trip.

The ratio of the number of students who can participate in swimming, rock climbing and go karting is 5 : 3 : 2

Complete the activity list for Hayden.

Activity	Number of Students
Swimming	
Rock climbing	
Go karting	
Total	

- 5 Charlie recently used 14 litres of paint to decorate the living room walls.

The total area painted was 91 m^2

Charlie now wants to paint the bedroom walls.

The total area to be painted is 78 m^2

Charlie has 11 litres of paint.

Does Charlie have enough paint?

Show how you decide.

UN12**Follow the order of precedence of operators, including indices****Teaching Guidance**

Learners should be able to:

- apply order of precedence (sometimes called BIDMAS or BODMAS) to a set of calculations
- enter a given calculation into a calculator using the correct functions.

Notes

When a division is part of a calculation, we may use the divide symbol or we may use fraction notation.

Examples

1 Work out $7^2 + 6 \times 5$

2 Work out:

$$\left(\frac{25 + 5 \times 3}{10^2} \right)$$

Give your answer as a decimal.

3 Work out $10^2 - 25 \times 4$

4 Calculate:

$$\frac{2.5^2 + 1.5^2}{2.5^2 - 1.5^2}$$

5 Calculate $12^2 - 3 \times 2.1$

6. Calculate $10^2 + 30 \div 5$

2

Use of measures, shape and space

Level 2 - use of measures, shape and space

In this area (identified as UCM in our materials), the Department for Education's guidance² expects learners at Level 2 to:

- be able to handle relationships between measurements of various kinds
- use angles and coordinates when involving position and direction
- make use of geometric properties in calculations with 2-D and 3-D shapes
- understand the relationships between them.

UCM13

Calculate amounts of money, compound interest, percentage increases, decreases and discounts including tax and simple budgeting

Teaching Guidance

Learners should be able to:

- calculate with amounts of money, giving answers in correct form
- calculate an amount after two or more periods of compound interest
- calculate the interest earned after two or more periods of compound interest
- calculate an amount after a percentage increase or decrease
- calculate with VAT
- calculate with income tax
- budget using income (including salary), expenditure and savings.

Notes

VAT and income tax will be given at the rate applied by the UK government.

Calculations with money are generally an Entry Level 1 skill, so questions including this will have to have a Level 2 aspect.

Students should know the difference between simple interest and compound interest, although questions will usually be set around compound interest.

² Department for Education Subject content functional skills: mathematics, published February 2018

Examples

- 1 Two years ago, Nicky paid £8000 into a new savings account.

The savings account paid 4% compound interest per year.

Nicky sees this car for sale:

<p>Car for sale £12 975</p>

All the money in the savings account will be used as a deposit towards the car.

The balance will be paid in 20 equal monthly instalments.

How much will each monthly instalment be?

- 2 Riley's annual salary is £32 000 before tax.

Riley knows that:

- £12 570 will be tax free
- 20% tax will be deducted from the amount above £12 570

How much will the annual salary be after tax has been deducted?

- 3 Harper paid £12 500 into a new savings account 2 years ago.

The savings account paid 3% compound interest per year.

Harper wants to buy a new car for £18 750

Harper puts all the money in the savings account towards the new car.

How much more money is needed to pay for the car?

- 4 Idris sees this mobile phone in a sale:

<p>Mobile phone Was £95.00 Now 12% off</p>

How much money will Idris save buying the phone in the sale?

- 5 Alex pays £435.50 rent each month.
Next month the rent is increasing by 2%.
How much will Alex's rent be next month?

Show your working.

- 6 The original price of an electric bike Quinn wants to buy is £2799
There is an 8% discount for a cash payment.
Quinn's bank will loan the discounted cash price.
The loan and any interest are paid back after 2 years.
The bank charges 4% per year compound interest.
How much will Quinn pay back to the bank in total?

Show your working.

UCM14

Convert between metric and imperial units of length, weight and capacity using **a)** a conversion factor and **b)** a conversion graph

Teaching Guidance

Learners should be able to:

- use a conversion factor given as a direct proportion, a ratio or a formula to convert between metric and imperial units
- use a conversion graph to convert between metric and imperial units.

Notes

Students are not expected to know any of the conversions between metric and imperial units. They will be given in the question if needed. However, it may be useful for them to be familiar with some basic conversions such as $2.5 \text{ cm} \approx 1 \text{ inch}$, $8 \text{ km} \approx 5 \text{ miles}$, $1 \text{ litre} \approx 1.76 \text{ pints}$, $4.5 \text{ litres} \approx 1 \text{ gallon}$, $1 \text{ kilogram} \approx 2.2 \text{ pounds}$.

Although most conversions are inexact we may present them as equalities with rounded values, e.g.
Use $1 \text{ pound} = 0.45 \text{ kilograms}$.

Examples

- 1** Sam needs 2.5 pounds (lbs) of flour to do some baking.

The shop sells flour in kilogram (kg) bags.

Sam buys a 2-kilogram bag of flour.

How much flour will Sam have left over?

Use $1 \text{ lb} = 0.454 \text{ kg}$

- 2** There are 2.54 centimetres (cm) in 1 inch.

How many inches are there in 127 cm?

UCM15

Calculate using compound measures including speed, density and rates of pay

Teaching Guidance

Learners should be able to:

- use any two of distance, time and speed to calculate the other
- use any two of mass, volume and density to calculate the other
- use any two of hourly rate, number of hours worked and total pay to work out the other
- understand and use compound units such as miles per hour (mph), kilograms per square metre (kg/m^2)
- understand compound and measures and units that they may be unfamiliar with, but which are given in the question, e.g. population density in people per square kilometre.

Notes

Other than speed, density and rates of pay an explanation of or formula for the compound measure will be given.

Units will not be given in the form using the index -1 , e.g. ms^{-1}

Although it may not be entirely functional, we may assume in questions that journeys are made at a constant speed.

Examples

- 1 The mass of a sphere is 1800 grams (g).

The volume of the sphere is 450 cm^3

Work out the density of the sphere.

- 2 Alex needs to know what time to leave home to get to a dentist appointment by 10:40 am.

