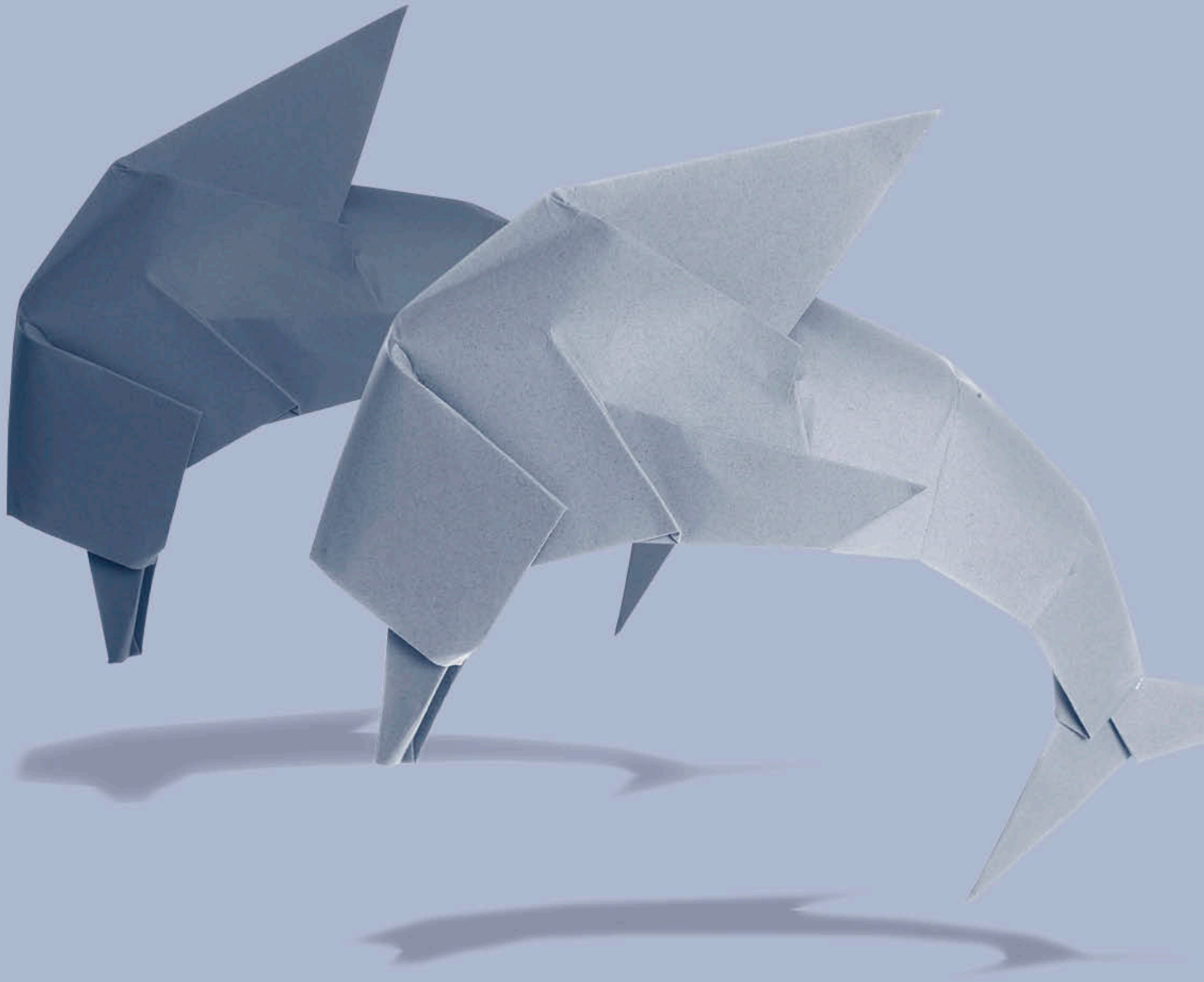


Pearson Edexcel Level 1/ Level 2 GCSE (9-1) in Mathematics (1MA1)



**EXEMPLIFICATION OF THE
SPECIMEN PAPERS SET 1**

First certification 2017

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About this booklet

This booklet has been produced to support mathematics teachers delivering the new GCSE (9–1) Mathematics specification (first assessment summer 2017).

The booklet provides additional information on all the questions in the Specimen Papers Set 1. It details the content references and Assessment Objectives being assessed in each question or question part, along with indicating if a question or question part is new to the Foundation tier, new to this specification, or a common question appearing in the respective paper for both tiers.

How to use this booklet

Callouts have been added to each question in the Specimen Papers Set 1. In the callouts, the following information has been presented, as relevant to the question:

- **specification references** (in standard, underlined or bold type);
- **Assessment Objectives**, including elements and marks awarded for each element;
- **new to Foundation tier**, for any content previously assessed at Higher tier in 1MA0 or 2MB01;
- **new to 1MA1**, for any content not previously assessed in 1MA0 or 2MB01;
- **common question across both tiers**, for any question that appears in both tiers and is assessing performance at grades 4–5;
- **formula(e) given with the question**: formulae will be provided for students with the relevant examination questions, rather than in a formulae sheet at the front of the examination paper (see Issue 2 of the specification).

Where content references or Assessment Objectives are being assessed across all the parts of a question, these are referred to by a single callout at the end of the question rather than by a callout for each question part.

The New Sample Assessment Materials, along with the two sets of specimen papers, are also available in the new GCSE (9–1) level on [Exam Wizard](#), where you can search by topic or assessment objective and build your own practice papers.

26 (a) Write down the exact value of $\cos 30^\circ$
<u>know the exact values of $\sin \theta$ and $\cos \theta$ for $\theta = 0^\circ, 30^\circ, 45^\circ, 60^\circ$ and 90° (G21)</u>
AO1 1.1 – accurately recall facts, terminology and definitions (1 mark)
New to Foundation
New to 1MA1
Common question across both tiers
(1)

Set 1 Paper 1F

- 1 Change 530 centimetres into metres.

change freely between related standard units
(R1)

AO1
1.3a – accurately carry out routine procedures
(1 mark)

(Total for Question 1 is 1 mark)

- 2 How many minutes are there in $3\frac{1}{4}$ hours?

change freely between related standard units
(R1)

AO1
1.3a – accurately carry out routine procedures
(1 mark)

(Total for Question 2 is 1 mark)

- 3 Write 4.4354 correct to 2 decimal places.

round numbers and measures to an appropriate degree of accuracy (N15)

AO1
1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 3 is 1 mark)

- 4 Write 0.9 as a percentage.

interpret percentages as a fraction or a decimal (R9)

AO1
1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 4 is 1 mark)

- 5 Work out $(-3)^3$

use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 (N6)

AO1
1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 5 is 1 mark)

6 Here are four cards.

There is a number on each card.

4

5

2

1

(a) Write down the largest 4-digit even number that can be made using each card only once.

order positive and negative integers, decimals and fractions (N1)

AO1 1.3a – accurately carry out routine procedures (2 marks)
--

(2)

(b) Write down all the 2-digit numbers that can be made using these cards.

apply systematic listing strategies (N5)
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AO3 3.1a – translate problems in mathematical contexts into a process (1 mark)
AO1 1.3a – accurately carry out routine procedures (1 mark)

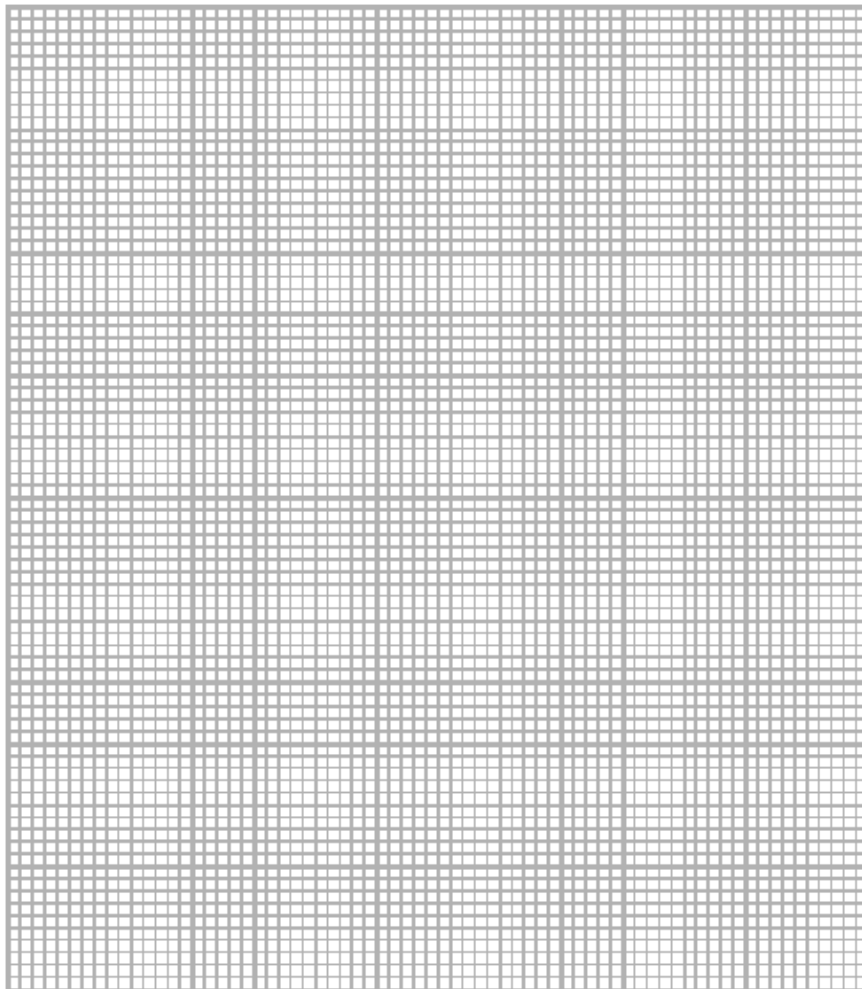
(2)

(Total for Question 6 is 4 marks)

7 The table shows information about the sports some students like best.

	Hockey	Tennis	Football	Golf
Boys	3	8	15	9
Girls	6	14	7	1

Draw a suitable diagram or chart for this information.



interpret and construct tables, charts and diagrams and know their appropriate use (S2)

AO2
 2.3a – interpret information accurately (2 marks)
 2.3b – communicate information accurately (2 marks)

(Total for Question 7 is 4 marks)

8 Bernard says,

“When you halve a whole number that ends in 8, you always get a number that ends in 4”

(a) Write down an example to show that Bernard is wrong.

apply the four operations, including formal written methods, to integers, decimals and simple fractions, and mixed numbers – all both positive and negative; understand and use place value (N2)

AO2
2.4a – present arguments (1 mark)

(1)

Alice says,

“Because 7 and 17 are both prime numbers, all whole numbers that end in 7 are prime numbers.”

(b) Is Alice correct?

You must give a reason with your answer.

use the concepts and vocabulary of prime numbers (N4)

AO2
2.5a – assess the validity of an argument (1 mark)

(1)

(Total for Question 8 is 2 marks)

9 Work out 247×63

apply the four operations, including formal written methods, to integers (N2)

AO1
1.3a – accurately carry out routine procedures (3 marks)

(Total for Question 9 is 3 marks)

- 10 An American airline has a maximum size for bags on its planes.
The diagram shows the maximum dimensions.



Chris has a bag.

It has

height 50 cm

width 40 cm

depth 20 cm

1 inch = 2.54 cm

Can Chris take this bag on the plane?

You must show your working.

apply the four operations, including formal written methods, to integers and decimals; understand and use place value (N2)
change freely between related standard units (R1)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

3.3 – Interpret results in the context of the given problem (1 mark)

(Total for Question 10 is 3 marks)

11 Complete the two-way table.

	blue eyes	brown eyes	green eyes	total
boys	5		4	12
girls		7		
total			9	30

interpret and construct tables (S2)

AO2

2.3a – interpret information accurately
(1 mark)

2.3b – communicate information accurately
(2 marks)

(Total for Question 11 is 3 marks)

12 There are 28 red pens and 84 black pens in a bag.

Write down the ratio of the number of red pens to the number of black pens.

Give your ratio in its simplest form.

use ratio notation, including reduction to
simplest form (R4)

AO1

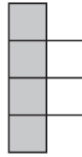
1.3a – accurately carry out routine procedures
(2 marks)

(Total for Question 12 is 2 marks)

13 Here is a sequence of patterns made with grey square tiles and white square tiles.



pattern number
1



pattern number
2



pattern number
3

(a) In the space below, draw pattern number 4.

generate terms of a sequence from either a term-to-term or a position-to-term rule (A23)

AO2

2.3b – communicate information accurately
(1 mark)

(1)

(b) Find the total number of tiles in pattern number 20.

recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions (A24)

AO2

2.3a – interpret information accurately
(1 mark)

AO1

1.3a – accurately carry out routine procedures
(1 mark)

(2)

(c) Write an expression, in terms of n , for the number of grey tiles in pattern number n .

deduce expressions to calculate the n th term of linear sequences (A25)

AO2

2.1a – make deductions to draw conclusions from mathematical information (2 marks)

(2)

(Total for Question 13 is 5 marks)

14 A unit of gas costs 4.2 pence.

On average Ria uses 50.1 units of gas a week.

She pays for the gas she uses in 13 weeks.

(a) Work out an estimate for the amount Ria pays.

use compound units such as speed, rates of pay, unit pricing, density and pressure (R11)
estimate answers (N14)

AO1
1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)
AO3
3.4a – evaluate methods used (1 mark)

(3)

(b) Is your estimate to part (a) an underestimate or an overestimate?

Give a reason for your answer.

apply the four operations, including formal written methods, to integers, decimals and simple fractions (proper and improper), and mixed numbers – all both positive and negative; understand and use place value (N2)
check calculations using approximation and estimation (N14)

AO3
3.4b – evaluate results obtained (1 mark)

(1)

(Total for Question 14 is 4 marks)

15 This is a scale plan of a rectangular floor.

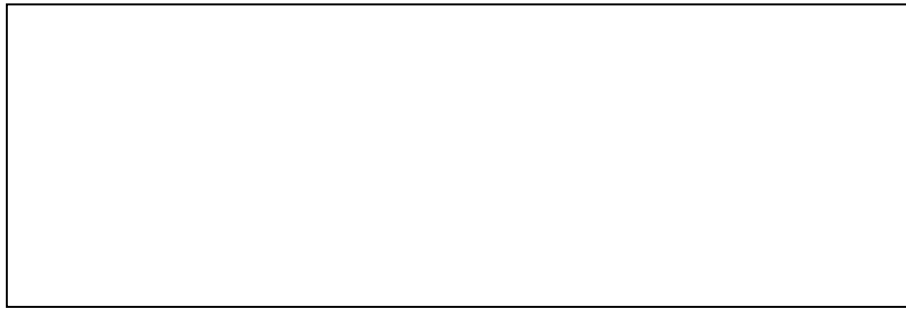


Diagram
accurately
drawn

Scale: 1 cm represents 2 m

Mrs Bridges is going to cover the floor with boards.

Each board is rectangular in shape.

Each board is 1.2 m long and 1 m wide.

Mrs Bridges has 150 boards.

Does she have enough boards?

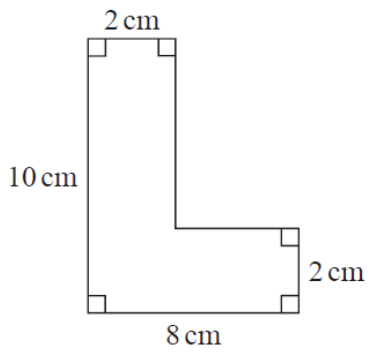
You must show how you get your answer.

use scale factors, scale diagrams and maps
(R2)

AO2
2.1a – make deductions to draw conclusions
from mathematical information (2 marks)
2.3a – interpret information accurately
(1 mark)

(Total for Question 15 is 3 marks)

16



Work out the area of the shape.

know and apply formulae to calculate area of parallelograms (G16)

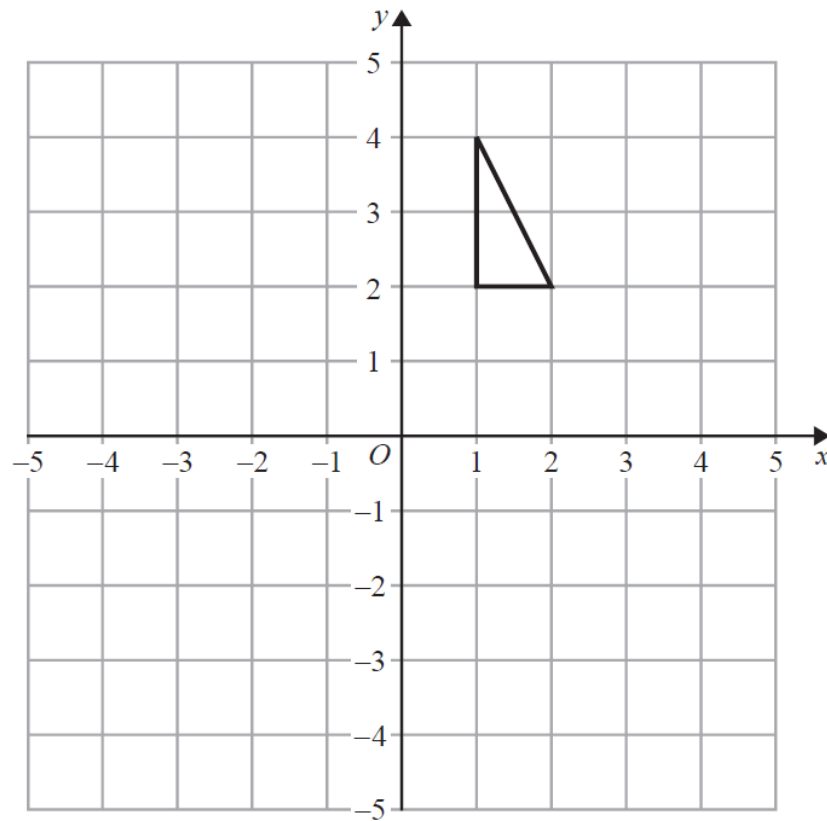
AO1

1.1 – accurately recall facts, terminology and definitions (1 mark)

1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 16 is 2 marks)

17



On the grid, rotate the triangle 90° clockwise about $(0, 0)$.

identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation (G7)

AO1

1.3a – accurately carry out routine procedures (2 marks)

(Total for Question 17 is 2 marks)

18 There are 500 passengers on a train.

$\frac{7}{20}$ of the passengers are men.

40% of the passengers are women.

The rest of the passengers are children.

Work out the number of children on the train.

apply the four operations, including formal written methods, to integers, decimals and simple fractions (N2)
interpret fractions and percentages as operators (N12)
define percentage as ‘number of parts per hundred’; interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively (R9)

AO3
3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)
AO1
1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 18 is 3 marks)

19 A shop sells milk in 1 pint bottles and in 2 pint bottles.

Each 1 pint bottle of milk costs 52p.

Each 2 pint bottle of milk costs 93p.

Martin has **no** milk.

He assumes that he uses, on average, $\frac{3}{4}$ of a pint of milk each day.

Martin wants to buy enough milk to last for 7 days.

(a) Work out the smallest amount of money Martin needs to spend on milk.

You must show all your working.

apply the four operations, including formal written methods, to integers, decimals and simple fractions (proper and improper), and mixed numbers – all both positive and negative (N2)
 calculate exactly with fractions (N8)
 solve problems involving direct and inverse proportion, including graphical and algebraic representations (R10)

AO3
 3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (1 mark)
 3.3 – Interpret results in the context of the given problem (1 mark)
 AO1
 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(3)

Set 1 Paper 1F

Martin actually uses more than $\frac{3}{4}$ of a pint of milk each day.

(b) Explain how this might affect the amount of money he needs to spend on milk.

solve problems involving direct and inverse proportion, including graphical and algebraic representations (R10)

use compound units such as speed, rates of pay and unit pricing (R11)

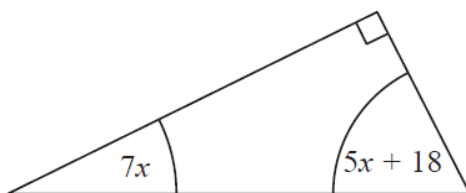
AO3

3.4 – Evaluate methods used and results obtained (1 mark)

(1)

(Total for Question 19 is 4 marks)

20 The diagram shows a right-angled triangle.



All the angles are in degrees.

Work out the size of the smallest angle of the triangle.

translate simple situations or procedures into algebraic expressions or formulae; derive an equation, solve the equation(s) and interpret the solution (A21)

derive and use the sum of angles in a triangle (G3)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (2 marks)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

Common question across both tiers

(Total for Question 20 is 3 marks)

Set 1 Paper 1F

21 A box exerts a force of 140 newtons on a table.

The pressure on the table is 35 newtons/m².

Calculate the area of the box that is in contact with the table.

$$P = \frac{F}{A}$$

p = pressure
 F = force
 A = area

use compound units such as speed, rates of pay, unit pricing, density and pressure (R11)
substitute numerical values into formulae and expressions, including scientific formulae (A2)

AO1
1.2 – use and interpret notation correctly (1 mark)
1.3a – accurately carry out routine procedures (2 marks)

New to 1MA1

Common question across both tiers

(Total for Question 21 is 3 marks)

- 22 There are only red counters, blue counters, green counters and yellow counters in a bag.

The table shows the probabilities of picking at random a red counter and picking at random a yellow counter.

Colour	red	blue	green	yellow
Probability	0.24			0.32

The probability of picking a blue counter is the same as the probability of picking a green counter.

Complete the table.

apply the property that the probabilities of an exhaustive set of outcomes sum to one (P4)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (1 mark)

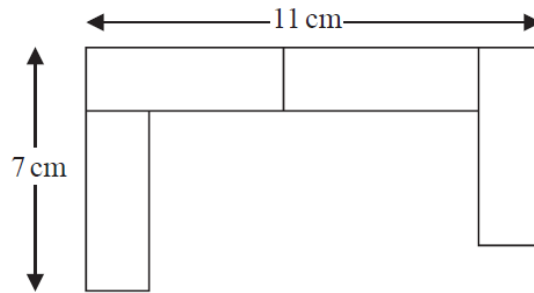
AO1

1.3a – accurately carry out routine procedures (1 mark)

Common question across both tiers

(Total for Question 22 is 2 marks)

23 A pattern is made using identical rectangular tiles.



Find the total area of the pattern.

translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution (A21)

calculate areas of composite shapes (G17)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (2 marks)

3.2 – Make and use connections between different parts of mathematics (1 mark)

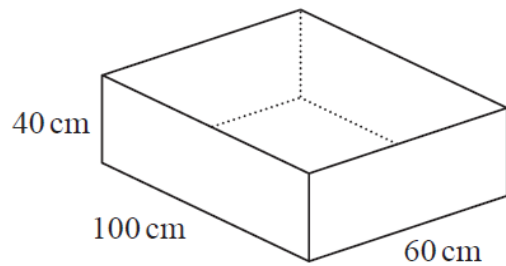
AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

Common question across both tiers

(Total for Question 23 is 4 marks)

- 24 The diagram shows a sand pit.
The sand pit is in the shape of a cuboid.