Alex can cycle at an average speed of 12 miles per hour.

The dental surgery is 15 miles from Alex's house.

What is the **latest** time Alex can leave home to cycle to the appointment?

3 Alex has just been on a cruise:

- the cruise ship travelled 4320 miles
- it took 10 days of non-stop sailing.

Alex thinks the average speed of the cruise ship was 20 miles per hour.

Is Alex correct?

Show how you decide.

4 Remy drives 154 miles.

It takes 3 hours and 30 minutes.

Remy thinks their average speed was more than 40 miles per hour.

Is Remy correct?

Show how you decide.

5 A cyclist cycles 3 miles in 10 minutes.

What is the cyclist's average speed in miles per hour (mph)?

UCM16

Calculate perimeters and areas of 2-D shapes including triangles and circles and composite shapes including non-rectangular shapes (formulae given except for triangles and circles)

Teaching Guidance

Learners should be able to:

- work out the perimeter of a triangle
- work out the length of one side of a triangle given its perimeter and the other two sides
- remember and use the formula for the area of a triangle
- remember and use the formula for the circumference of a circle
- remember and use the formula for the area of a circle
- work out the perimeter of compound shapes that include at least one triangle and/or at least one circle or part of a circle
- work out the area of compound shapes that include at least one triangle and/or at least one circle or part of a circle
- use a formula to work out a perimeter or area.

Notes

The value to be used for pi will be given in the question.

Learners will not be expected to give answers in terms of pi, but in purely numerical form. Answers given in terms of pi are unlikely to score full marks.

Learners should understand that lengths may be given in questions which do not need to be used in the questions. They should be familiar with selecting the appropriate information.

In questions involving sectors of circles, the sector will be a fraction of the circle where the denominator of the fraction is a factor of 360.

Examples

- 1 The world's largest clockface is circular.

It has a radius of 21.5 m.

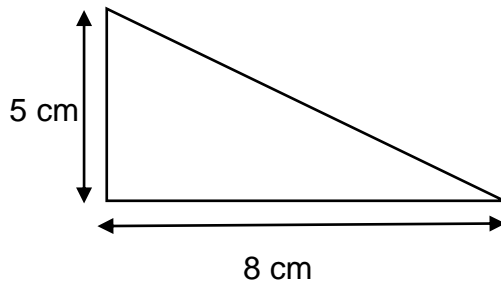
Calculate the circumference of the circle.

Use $\pi = 3.14$

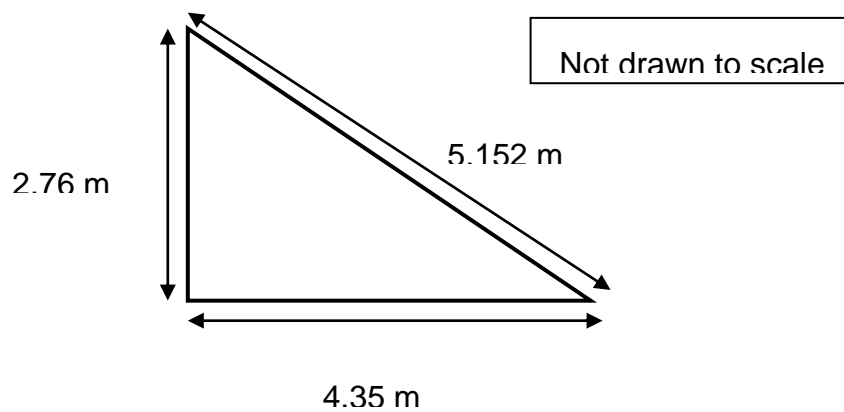
- 2 Work out the area of a circle with a diameter equal to 10 cm.

Use $\pi = 3.14$

- 3 Work out the area of this triangle:



- 4 Work out the perimeter of this triangle.



UCM17

Use formulae to find volumes and surface areas of 3-D shapes including cylinders (formulae to be given for 3-D shapes other than cylinders)

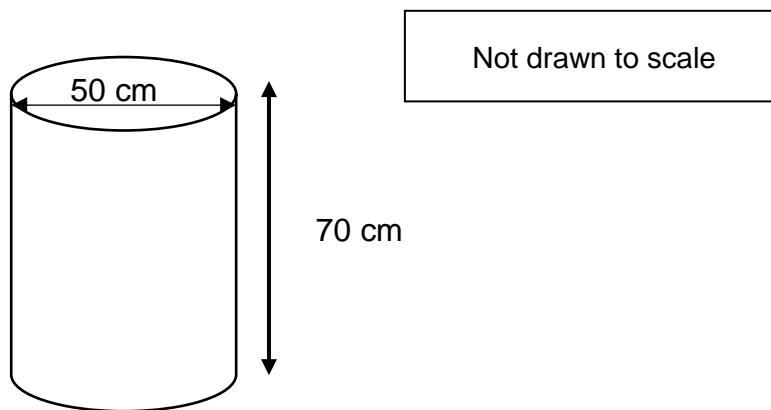
Teaching Guidance

Learners should be able to:

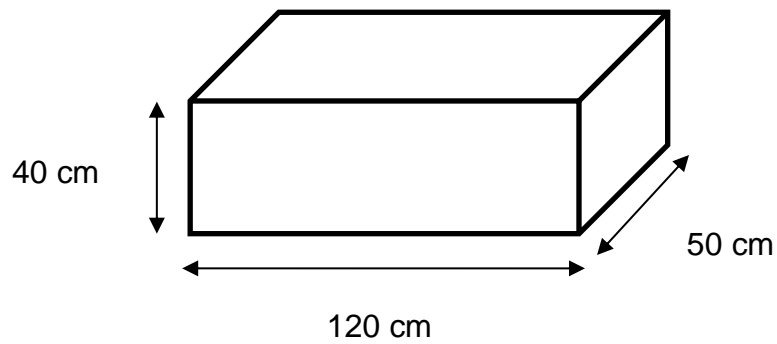
- remember and use the formula for the volume of a cylinder
- remember and use the formula for the surface area of a cylinder
- use a formula to work out a volume or surface area.