Sally wants to fill the sand pit with sand.
A bag of sand costs £2.50.
There are 8 litres of sand in each bag.

Sally says,
“The sand will cost less than £70.”

Show that Sally is wrong.

know and apply formulae to calculate volume of cuboids (G16)
change freely between related standard units in numerical contexts (R1)
solve problems involving direct and inverse proportion (R10)
apply the four operations, including formal written methods, to integers and decimals; understand and use place value (N2)

AO2
2.2 – Construct chains of reasoning to achieve a given result (3 marks)
AO3
3.1b – translate problems in mathematical contexts into a series of processes (1 mark)
AO1
1.3a – accurately carry out routine procedures (1 mark)

Common question across both tiers

(Total for Question 24 is 5 marks)

- 25 Four friends each throw a biased coin a number of times.

The table shows the number of heads and the number of tails each friend got.

	Ben	Helen	Paul	Sharif
heads	34	66	80	120
tails	8	12	40	40

The coin is to be thrown one more time.

- (a) Which of the four friends' results will give the best estimate for the probability that the coin will land heads?

Justify your answer.

understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size (P5)

AO3

3.4a – evaluate methods used (1 mark)

Common question across both tiers

(1)

Paul says,

“With this coin you are twice as likely to get heads as to get tails.”

- (b) Is Paul correct?

Justify your answer.

relate relative expected frequencies to theoretical probability, using appropriate language and the 0-1 probability scale (P3)

AO3

3.4b – evaluate results obtained (2 marks)

Common question across both tiers

(2)

The coin is to be thrown twice.

(c) Use all the results in the table to work out an estimate for the probability that the coin will land heads both times.

calculate the probability of independent and dependent combined events (P8)

AO2

2.1b – make inferences to draw conclusions from mathematical information (1 mark)

AO1

1.3a – accurately carry out routine procedures (1 mark)

Common question across both tiers

(2)

(Total for Question 25 is 5 marks)

26 (a) Write down the exact value of $\cos 30^\circ$

know the exact values of $\sin \theta$ and $\cos \theta$ for $\theta = 0^\circ, 30^\circ, 45^\circ, 60^\circ$ and 90° (G21)

AO1

1.1 – accurately recall facts, terminology and definitions (1 mark)

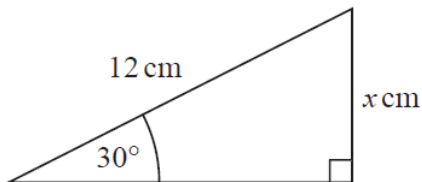
New to Foundation

New to 1MA1

Common question across both tiers

(1)

(b)



Given that $\sin 30^\circ = 0.5$,
work out the value of x .

know the formulae for the trigonometric ratios; apply them to find angles and lengths in right-angled triangles in two-dimensional figures (G20)

AO1

1.3a – accurately carry out routine procedures (1 mark)

New to Foundation

New to 1MA1

Common question across both tiers

(2)

(Total for Question 26 is 3 marks)

27 Expand and simplify $(x + 3)(x - 1)$

simplify and manipulate algebraic expressions by collecting like terms and expanding products of two binomials (A4)

AO1

1.3a – accurately carry out routine procedures (2 marks)

New to Foundation

(Total for Question 27 is 2 marks)

28 Factorise $x^2 - 16$

simplify and manipulate algebraic expressions by factorising quadratic expressions of the form $x^2 + bx + c$, including the difference of two squares (A4)

AO1

1.3a – accurately carry out routine procedures (1 mark)

New to Foundation

(Total for Question 28 is 1 mark)

29 Solve the simultaneous equations

$$4x + y = 25$$

$$x - 3y = 16$$

solve two simultaneous equations in two variables (linear/linear) algebraically (A19)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

New to Foundation

(Total for Question 29 is 3 marks)

TOTAL FOR PAPER IS 80 MARKS

Set 1 Paper 2F

- 1 Write down the value of the 3 in 16.35.

understand and use place value (N2)

AO1
1.2 – use and interpret notation correctly
(1 mark)

(Total for Question 1 is 1 mark)

- 2 Here is a list of six numbers.

1 3 6 9 12 24

Which number in the list is **not** a factor of 24?

use the concepts and vocabulary of factors
(N4)

AO1
1.1 – accurately recall facts, terminology and
definitions (1 mark)

(Total for Question 2 is 1 mark)

- 3 Write 0.21 as a fraction.

work interchangeably with terminating
decimals and their corresponding fractions
(N10)

AO1
1.3a – accurately carry out routine procedures
(1 mark)

(Total for Question 3 is 1 mark)

4 (a) Simplify $5f - f + 2f$

use and interpret algebraic manipulation (A4)

AO1
1.3a – accurately carry out routine procedures
(1 mark)

(1)

(b) Simplify $2 \times m \times n \times 8$

use and interpret algebraic manipulation (A4)

AO1
1.2 – use and interpret notation correctly
(1 mark)

(1)

(c) Simplify $t^2 + t^2$

simplify and manipulate algebraic expressions
by simplifying expressions involving sums,
products and powers, including the laws of
indices (A4)

AO1
1.3a – accurately carry out routine procedures
(1 mark)

(1)

(Total for Question 4 is 3 marks)

- 5 A shop sells pens at different prices.
The cheapest pens in the shop cost 27p each.

Lottie buys 18 pens from the shop.

She pays with a £10 note.

- (a) If Lottie buys 18 of the cheapest pens, how much change should Lottie get?

use standard units of mass, length, time, money and other measures using decimal quantities where appropriate (N12)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (1 mark)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(2)

Instead of buying the cheapest pens, Lottie buys 18 of the more expensive pens.

She still pays with a £10 note.

- (b) How does this affect the amount of change she should get?

use standard units of mass, length, time, money and other measures using decimal quantities where appropriate (N12)

AO3

3.5 – Evaluate solutions to identify how they may have been affected by assumptions made (1 mark)

(1)

(Total for Question 5 is 3 marks)

Set 1 Paper 2F

- 6 Michelle and Wayne have saved a total of £458 for their holiday.
Wayne saved £72 more than Michelle.

How much did Wayne save?

apply the four operations, including formal written methods, to integers (N2)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (1 mark)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 6 is 2 marks)

- 7 Work out 70% of £90.

define percentage as ‘number of parts per hundred’; interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively (R9)

AO1

1.3a – accurately carry out routine procedures (2 marks)

(Total for Question 7 is 2 marks)

8 Here are four fractions.

$$\frac{1}{2} \quad \frac{17}{24} \quad \frac{3}{4} \quad \frac{5}{12}$$

Write these fractions in order of size.

Start with the smallest fraction.

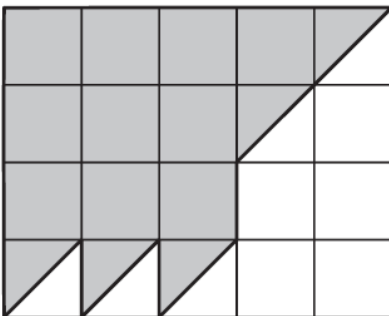
order positive and negative integers, decimals and fractions (N1)

AO1

1.3a – accurately carry out routine procedures (2 marks)

(Total for Question 8 is 2 marks)

9 What percentage of this shape is shaded?



express one quantity as a percentage of another (R9)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

(Total for Question 9 is 3 marks)

10 The manager of a clothes shop recorded the size of each dress sold one morning.

10	10				
12	12				
14	14	14	14	14	14
16	16	16	16		
18	18	18			
20	20	20			

The sizes of dresses are always even numbers.

The mean size of the dresses sold that morning is 15.3.

The manager says,

“The mean size of the dresses is **not** a very useful average.”

- (i) Explain why the manager is right.
- (ii) Which is the more useful average for the manager to know, the median or the mode?
You must give a reason for your answer.

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (S4)

AO2
2.4a – present arguments (2 marks)

(Total for Question 10 is 2 marks)

11 In a shop, the normal price of a coat is £65.

The shop has a sale.

In week 1 of the sale, the price of the coat is reduced by 20%

In week 2 of the sale, the price of the coat is reduced by a further £10.

Maria has £40.

Does Maria have enough money to buy the coat in week 2 of the sale?

You must show how you get your answer.

solve problems involving percentage change, including percentage increase/decrease and original value problems (R9)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

3.3 – Interpret results in the context of the given problem (1 mark)

(Total for Question 11 is 3 marks)

12 The length of a car is 3.6 metres.

Karl makes a scale model of the car.

He uses a scale of 1 cm to 30 cm.

Work out the length of the scale model of the car.

Give your answer in centimetres.

use scale factors, scale diagrams and maps (R2)
change freely between related standard units in numerical contexts (R1)
apply ratio to real contexts and problems (R5)

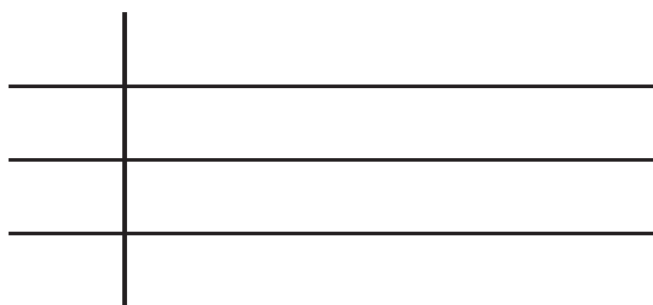
AO3
3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (1 mark)
AO1
1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 12 is 2 marks)

13 Here are the heights, in centimetres, of 15 children.

123	147	135	150	147
129	148	149	125	137
133	138	133	130	151

(a) Show this information in a stem and leaf diagram.



interpret and construct tables, charts and diagrams and know their appropriate use (S2)

AO2
2.3b – communicate information accurately
(3 marks)

(3)

One of the children is chosen at random.

(b) What is the probability that this child has a height greater than 140 cm?

apply ideas of randomness, fairness and equally likely events to calculate expected outcomes of multiple future experiments (P2)
construct theoretical possibility spaces for single and combined experiments with equally likely outcomes and use these to calculate theoretical probabilities (P7)

AO2

2.3a – interpret information accurately
(1 mark)

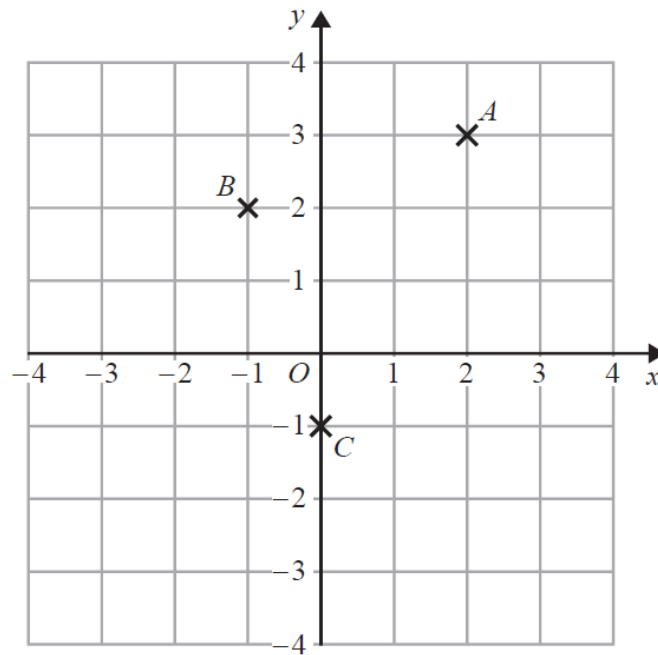
AO1

1.3a – accurately carry out routine procedures
(1 mark)

(2)

(Total for Question 13 is 5 marks)

14



- (a) Write down the coordinates of point C .

work with coordinates in all four quadrants
(A8)

AO1
1.3a – accurately carry out routine procedures
(1 mark)

(1)

$ABCD$ is a square.