Examples

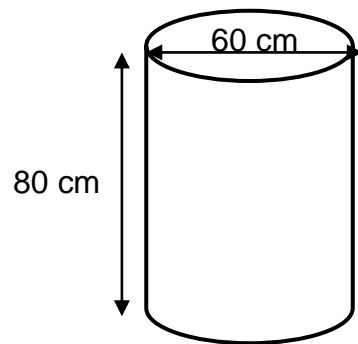
- 1 Work out the volume of this cylinder.



- 2 Work out the surface area of this cuboid:



- 3 Work out the surface area of this cylinder.



Not drawn to scale

UCM18

Calculate actual dimensions from scale drawings and create a scale drawing given actual measurements

Teaching Guidance

Learners should be able to:

- use a scale given as a ratio in the form $1 : n$
- measure a length on a scale diagram or map and use it to work out an actual length
- create a scale drawing given actual lengths and a scale
- understand the word 'plan' as an overhead view.

Notes

Learners are expected to have access to a ruler, protractor and pair of compasses during exams.

Examples

1 Leslie is planning a road trip.

The scale on the map is $1 : 75\,000$

The distance Leslie wants to travel represents 11 centimetres (cm) on the map.

Leslie calculates this to be 82.5 kilometres (km).

Is Leslie correct?

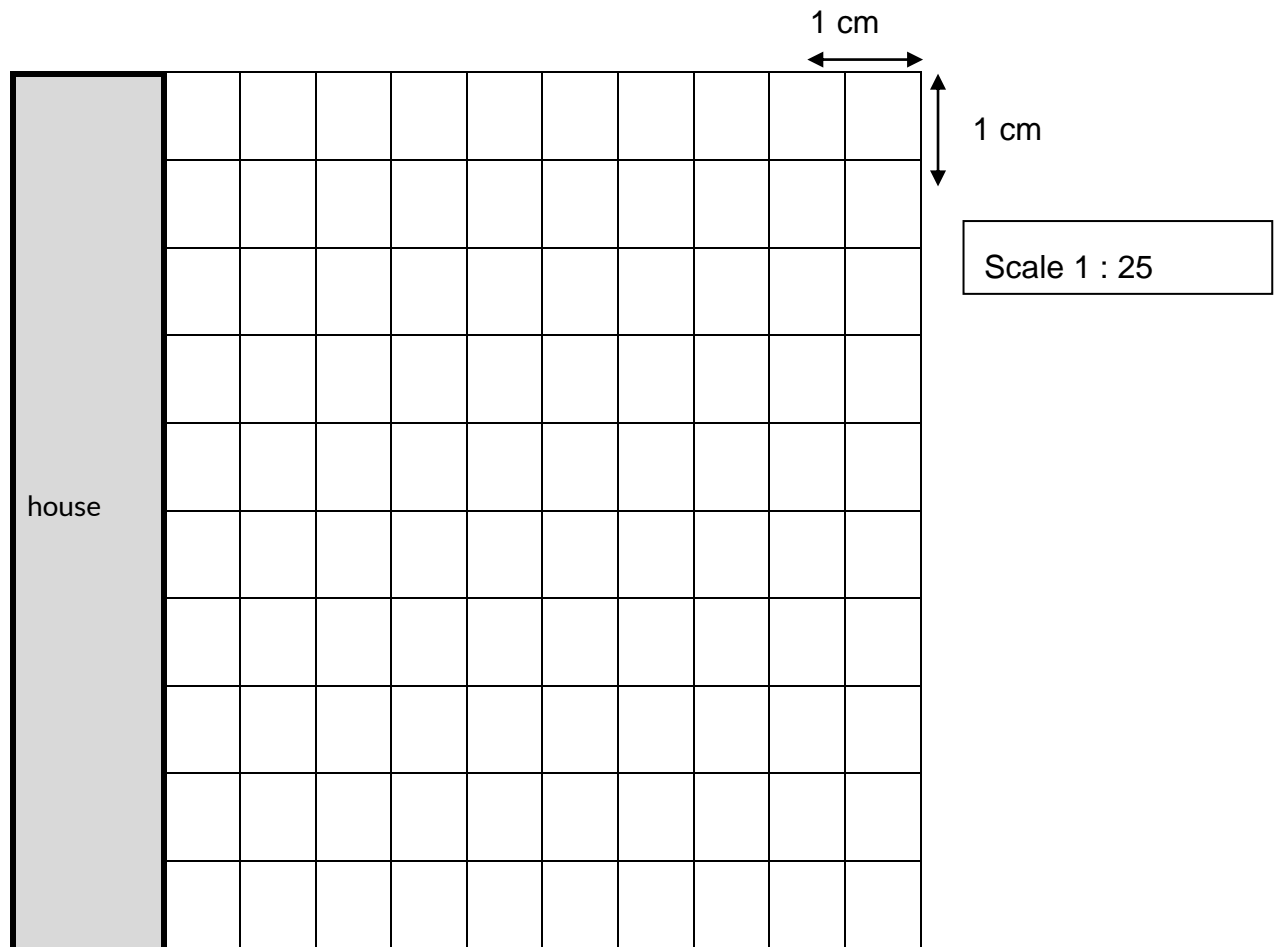
Show how you decide.

- 2 Charlie wants to build a pond in a garden.

The pond needs to be a rectangle with:

- a length of 2 metres and a width of 1 metre
- at least 1 metre away from the house.

Draw a possible position for the pond on the scale diagram below:



- 3 A map has a scale of 1 : 50 000

A school and a supermarket are 2.5 centimetres (cm) apart on the map.

How far apart are the school and supermarket in real life?

Give the units in your answer.

UCM19

Use coordinates in 2-D, positive and negative, to specify the position of points

Teaching Guidance

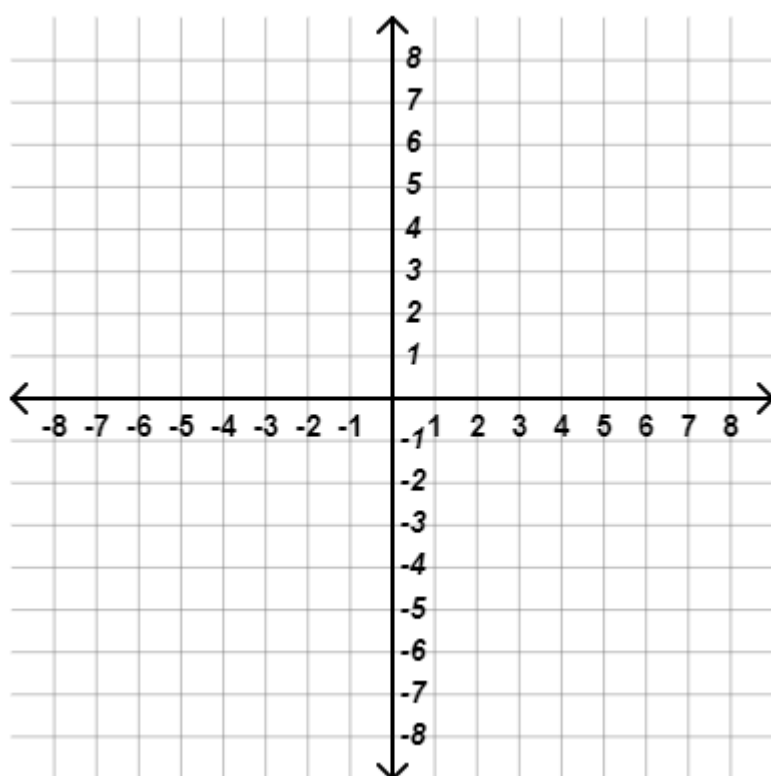
Learners should be able to:

- use a Cartesian coordinate system to plot and identify points in all four quadrants
- use the (x, y) system to identify the position of a point
- understand the terms 'x-coordinate', 'y-coordinate', 'x-axis' and 'y-axis'
- use two numbers or letters to identify a point or square in a real-life situation such as a board game.

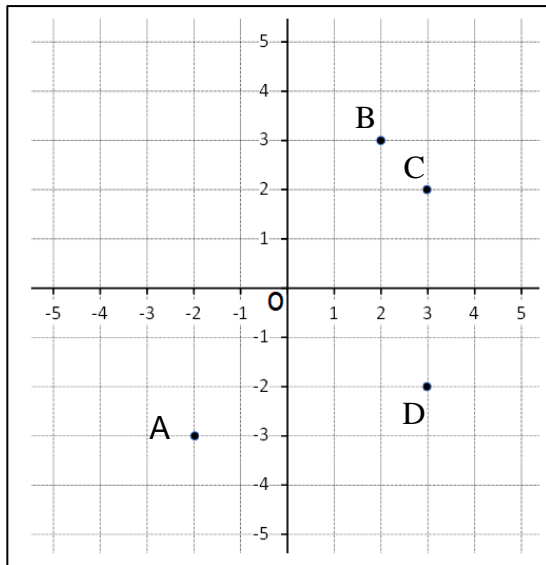
[GCSE Link – A8, G11](#)

Examples

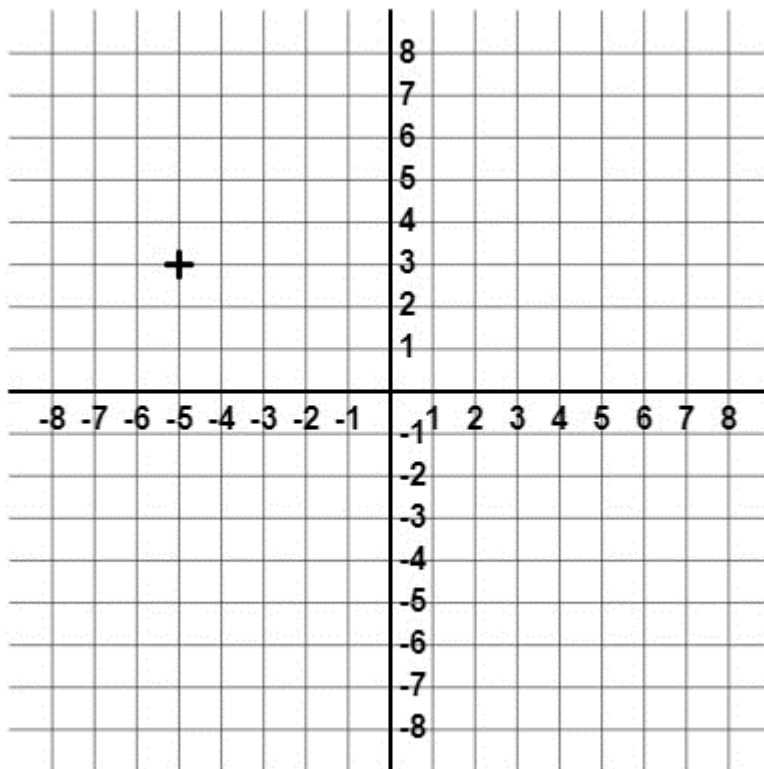
- 1 Plot the point $(6, -3)$ on this coordinate grid:



- 2 Which of these points has the coordinates (2, 3)?



- 3 Write down the coordinates of the point labelled on the grid.



UCM20

Understand and use common 2-D representations of 3-D objects

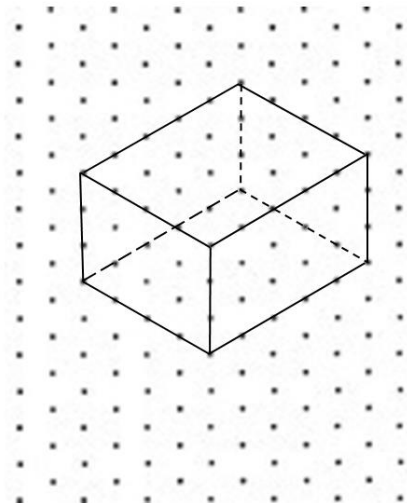
Teaching Guidance

Learners should be able to:

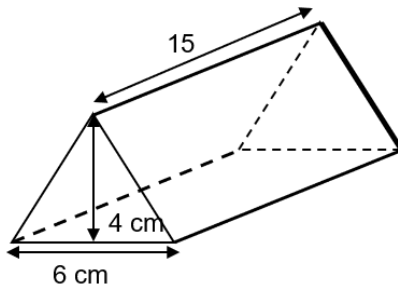
- interpret a solid drawn on isometric paper
- draw a solid on isometric paper
- interpret a 2-D diagram of a 3-D object
- sketch a 2-D diagram of a 3-D object.