- (b) On the grid, mark with a cross (X) the point D so that $ABCD$ is a square.

solve geometrical problems on coordinate axes
(G11)

derive and apply the properties and definitions
of special types of quadrilaterals, including
square, rectangle, parallelogram, trapezium,
kite and rhombus (G4)

AO3
3.1a – translate problems in mathematical
contexts into a process (1 mark)

(1)

(c) Write down the coordinates of the midpoint of the line segment BC .

solve geometrical problems on coordinate axes (G11)

AO1
1.3a – accurately carry out routine procedures (1 mark)

(1)

(Total for Question 14 is 3 marks)

15 (a) Work out $\frac{4}{5}$ of 210 cm.

interpret fractions and percentages as operators (N12)
calculate exactly with fractions (N8)

AO1
1.3a – accurately carry out routine procedures (1 mark)

(1)

(b) Work out $(6 - 2.5)^2 + \sqrt{9.34 - 2.58}$

use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 (N6)

AO1
1.3a – accurately carry out routine procedures (2 marks)

(2)

(Total for Question 15 is 3 marks)

16 (a) Solve $4c + 5 = 11$

solve linear equations in one unknown algebraically (A17)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

(2)

(b) Solve $5(e + 7) = 20$

solve linear equations in one unknown algebraically (A17)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

(2)

(c) Simplify $(m^3)^2$

simplify and manipulate algebraic expressions by simplifying expressions involving sums, products and powers, including the laws of indices (A4)

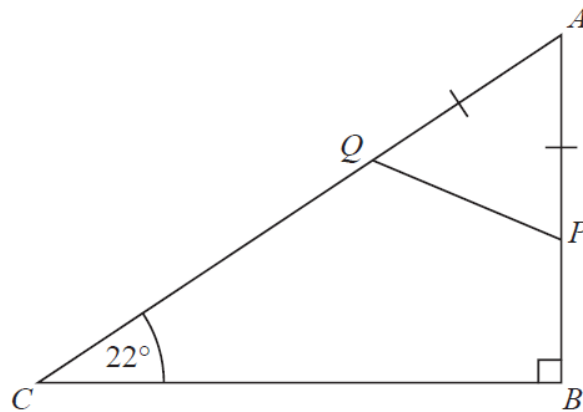
AO1

1.3a – accurately carry out routine procedures (1 mark)

(1)

(Total for Question 16 is 5 marks)

17 ABC is a right-angled triangle.



P is a point on AB .

Q is a point on AC .

$AP = AQ$.

Work out the size of angle AQP .

You must give a reason for each stage of your working.

apply the properties of angles at a point on a straight line; derive and use the sum of angles in a triangle (G3)

derive and apply the properties and definitions of triangles using appropriate language (G4)

use conventional terms and notation; use the standard conventions for labelling and referring to the sides and angles of triangles (G1)

AO2

2.1a – make deductions to draw conclusions from mathematical information (2 marks)

2.4a – present arguments (2 marks)

(Total for Question 17 is 4 marks)

18 Here is a list of ingredients for making 16 mince pies.

Ingredients for 16 mince pies

240 g of butter

350 g of flour

100 g of sugar

280 g of mincemeat

Elaine wants to make 72 mince pies.

How much of each ingredient will Elaine need?

apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations) (R5)
solve problems involving direct proportion (R10)
change freely between related standard units in numerical contexts (R1)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

(Total for Question 18 is 3 marks)

19 Lethna worked out $\frac{2}{5} + \frac{1}{2}$

She wrote

$$\frac{2}{5} + \frac{1}{2} = \frac{2}{10} + \frac{1}{10} = \frac{3}{10}$$

The answer of $\frac{3}{10}$ is wrong.

(a) Describe one mistake that Lethna made.

(1)

Dave worked out $1\frac{1}{2} \times 5\frac{1}{3}$

He wrote:

$$1 \times 5 = 5 \quad \text{and} \quad \frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$$

So $1\frac{1}{2} \times 5\frac{1}{3} = 5\frac{1}{6}$

The answer of $5\frac{1}{6}$ is wrong.

(b) Describe one mistake that Dave made.

(1)

apply the four operations, including formal written methods, to simple fractions (N2)

AO2
2.5a – assess the validity of an argument
(2 marks)

New to Foundation

(Total for Question 19 is 2 marks)

20 Make t the subject of the formula $w = 3t + 11$

understand and use standard mathematical formulae; rearrange formulae to change the subject (A5)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

Common question across both tiers

(Total for Question 20 is 2 marks)

21 Three companies sell the same type of furniture.

The price of the furniture from Pooles of London is £1480

The price of the furniture from Jardins of Paris is €1980

The price of the furniture from Outways of New York is \$2250

The exchange rates are

$$£1 = €1.34$$

$$£1 = \$1.52$$

Which company sells this furniture at the lowest price?

You must show how you get your answer.

use standard units of mass, length, time, money and other measures using decimal quantities where appropriate (N13)
apply the four operations, including formal written methods, to integers and decimals
understand and use place value (N2)

AO3

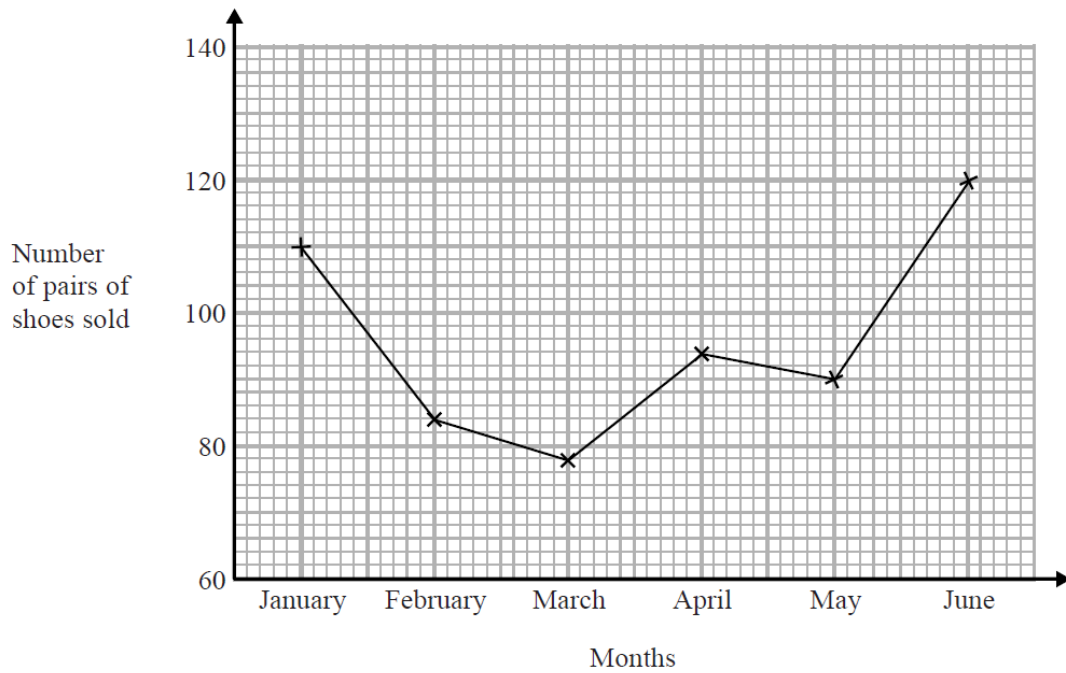
3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

3.3 – Interpret results in the context of the given problem (1 mark)

Common question across both tiers

(Total for Question 21 is 3 marks)

- 22 The time-series graph gives some information about the number of pairs of shoes sold in a shoe shop in the first six months of 2014.



The sales target for the first six months of 2014 was to sell a mean of 96 pairs of shoes per month.

Did the shoe shop meet this sales target?

You must show how you get your answer.

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate graphical representation involving discrete, continuous and grouped data and appropriate measures of central tendency (S4)
interpret line graphs for time series data and know their appropriate use (S2)

AO2
2.1a – make deductions to draw conclusions from mathematical information (1 mark)
2.3a – interpret information accurately (1 mark)
AO1
1.3a – accurately carry out routine procedures (1 mark)

Common question across both tiers

(Total for Question 22 is 3 marks)

23 The grouped frequency table gives information about the heights of 30 students.

Height (h cm)	Frequency
$130 < h \leq 140$	1
$140 < h \leq 150$	7
$150 < h \leq 160$	8
$160 < h \leq 170$	10
$170 < h \leq 180$	4

(a) Write down the modal class interval.

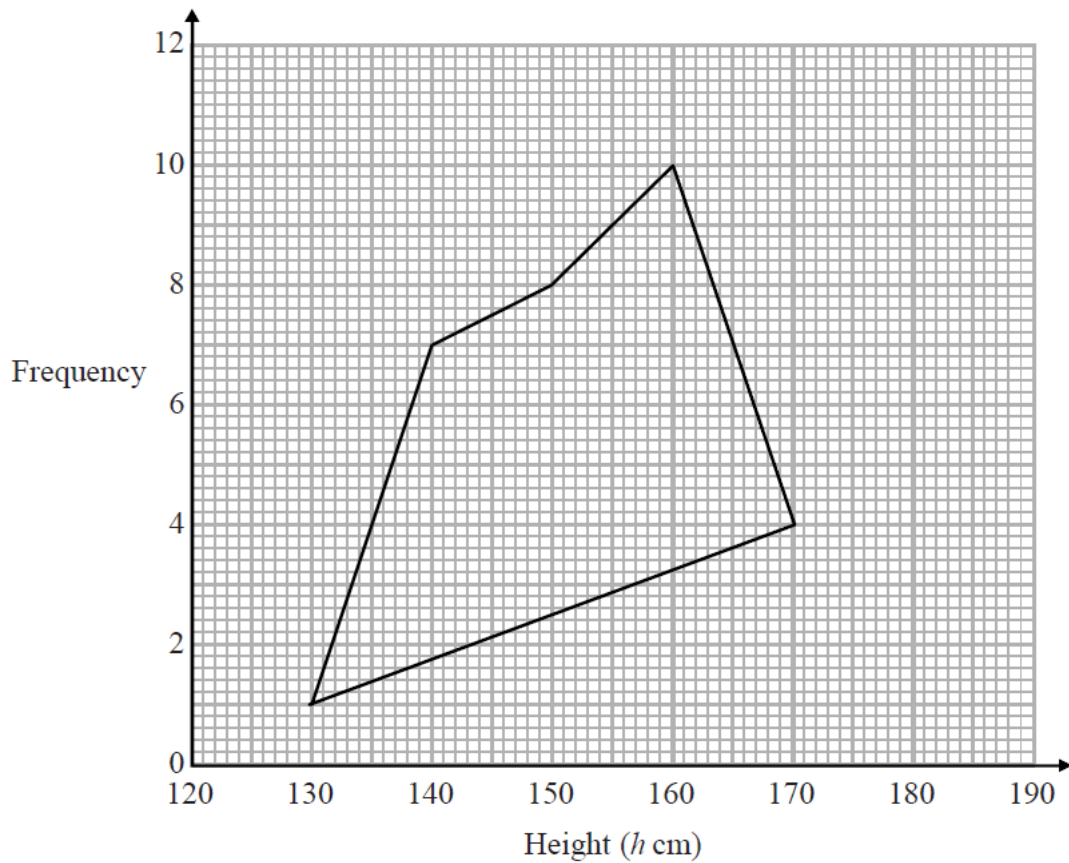
interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (S4)

AO1
1.1 – accurately recall facts, terminology and definitions (1 mark)

Common question across both tiers

(1)

This incorrect frequency polygon has been drawn for the information in the table.