Examples

- 1 What is the name of this shape?

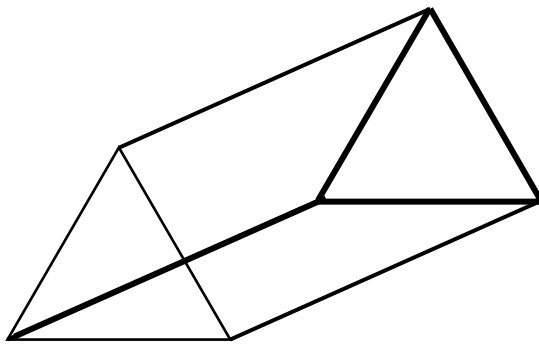


- 2 The diagram shows a triangular prism.



Work out the area of the base of the prism.

- 3 What is this shape?



UCM21

Draw 3-D shapes including plans and elevations

Teaching Guidance

Learners should be able to:

- draw a plan of an object
- understand and use the words plan, elevation and base
- draw an elevation of an object from a given side.

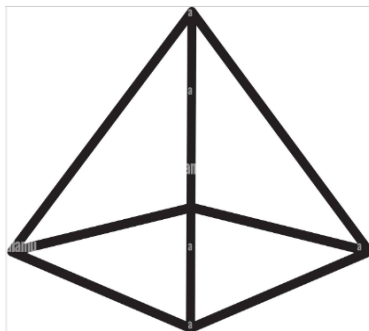
Notes

The required side for an elevation will be identified by an arrow.

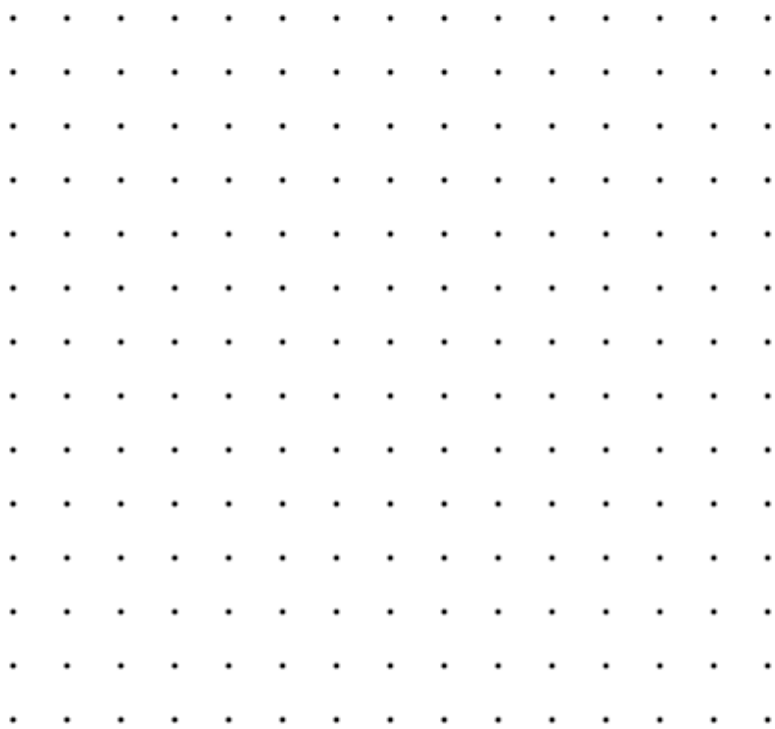
Learners should include internal lines on plans and elevations to identify changes in depth, where appropriate.

Examples

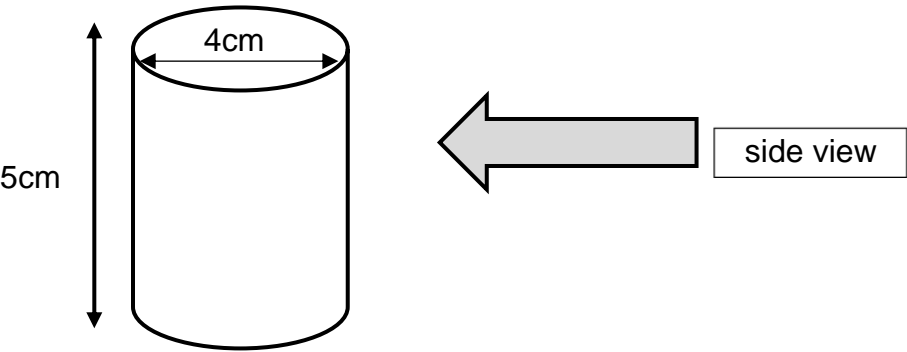
- 1 The diagram shows a square-based pyramid:



Draw the plan view of the square-based pyramid on this grid:



2 Draw to scale the side view of this cylinder on this cm square grid:



UCM22

Calculate values of angles and/or coordinates with 2-D and 3-D shapes

Teaching Guidance

Learners should be able to:

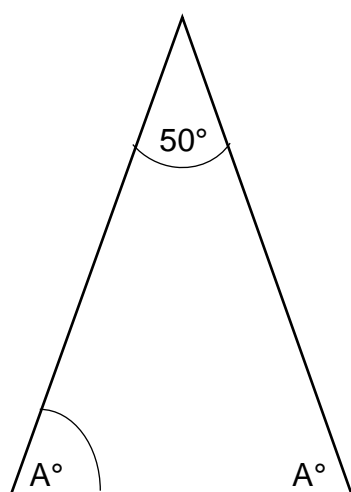
- apply the properties of angles at a point and angles at a point on a straight line
- know that the angles in a triangle sum to 180°
- know that the angles in a quadrilateral sum to 360°
- know that a right angle is equal to 90° and interpret the symbol for a right angle
- know that isosceles triangles have two equal angles
- know that equilateral triangles have three equal angles
- understand the terms 'interior angle' and 'exterior angle' when used with polygons
- apply the properties of shapes and lines to a 2-D coordinate system.

Notes

3-D coordinates will not be tested.

Examples

- 1 Work out the value of A shown in this triangle:

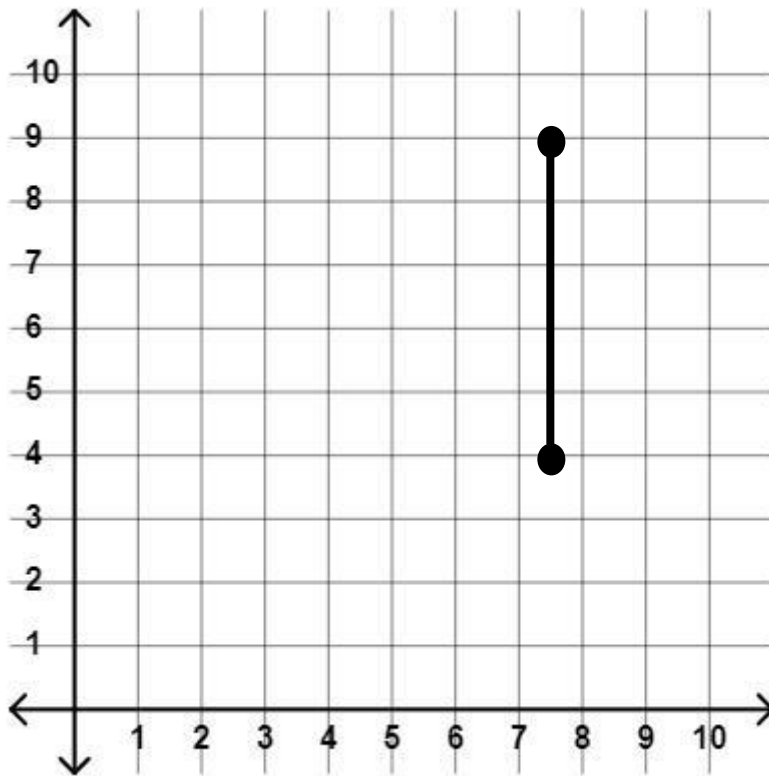


Not drawn to scale

- 2 Ezra is going to put a shed in a garden.

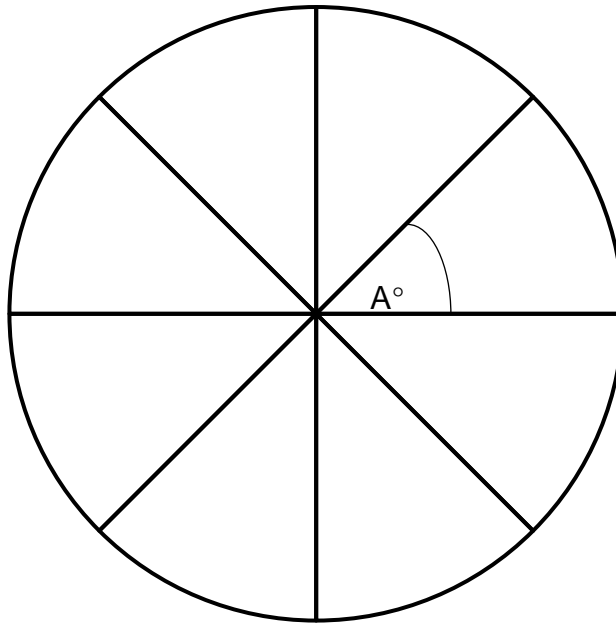
The shed is in the shape of a square.

The coordinate grid shows where two corners and one edge of the square will go.



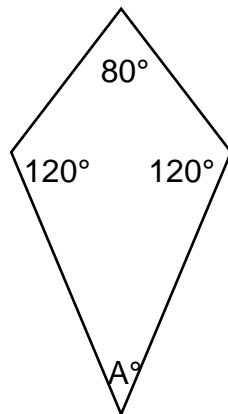
What are the possible coordinates for the other **two** corners of the square?

- 3 A circle is divided into 8 equal sections as show below:



Calculate the value of A.

- 3 Work out the value of angle A.



Not drawn to scale

3

Handling information and data

Level 2 - handling information and data

In this area (identified as HID in our materials), the Department for Education's guidance³ expects learners at Level 2 to:

- be able to construct, interpret and evaluate a range of statistical diagrams
- calculate and interpret probabilities
- calculate, analyse, compare and interpret appropriate data sets, tables, diagrams and statistical measures such as common averages (mean, median, mode) and spread (range), and use statistics to compare sets of data
- identify patterns and trends from data as well as recognise simple correlation.

HID23

Calculate the median and mode of a set of quantities

Teaching Guidance

Learners should be able to:

- identify the median in an even or odd number of discrete data
- work out the median from a statistical diagram showing quantitative data
- identify the mode in a number of discrete data
- identify the mode from a statistical diagram
- understand that some data have no mode
- understand that 'modal' is the adjective from 'mode'.

³ Department for Education Subject content functional skills: mathematics, published February 2018

Examples

- 1 Work out the median of these numbers:

5000 3000 2500 4250 5500 6600

- 2 Write down the mode of these numbers:

1450 2800 1250 1385 2365 2800

HID24**Estimate the mean of a grouped frequency distribution from discrete data****Teaching Guidance**

Learners should be able to:

- work out an estimate of the mean from a grouped frequency table
- understand that the actual mean may be higher or lower than their estimate.

Examples

1 Drew is a gardener.

This table shows how much other local gardeners charge per hour:

Amount (A) charged per hour (£)	Number of gardeners
$20 < A \leq 30$	2
$30 < A \leq 40$	6
$40 < A \leq 50$	8
$50 < A \leq 60$	4
Total	20

Drew wants to charge an hourly rate equal to the estimated mean amount per hour.