(b) Write down two things wrong with this incorrect frequency polygon.

interpret and construct tables, charts and diagrams and know their appropriate use (S2)

AO2
2.5b – critically evaluate a given way of presenting information (2 marks)

Common question across both tiers

(2)

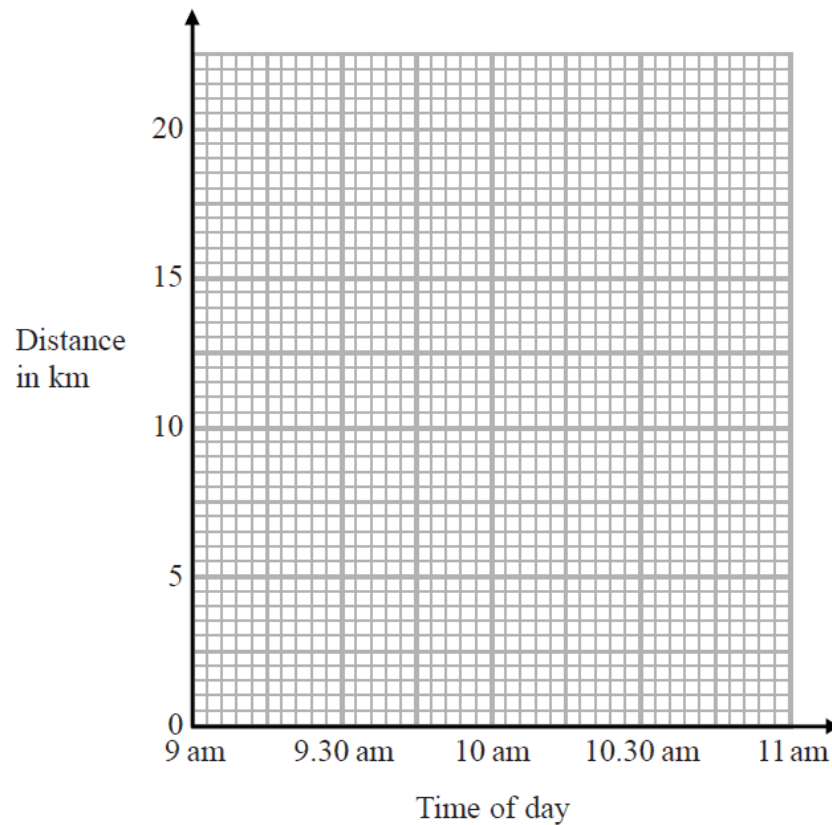
(Total for Question 23 is 3 marks)

24 At 9 am, Bradley began a journey on his bicycle.

From 9 am to 9.36 am, he cycled at an average speed of 15 km/h.

From 9.36 am to 10.45 am, he cycled a further 8 km.

(a) Draw a travel graph to show Bradley's journey.



plot and interpret graphs in real contexts to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration (A14)
use compound units such as speed (R11)

AO2

2.3a – interpret information accurately
(1 mark)

2.3b – communicate information accurately
(2 marks)

Common question across both tiers

(3)

Set 1 Paper 2F

From 10.45 am to 11 am, Bradley cycled at an average speed of 18 km/h.

(b) Work out the distance Bradley cycled from 10.45 am to 11 am.

use compound units such as speed (R11)

AO1

1.3a – accurately carry out routine procedures
(2 marks)

Common question across both tiers

(2)

(Total for Question 24 is 5 marks)

25 Toby invested £7500 for 2 years in a savings account.

He was paid 4% per annum compound interest.

How much money did Toby have in his savings account at the end of 2 years?

set up, solve and interpret the answers in growth and decay problems, including compound interest (R16)

AO1

1.3a – accurately carry out routine procedures
(2 marks)

New to Foundation

Common question across both tiers

(Total for Question 25 is 2 marks)

- 26** Becky has some marbles.
Chris has two times as many marbles as Becky.
Dan has seven more marbles than Chris.

They have a total of 57 marbles.

Dan says,

“If I give some marbles to Becky, each of us will have the same number of marbles.”

Is Dan correct?

You must show how you get your answer.

translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution (A21)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

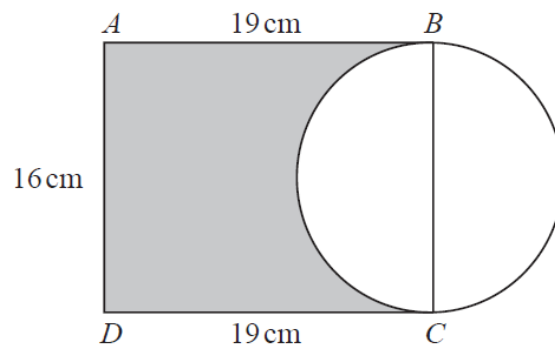
AO2

2.1a – make deductions to draw conclusions from mathematical information (1 mark)

Common question across both tiers

(Total for Question 26 is 3 marks)

27 Here is a diagram showing a rectangle, $ABCD$, and a circle.



BC is a diameter of the circle.

Calculate the percentage of the area of the rectangle that is shaded.

Give your answer correct to 1 decimal place.

know the formulae for area of a circle;
 calculate: areas of circles and composite shapes (G17)
 express one quantity as a percentage of another (R9)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (3 marks)

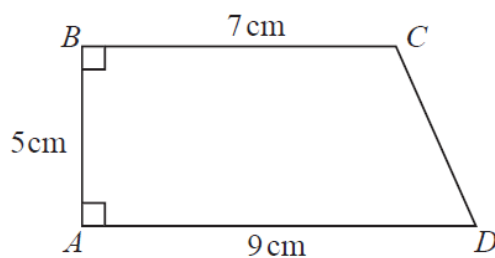
AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

Common question across both tiers

(Total for Question 27 is 4 marks)

28 $ABCD$ is a trapezium.



A square has the same perimeter as this trapezium.

Work out the area of the square.

Give your answer correct to 3 significant figures.

know the formulae for: Pythagoras' theorem;
apply to find angles and lengths in
right-angled triangles in two-dimensional
figures (G20)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (3 marks)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 28 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

Set 1 Paper 3F

- 1 Write the number 5689 correct to the nearest thousand.

round numbers and measures to an appropriate degree of accuracy (N15)

AO1
1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 1 is 1 mark)

- 2 Work out $\frac{30+12}{5+3}$

recognise and use relationships between operations; use conventional notation for priority of operations, including brackets, powers, roots and reciprocals (N3)

AO1
1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 2 is 1 mark)

- 3 Work out the reciprocal of 0.125.

recognise and use relationships between operations; use conventional notation for priority of operations, including brackets, powers, roots and reciprocals (N3)

AO1
1.2 – use and interpret notation correctly (1 mark)

(Total for Question 3 is 1 mark)

4 Here is a list of numbers.

1 2 5 6 12

From the list, write down

- (i) a multiple of 4
- (ii) a prime number.

use the concepts and vocabulary of prime numbers, factors and multiples (N4)

AO1
1.1 – accurately recall facts, terminology and definitions (2 marks)

(Total for Question 4 is 2 marks)

5 There are 1.5 litres of water in a bottle.

There are 250 millilitres of water in another bottle.

Work out the total amount of water in the two bottles.

change freely between related standard units in numerical contexts (R1)

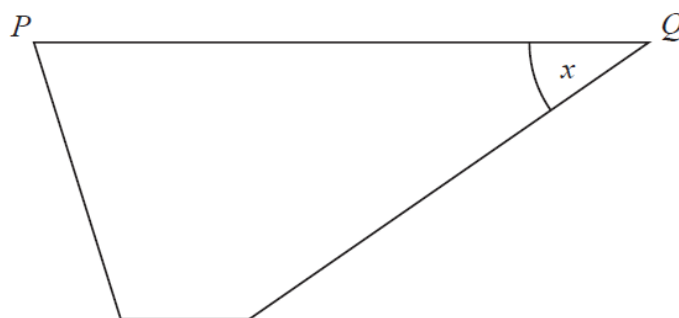
AO3
3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

AO1
1.1 – accurately recall facts, terminology and definitions (1 mark)

(Total for Question 5 is 3 marks)

6 Here is a trapezium.

This diagram is accurately drawn.



(a) Measure the length of the line PQ .

(1)

(b) Measure the size of the angle marked x .

(1)

measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings (G15)

AO1
1.3a – accurately carry out routine procedures (2 marks)

(Total for Question 6 is 2 marks)

7 (a) Solve $f + 2f + f = 20$

(1)

(b) Solve $18 - m = 6$

(1)

solve linear equations in one unknown algebraically (A17)

AO1
1.3a – accurately carry out routine procedures (2 marks)

(c) Simplify $d^2 \times d^3$

simplify and manipulate algebraic expressions by simplifying expressions involving sums, products and powers, including the laws of indices (A4)

AO1
1.3a – accurately carry out routine procedures (1 mark)

(1)

(Total for Question 7 is 3 marks)

- 8 Jayne writes down the following

$$3.4 \times 5.3 = 180.2$$

Without doing the exact calculation, explain why Jayne's answer cannot be correct.

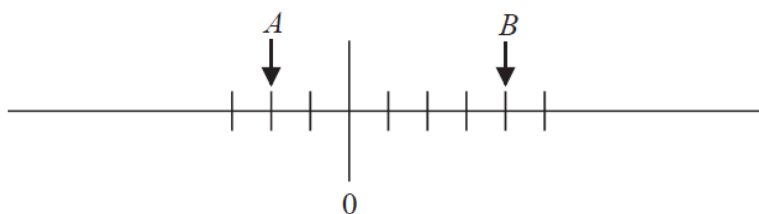
estimate answers (N14)

AO3

3.4a – evaluate methods used (1 mark)

(Total for Question 8 is 1 mark)

- 9 The two numbers, A and B , are shown on a scale.



The difference between A and B is 48.

Work out the value of A and the value of B .

apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations) (R5)
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AO3

3.1b – translate problems in mathematical contexts into a series of processes (2 marks)

AO1

1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 9 is 3 marks)

10 Complete this table of values.

n	$3n + 2$
12
.....	47

substitute numerical values into formulae and expressions (A2)
translate simple situations or procedures into algebraic expressions or formulae; derive an equation, solve the equation(s) and interpret the solution (A21)

AO1

1.3a – accurately carry out routine procedures (1 mark)

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (1 mark)

(Total for Question 10 is 3 marks)

11 The same number is missing from each box.

$$\square \times \square \times \square = 343$$

(a) Find the missing number.

use positive integer powers and associated real roots, recognise powers of 2, 3, 4, 5 (N6)

AO1
1.3a – accurately carry out routine procedures (1 mark)

(1)

(b) Work out 4^4 .

use positive integer powers and associated real roots, recognise powers of 2, 3, 4, 5 (N6)

AO1
1.2 – use and interpret notation correctly (1 mark)

(1)

(Total for Question 11 is 2 marks)

12 Here are two numbers.

29 37

Nadia says both of these numbers can be written as the **sum** of two square numbers.

Is Nadia correct?

You must show how you get your answer.

use positive integer powers and associated real roots, recognise powers of 2, 3, 4, 5 (N6)

AO1

1.1 – accurately recall facts, terminology and definitions (3 marks)

(Total for Question 12 is 3 marks)

13 Here are the first three terms of a sequence.

32 26 20

Find the first two terms in the sequence that are less than zero.

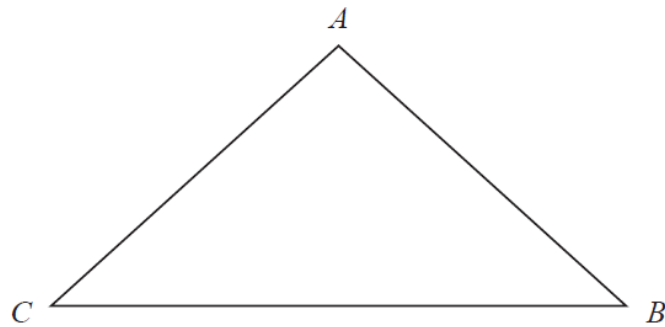
generate terms of a sequence from either a term-to-term or a position-to-term rule (A23)

AO2

2.1a – make deductions to draw conclusions from mathematical information (3 marks)

(Total for Question 13 is 3 marks)

14 Here is a triangle ABC .



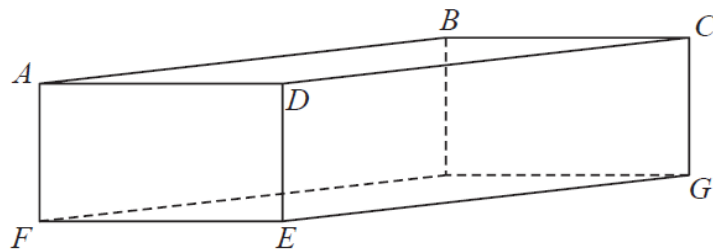
(a) Mark, with the letter y , the angle CBA .

use the standard conventions for labelling and referring to the sides and angles of triangles (G1)

AO1
1.2 – use and interpret notation correctly (1 mark)

(1)

Here is a cuboid.



Some of the vertices are labelled.

(b) Shade in the face $CDEG$.

identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres (G12)

AO1
1.2 – use and interpret notation correctly (1 mark)

(1)

(c) How many edges has a cuboid?

identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres (G12)

AO1

1.1 – accurately recall facts, terminology and definitions (1 mark)

(1)

(Total for Question 14 is 3 marks)

15 There are 5 grams of fibre in every 100 grams of bread.

A loaf of bread has a weight of 400 g.

There are 10 slices of bread in a loaf.

Each slice of bread has the same weight.

Work out the weight of fibre in one slice of bread.

understand and use proportion as equality of ratios (R7)
solve problems involving direct and inverse proportion, including graphical and algebraic representations (R10)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

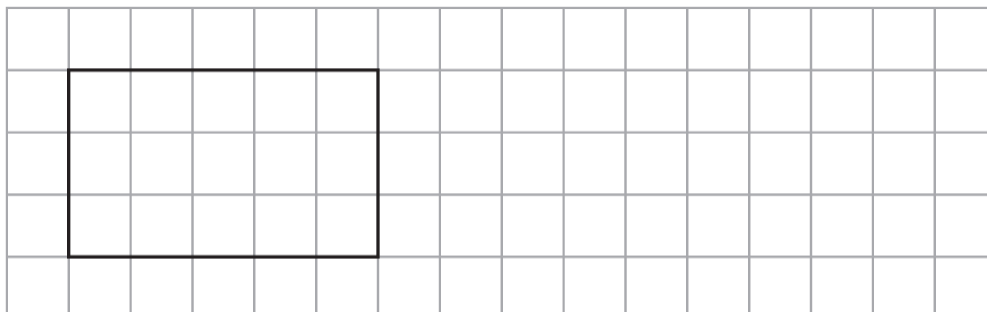
AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

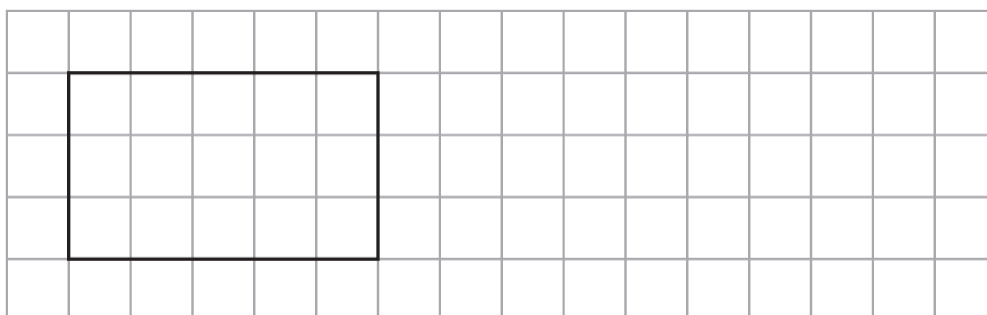
(Total for Question 15 is 3 marks)

16 Give an example to show that when a piece is cut off a rectangle the perimeter of the new shape

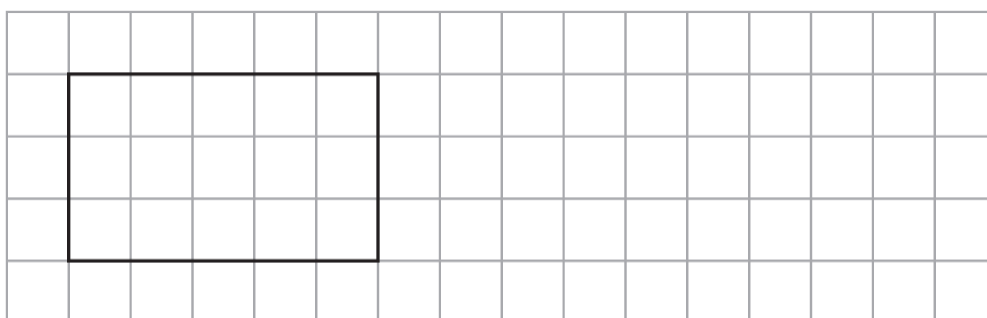
(i) is less than the perimeter of the rectangle,



(ii) is the same as the perimeter of the rectangle,



(iii) is greater than the perimeter of the rectangle.



calculate perimeters of 2D shapes (G17)

know and apply formulae to calculate: area of triangles, parallelograms, trapezia (G16)

AO2

2.3b – communicate information accurately (3 marks)

(Total for Question 16 is 3 marks)

17 ABC is an isosceles triangle.

When angle $A = 70^\circ$, there are 3 possible sizes of angle B .

(a) What are they?

derive and apply the properties and definitions of triangles using appropriate language (G4)
derive and use the sum of angles in a triangle (G3)

AO3
3.1b – translate problems in mathematical contexts into a series of processes (2 marks)
AO1
1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(3)

When angle $A = 120^\circ$, there is only one possible size of angle B .

(b) Explain why.

derive and use the sum of angles in a triangle (G3)

AO2
2.4a – present arguments (1 mark)

(1)

(Total for Question 17 is 4 marks)

Set 1 Paper 3F

18 In a breakfast cereal, 40% of the weight is fruit.

The rest of the cereal is oats.

(a) Write down the ratio of the weight of fruit to the weight of oats.

Give your answer in the form $1 : n$.

use ratio notation, including reduction to simplest form (R4)
compare two quantities using percentages (R9)
apply ratio to real contexts and problems (R5)

AO1
1.3a – accurately carry out routine procedures (1 mark)
AO2
2.3b – communicate information accurately (1 mark)

(2)

A different breakfast cereal is made using only fruit and bran.

The ratio of the weight of fruit to the weight of bran is $1 : 3$

(b) What fraction of the weight of this cereal is bran?

relate ratios to fractions and to linear functions (R8)

AO1
1.3a – accurately carry out routine procedures (1 mark)

(1)

(Total for Question 18 is 3 marks)

19 Boxes of chocolates cost £3.69 each.

A shop has an offer.

Boxes of chocolates

3 for the price of 2

Ali has £50

He is going to get as many boxes of chocolates as possible.

How many boxes of chocolates can Ali get?

use standard units of mass, length, time and money using decimal quantities where appropriate (N13)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 19 is 3 marks)

Set 1 Paper 3F

20 $\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$A = \{\text{multiples of } 2\}$

$A \cap B = \{2, 6\}$

$A \cup B = \{1, 2, 3, 4, 6, 8, 9, 10\}$

Draw a Venn diagram for this information.

enumerate sets and combinations of sets systematically, using Venn diagrams (P6)
use the concepts and vocabulary of multiples (N4)

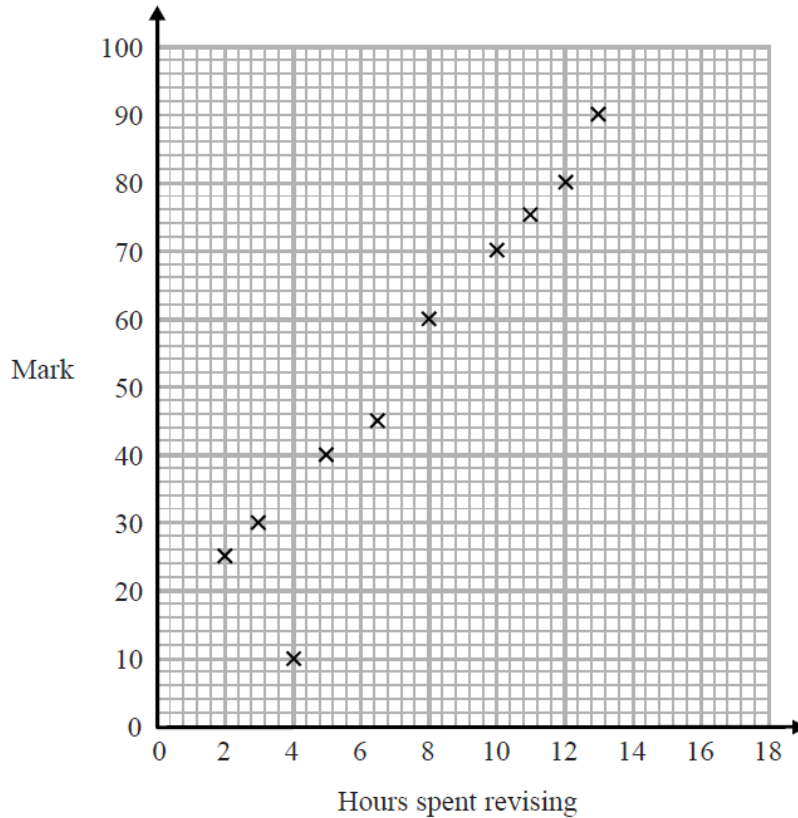
AO2
2.3a – interpret information accurately (2 marks)
2.3b – communicate information accurately (2 marks)

New to 1MA1

(Total for Question 20 is 4 marks)

21 The scatter diagram shows information about 10 students.

For each student, it shows the number of hours spent revising and the mark the student achieved in a Spanish test.



One of the points is an outlier.

(a) Write down the coordinates of the outlier.

use and interpret scatter graphs of bivariate data (S6)

AO2
2.3a – interpret information accurately
(1 mark)

Common question across both tiers

(1)

Set 1 Paper 3F

For all the **other** points

- (b) (i) draw the line of best fit,
- (ii) describe the correlation.

recognise correlation and know that it does not indicate causation; draw estimated lines of best fit (S6)

AO1

1.3a – accurately carry out routine procedures (1 mark)

1.1 – accurately recall facts, terminology and definitions (1 mark)

Common question across both tiers

(2)

A different student revised for 9 hours.

- (c) Estimate the mark this student got

make predictions; interpolate and extrapolate apparent trends while knowing the dangers of so doing (S6)

AO2

2.1b – make inferences to draw conclusions from mathematical information (1 mark)

Common question across both tiers

(1)

The Spanish test was marked out of 100.

Lucia says,

“I can see from the graph that had I revised for 18 hours I would have got full marks.”

(d) Comment on what Lucia says.

make predictions; interpolate and extrapolate apparent trends while knowing the dangers of so doing (S6)

AO2

2.5a – assess the validity of an argument (1 mark)

Common question across both tiers

(1)

(Total for Question 21 is 5 marks)

22 The length, L cm, of a line is measured as 13 cm correct to the nearest centimetre.

Complete the following statement to show the range of possible values of L .