How much should Drew charge per hour?

- 2 The table shows the number of stars awarded by some friends to a video game:

Number of stars	Frequency
1 – 3	16
4 – 6	5
7 – 9	9

Work out the estimated mean number of stars awarded.

- 3 An athletics club awards points each year to its members.

In 2021, the club awarded its members a mean of 90.3 points in the year.

The grouped frequency table shows the points the club awarded its members in 2022:

Number of points awarded	Frequency
$0 \leq \text{points} < 40$	7
$40 \leq \text{points} < 80$	34
$80 \leq \text{points} < 120$	100
$120 \leq \text{points} < 160$	9
Total	150

The club president says:

'The mean number of points per member in 2022 has increased since 2021'

Is the president correct?

Show how you decide.

HID25**Use the mean, median, mode and range to compare two sets of data****Teaching Guidance**

Learners should be able to:

- work out which of two sets of data has the higher mean, median and mode and relate this to having a higher average
- Compare two means, medians, modes or ranges and draw conclusions
- know that mean, median and mode are all types of average
- identify which is the most appropriate measure of average to use in a certain situation
- understand that a person or company may choose which measure of average to use to their advantage
- know that range is a measure of spread
- know that a smaller range implies less variability or greater consistency
- understand that the range can be affected to a large degree by one piece of data.

Notes

Learners should not just work out the values, but must relate them to the context, e.g. in a question comparing performance in a series of tests, 'John had the higher mean' will not attract full marks unless accompanied by 'this means that on average his score was better'. Alternatively, the question may ask which score was better on average and an answer of just "John" will not attract full marks unless accompanied by supporting average calculations.

Examples

- 1 Riley grows apples and oranges.

The weights of the apples collected on Monday are shown below:

173 grams	151 grams	182 grams	248 grams	214 grams
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The weights of the oranges collected on Monday are summarised below:

Oranges weights	
Mean weight	188 grams
Range	112

Riley claims:

- 'On average the weight of the apples is greater than the weight of the oranges.'
- 'The weights of the apples are more consistent.'

Are each of Riley's claims correct?

Give reasons for your answers.

Show your working.

- 2 Over a period of six weeks, Jamie sold chocolate cupcakes and lemon cupcakes.

The number of chocolate cupcakes Jamie sold each week is shown below:

Number of chocolate cupcakes sold					
Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
91	85	64	68	100	72

The number of lemon cupcakes Jamie sold is summarised below:

Lemon cupcakes sold	
Mean number sold per week	84
Range	20

Jamie claims:

- a) “On average, I have sold more chocolate cupcakes per week”
- b) “The chocolate cupcake sales are more consistent”.

Are both of Jamie’s claims correct?

Give reasons for your answers.

- 3 Rope A and Rope B were tested to find out which one is the stronger.

12 samples of rope A were chosen.

The greatest weight, in kg, that each sample could hold without breaking was recorded.

Here are the results:

3595 2974 3147 3311 3028 3072
 3246 3072 3522 3527 3486 3167

Summarised below is the weight in kg that 12 different samples of Rope B were able to hold before breaking:

Mean weight held before breaking: 3172 kg

Range of weights: 213 kg

The manufacturer claims:

- a. 'on average, Rope A can hold the greater weight before breaking'
- b. 'the 12 samples of Rope A were more consistent.'

Is the manufacturer correct?

Show how you decide.

- 4 A delivery driver keeps a record of the number of miles per gallon (mpg) their car achieves each day.

These are the results for week 2:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
30	38	22	37	40	32	39

This is a summary of the results for week 1:

Week 1	
Mean mpg	32
Range	16

The delivery driver claims:

- a) 'on average, the car achieved more miles per gallon in week 2 than in week 1'
- b) 'the miles per gallon achieved in week 2 were more consistent than in week 1.'

Are **each** of the driver's claims correct?

Give reasons for your answers.

Show your working.

HID26**Work out the probabilities of combined events including the use of diagrams and tables****Teaching Guidance**

Learners should be able to:

- work out a probability from a two-way table
- work out a probability from a Venn diagram
- work out a probability from a tree diagram
- work out a probability from a frequency tree
- know when it is appropriate to add probabilities
- know when it is appropriate to multiply probabilities (learners will not be expected to multiply probabilities expressed as fractions).

Examples

- 1 A company has 60 employees.

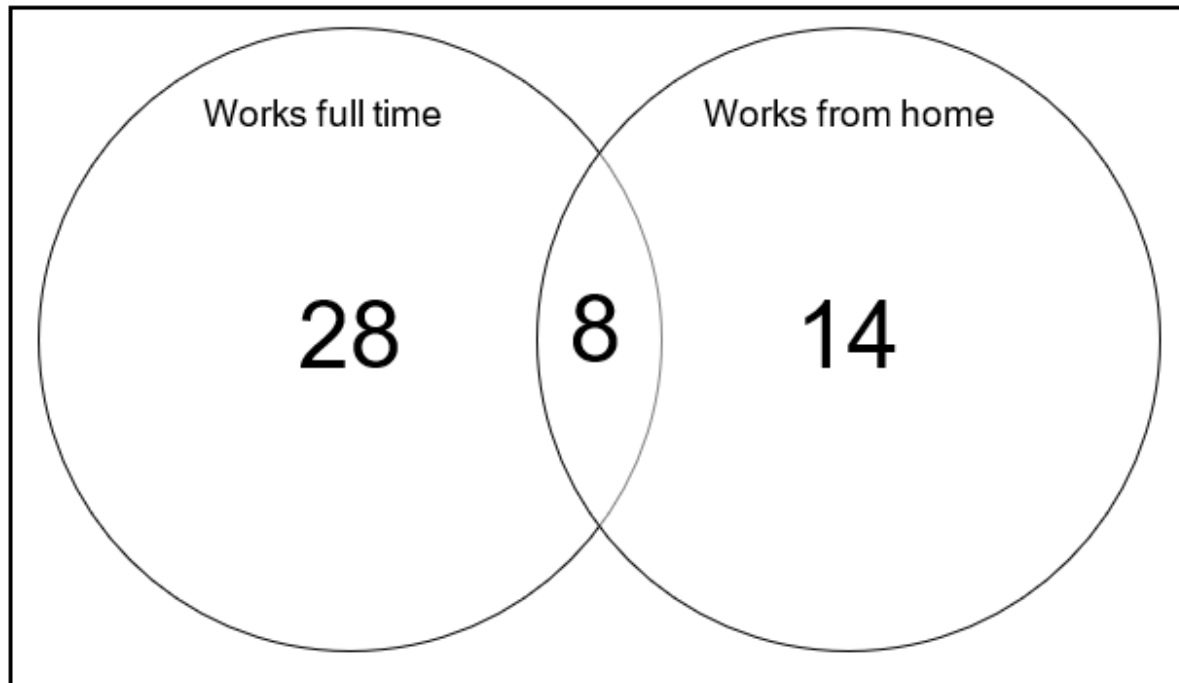
The table shows the way that each person travels to work:

	Car	Walk
Part-time employees	10	18
Full-time employees	30	2

One person is chosen at random.

What is the probability that the person chosen works part-time and walks to work?

2. The Venn diagram shows the working patterns of a group of employees.



One of these employees is chosen at random.

What is the probability that this employee works full time?

Give your answer as a decimal **and** a percentage.

HID27**Express probabilities as fractions, decimals and percentages****Teaching Guidance**

Learners should be able to:

- give and understand a probability as a (simplified) fraction
- give and understand a probability as a decimal
- give and understand a probability as a percentage
- know that the probabilities of an exhaustive set of outcomes sum to 1, or 100%

Notes

Unless specified in the question, probabilities can be given in any of the three forms.

Probabilities will not be accepted in words or using a ratio.

Examples

- 1 A company has 60 employees.

The table shows the way that each person travels to work:

	Car	Walk
Part-time employees	10	18
Full-time employees	30	2

One person is chosen at random.

What is the probability that the person chosen works part-time and walks to work?

Give your answer as a decimal.

HID28

Draw and interpret scatter diagrams and recognise positive and negative correlation

Teaching Guidance

Learners should be able to:

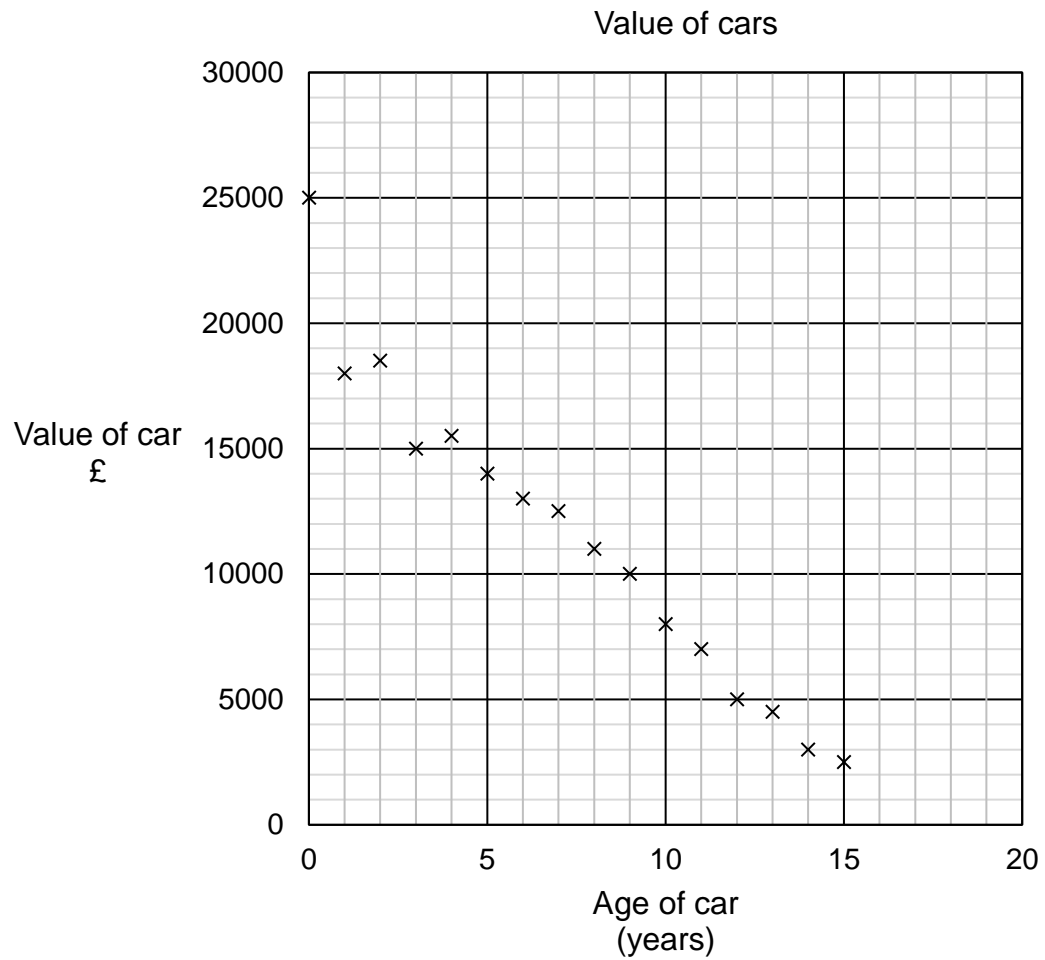
- plot points to form a scatter diagram
- identify positive correlation, negative correlation and no correlation
- compare, by sight, strengths of correlation
- identify outliers and relate them to the given context.
- Where appropriate learners should be encouraged to draw a line of best fit.

Notes

Learners should understand the difference between identifying the type of correlation (positive, negative or none) and describing a relationship (e.g. as one goes up the other goes down).

Examples

- 1 The scatter diagram below shows the age and value of 15 cars:



What type of correlation is shown on the scatter diagram?

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