..... $\leq L <$

round numbers and measures to an appropriate degree of accuracy; use inequality notation to specify simple error intervals due to truncation or rounding (N15)

AO1

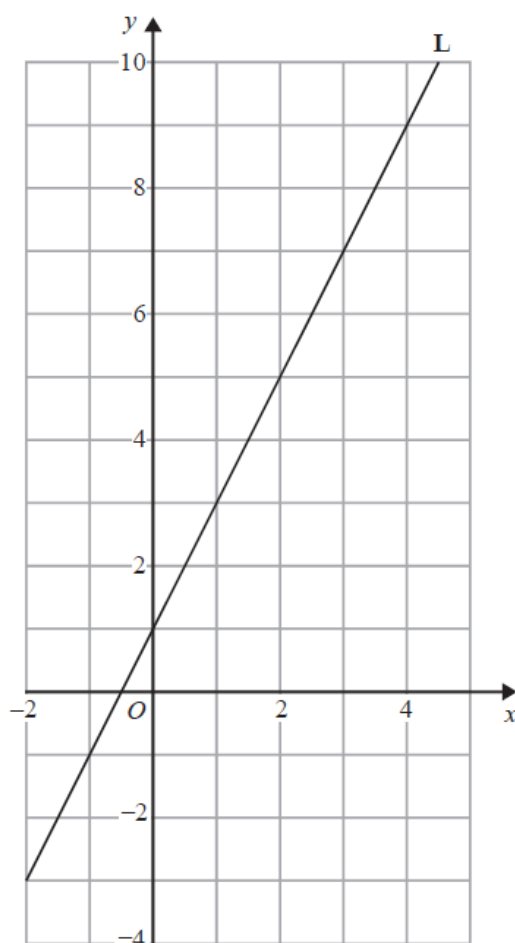
1.3a – accurately carry out routine procedures (2 marks)

New to 1MA1

Common question across both tiers

(Total for Question 22 is 2 marks)

23 Line L is drawn on the grid below.



Find an equation for the straight line L.

Give your answer in the form $y = mx + c$.

find the equation of the line through two given points or through one point with a given gradient (A9)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

AO2

2.3b – communicate information accurately (1 mark)

New to Foundation

Common question across both tiers

(Total for Question 23 is 3 marks)

24 Jenny works in a shop that sells belts.

The table shows information about the waist sizes of 50 customers who bought belts from the shop in May.

Belt size	Waist (w inches)	Frequency
Small	$28 < w \leq 32$	24
Medium	$32 < w \leq 36$	12
Large	$36 < w \leq 40$	8
Extra Large	$40 < w \leq 44$	6

(a) Calculate an estimate for the mean waist size.

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (S4)

AO1
1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

Common question across both tiers

(3)

Set 1 Paper 3F

Belts are made in sizes Small, Medium, Large and Extra Large.

Jenny needs to order more belts in June.

The modal size of belts sold is Small.

Jenny is going to order $\frac{3}{4}$ of the belts in size Small.

The manager of the shop tells Jenny she should **not** order so many Small belts.

(b) Who is correct, Jenny or the manager?

You must give a reason for your answer.

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (S4)

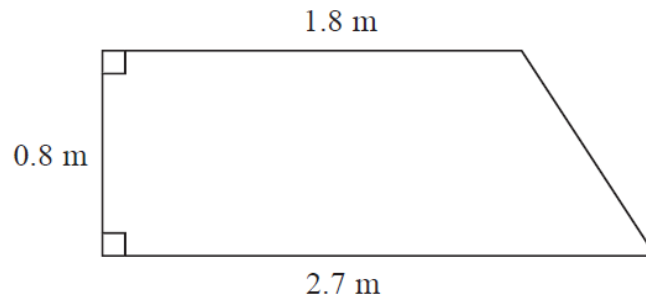
AO2
2.5a – assess the validity of an argument (2 marks)

Common question across both tiers

(2)

(Total for Question 24 is 5 marks)

25 The diagram shows part of a wall in the shape of a trapezium.



Karen is going to cover this part of the wall with tiles.

Each rectangular tile is 15 cm by 7.5 cm.

Tiles are sold in packs.

There are 9 tiles in each pack.

Karen divides the area of the wall by the area of a tile to work out an estimate for the number of tiles she needs to buy.

(a) Use Karen's method to work out an estimate for the number of packs of tiles she needs to buy.

know and apply formulae to calculate: area of triangles, parallelograms, trapezia (G16)

derive and apply the properties and definitions of special types of quadrilaterals (G4)

use standard units of mass, length, time, money and other measures using decimal quantities where appropriate (N13)

apply the four operations, including formal written methods, to integers and decimals; understand and use place value (N2)

change freely between related standard units (R1)

AO1
1.3b – accurately carry out set tasks requiring multi-step solutions (4 marks)

AO2
2.3a – interpret information accurately (1 mark)

Common question across both tiers

(5)

Set 1 Paper 3F

Karen is advised to buy 10% more tiles than she estimated.

Buying 10% more tiles will affect the number of the tiles Karen needs to buy.

She assumes she will need to buy 10% more packs of tiles.

(b) Is Karen's assumption correct?

You must show your working.

interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively; compare two quantities using percentages (R9)

AO3

3.1c – translate problems in non-mathematical contexts into a mathematical process (1 mark)

3.4 – Evaluate methods used and results obtained (1 mark)

Common question across both tiers

(2)

(Total for Question 25 is 7 marks)

26 Factorise $x^2 + 3x - 4$

simplify and manipulate algebraic expressions by factorising quadratic expressions of the form $x^2 + bx + c$ (A4)

AO1

1.3a – accurately carry out routine procedures (2 marks)

New to Foundation

Common question across both tiers

(Total for Question 26 is 2 marks)

27 Here are the equations of four straight lines.

Line A $y = 2x + 4$

Line B $2y = x + 4$

Line C $2x + 2y = 4$

Line D $2x - y = 4$

Two of these lines are parallel.

Write down the two parallel lines.

use the form $y = mx + c$ to identify parallel lines (A9)

AO2

2.3a – interpret information accurately (1 mark)

New to Foundation

Common question across both tiers

(Total for Question 27 is 1 mark)

28 The densities of two different liquids A and B are in the ratio 19 : 22

The mass of 1 cm³ of liquid B is 1.1 g.

5 cm³ of liquid A is mixed with 15 cm³ of liquid B to make 20 cm³ of liquid C.

Work out the density of liquid C.

apply ratio to real contexts and problems (R5)
apply the four operations, including formal written methods, to integers and decimals; understand and use place value (N2)
solve problems involving direct and inverse proportion (R10)

AO3
3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (3 marks)
AO1
1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

New to Foundation

(Total for Question 28 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS

Set 1 Paper 1H

- 1 The diagram shows a right-angled triangle.



All the angles are in degrees.

Work out the size of the smallest angle of the triangle.

translate simple situations or procedures into algebraic expressions or formulae; derive an equation, solve the equation(s) and interpret the solution (A21)

derive and use the sum of angles in a triangle (G3)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (2 marks)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

Common question across both tiers

(Total for Question 1 is 3 marks)

- 2 A box exerts a force of 140 newtons on a table.
The pressure on the table is 35 newtons/m².

Calculate the area of the box that is in contact with the table.

$$P = \frac{F}{A}$$

p = pressure
 F = force
 A = area

use compound units such as speed, rates of pay, unit pricing, density and pressure (R11)

substitute numerical values into formulae and expressions, including scientific formulae (A2)

AO1

1.2 – use and interpret notation correctly (1 mark)

1.3a – accurately carry out routine procedures (2 marks)

New to 1MA1

Common question across both tiers

(Total for Question 2 is 3 marks)

Set 1 Paper 1H

- 3 There are only red counters, blue counters, green counters and yellow counters in a bag.

The table shows the probabilities of picking at random a red counter and picking at random a yellow counter.

Colour	red	blue	green	yellow
Probability	0.24			0.32

The probability of picking a blue counter is the same as the probability of picking a green counter.

Complete the table.

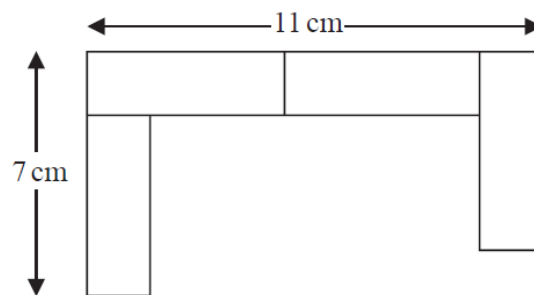
apply the property that the probabilities of an exhaustive set of outcomes sum to one (P4)

AO3
3.1b – translate problems in mathematical contexts into a series of processes (1 mark)
AO1
1.3a – accurately carry out routine procedures (1 mark)

Common question across both tiers

(Total for Question 3 is 2 marks)

- 4 A pattern is made using identical rectangular tiles.



Find the total area of the pattern.

translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution (A21)
 calculate areas of composite shapes (G17)

AO3
 3.1b – translate problems in mathematical contexts into a series of processes (2 marks)
 3.2 – Make and use connections between different parts of mathematics (1 mark)
 AO1
 1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

Common question across both tiers

(Total for Question 4 is 4 marks)

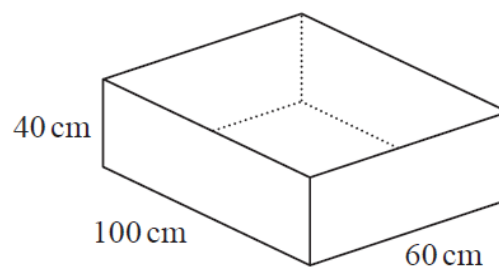
Set 1 Paper 1H

- 5 The diagram shows a sand pit.
The sand pit is in the shape of a cuboid.

Sally wants to fill the sand pit with sand.

A bag of sand costs £2.50.

There are 8 litres of sand in each bag.



Sally says,

“The sand will cost less than £70.”

Show that Sally is wrong.

know and apply formulae to calculate volume of cuboids (G16)
change freely between related standard units in numerical contexts (R1)
solve problems involving direct and inverse proportion (R10)
apply the four operations, including formal written methods, to integers and decimals; understand and use place value (N2)

AO2
2.2 – Construct chains of reasoning to achieve a given result (3 marks)
AO3
3.1b – translate problems in mathematical contexts into a series of processes (1 mark)
AO1
1.3a – accurately carry out routine procedures (1 mark)

Common question across both tiers

(Total for Question 5 is 5 marks)

- 6 Four friends each throw a biased coin a number of times.

The table shows the number of heads and the number of tails each friend got.

	Ben	Helen	Paul	Sharif
heads	34	66	80	120
tails	8	12	40	40

The coin is to be thrown one more time.

- (a) Which of the four friends' results will give the best estimate for the probability that the coin will land heads?

Justify your answer.

understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size (P5)

AO3

3.4a – evaluate methods used (1 mark)

Common question across both tiers

(1)

Paul says,

“With this coin you are twice as likely to get heads as to get tails.”

- (b) Is Paul correct?

Justify your answer.

relate relative expected frequencies to theoretical probability, using appropriate language and the 0-1 probability scale (P3)

AO3

3.4b – evaluate results obtained (2 marks)

Common question across both tiers

(2)

Set 1 Paper 1H

The coin is to be thrown twice.

- (c) Use all the results in the table to work out an estimate for the probability that the coin

will land heads both times.

calculate the probability of independent and dependent combined events (P8)

AO2

2.1b – make inferences to draw conclusions from mathematical information (1 mark)

AO1

1.3a – accurately carry out routine procedures (1 mark)

Common question across both tiers

(2)

(Total for Question 6 is 5 marks)

- 7 (a) Write down the exact value of $\cos 30^\circ$

know the exact values of $\sin \theta$ and $\cos \theta$ for $\theta = 0^\circ, 30^\circ, 45^\circ, 60^\circ$ and 90°
(G21)

AO1

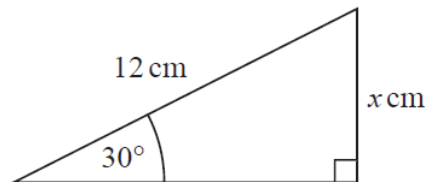
1.1 – accurately recall facts, terminology and definitions (1 mark)

New to IMA1

Common question across both tiers

(1)

- (b)



Given that $\sin 30^\circ = 0.5$,
work out the value of x .

know the formulae for the trigonometric ratios; apply them to find angles and lengths in right-angled triangles in two-dimensional figures
(G20)

AO1

1.3a – accurately carry out routine procedures (1 mark)

New to IMA1

Common question across both tiers`

(2)

(Total for Question 7 is 3 marks)

Set 1 Paper 1H

- 8 The mass of Jupiter is 1.899×10^{27} kg.
The mass of Saturn is 0.3 times the mass of Jupiter.

- (a) Work out an estimate for the mass of Saturn.
Give your answer in standard form.

(3)

- (b) Give evidence to show whether your answer to (a) is an underestimate or an overestimate.

(1)

estimate answers; check calculations using approximation and estimation, including answers obtained using technology (N14)
calculate with and interpret standard form (N9)

AO1
1.3a – accurately carry out routine procedures (3 marks)
AO3
3.4b – evaluate results obtained (1 mark)

(Total for Question 8 is 4 marks)

9 Walkden Reds is a basketball team.

At the end of 11 games, their mean score was 33 points per game.

At the end of 10 games, their mean score was 2 points higher.

Jordan says,

“Walkden Reds must have scored 13 points in their 11th game.”

Is Jordan right?

You must show how you get your answer.

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (S4)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

3.3 – Interpret results in the context of the given problem (1 mark)

(Total for Question 9 is 3 marks)

Set 1 Paper 1H

10 There are some red counters and some yellow counters in a bag.

There are 30 yellow counters in the bag.

The ratio of the number of red counters to the number of yellow counters is 1 : 6

(a) Work out the number of red counters in the bag.

(2)

Riza puts some more red counters into the bag.

The ratio of the number of red counters to the number of yellow counters is now 1 : 2

(b) How many red counters does Riza put into the bag?

(2)

divide a given quantity into two parts in a given part:part or part:whole ratio; express the division of a quantity into two parts as a ratio (R5)

AO1

1.3a – accurately carry out routine procedures (3 marks)

AO3

3.1a – translate problems in mathematical contexts into a process (1 mark)

(Total for Question 10 is 4 marks)

11 Write down the value of $125^{\frac{2}{3}}$

calculate with roots, and with integer and fractional indices (N7)

AO1

1.2 – use and interpret notation correctly (1 mark)

(Total for Question 11 is 1 mark)

12 Sean drives from Manchester to Gretna Green.

He drives at an average speed of 50 mph for the first 3 hours of his journey.

He then has 150 miles to drive to get to Gretna Green.

Sean drives these 150 miles at an average speed of 30 mph.

Sean says,

“My average speed from Manchester to Gretna Green was 40 mph.”

Is Sean right?

You must show how you get your answer.

use compound units such as speed, rates of pay, unit pricing, density and pressure (R11)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (3 marks)

3.3 – Interpret results in the context of the given problem (1 mark)

(Total for Question 12 is 4 marks)

13 $m = \sqrt{\frac{k^3 + 1}{4}}$

Make k the subject of the formula.

understand and use standard mathematical formulae; rearrange formulae to change the subject (A5)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

(Total for Question 13 is 3 marks)

14 Solve $\frac{x+2}{3x} + \frac{x-2}{2x} = 3$

solve linear equations in one unknown algebraically (A17)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

(Total for Question 14 is 3 marks)

15 Show that $\frac{2x^2 - 3x - 5}{x^2 + 6x + 5}$ can be written in the form $\frac{ax+b}{cx+d}$ where a, b, c and d are integers.

simplify and manipulate algebraic expressions (including those involving **algebraic fractions**) by factorising quadratic expressions of the form $x^2 + bx + c$; **factorising quadratic expressions of the form $ax^2 + bx + c$** (A4)

AO2

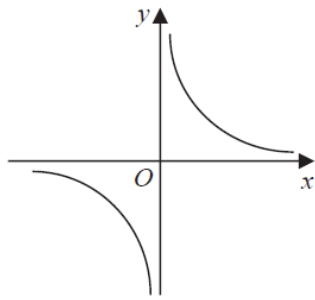
2.2 – Construct chains of reasoning to achieve a given result (2 marks)

AO1

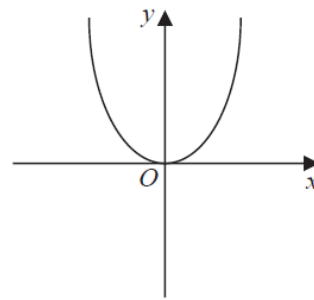
1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 15 is 3 marks)

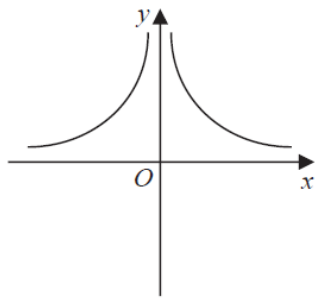
16 These graphs show four different proportionality relationships between y and x .



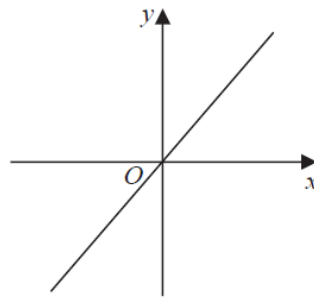
Graph A



Graph B



Graph C



Graph D

Match each graph with a statement in the table below.

Proportionality relationship	Graph letter
y is directly proportional to x	
y is inversely proportional to x	
y is proportional to the square of x	
y is inversely proportional to the square of x	

recognise and interpret graphs that illustrate direct and inverse proportion (R14)

AO2

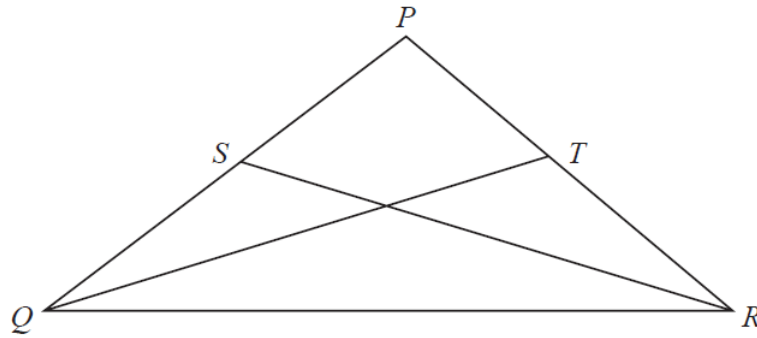
2.3a – interpret information accurately (1 mark)

2.3b – communicate information accurately (1 mark)

New to 1MA1

(Total for Question 16 is 2 marks)

17



$PQ = PR$.

S is the midpoint of PQ .

T is the midpoint of PR .

Prove triangle QTR is congruent to triangle RSQ .

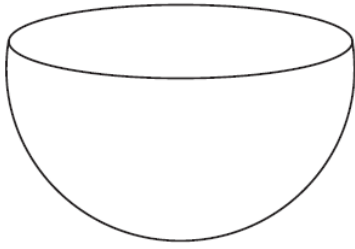
use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS) (G5)

AO2

2.4b – present proofs (3 marks)

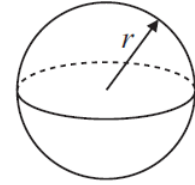
(Total for Question 17 is 3 marks)

18 The diagram shows a solid hemisphere.



$$\text{Volume of sphere} = \frac{4}{3} \pi r^3$$

$$\text{Surface area of sphere} = 4\pi r^2$$



The volume of the hemisphere is $\frac{250}{3} \pi$

Work out the exact total surface area of the solid hemisphere.

Give your answer as a multiple of π .

know the formulae: surface area and volume of spheres, pyramids, cones and composite solids (G17)

calculate exactly with fractions and multiples of π (N8)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (3 marks)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 18 is 4 marks)

19 Simplify fully $\frac{(6-\sqrt{5})(6+\sqrt{5})}{\sqrt{31}}$

You must show your working.

simplify surd expressions involving squares and rationalise denominators (N8)

AO2

2.2 – Construct chains of reasoning to achieve a given result (2 marks)

AO1

1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 19 is 3 marks)

20 Prove algebraically that the difference between the squares of any two consecutive integers is equal to the sum of these two integers.

simplify and manipulate algebraic expressions by: expanding products of two or more binomials and factorising quadratic expressions of the form $x^2 + bx + c$, including the difference of two squares (A4)

AO2

2.4b – present proofs (4 marks)

(Total for Question 20 is 4 marks)

21 There are 10 pens in a box.

There are x red pens in the box.

All the other pens are blue.

Jack takes at random two pens from the box.

Find an expression, in terms of x , for the probability that Jack takes one pen of each colour.

Give your answer in its simplest form.

calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions (P8)

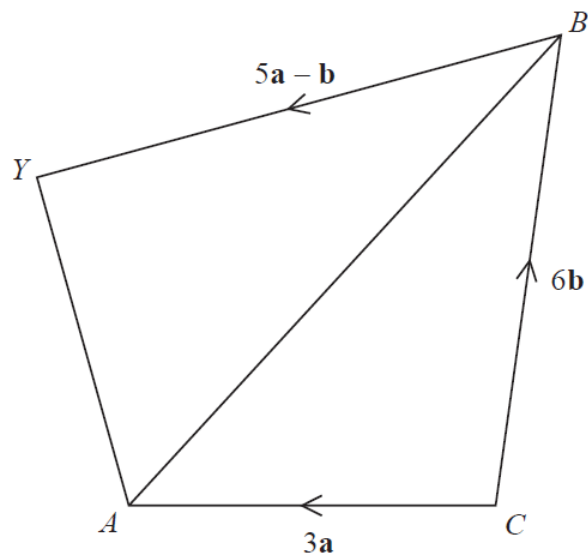
AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (4 marks)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 21 is 5 marks)



$CAYB$ is a quadrilateral.

$$\vec{CA} = 3\mathbf{a}$$

$$\vec{CB} = 6\mathbf{b}$$

$$\vec{BY} = 5\mathbf{a} - \mathbf{b}$$

X is the point on AB such that $AX : XB = 1 : 2$

Prove that $\vec{CX} = \frac{2}{5}\vec{CY}$

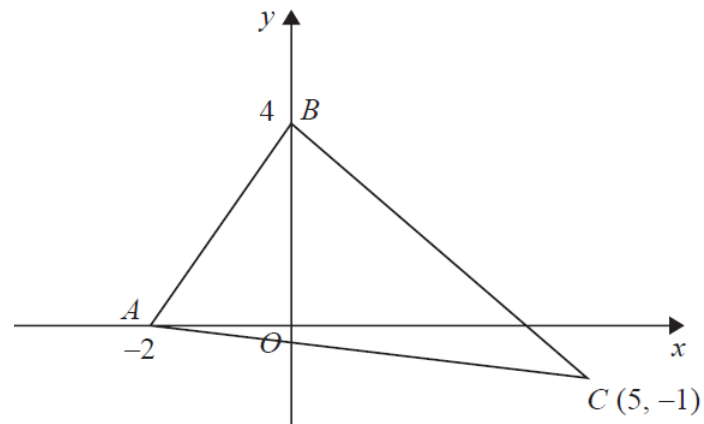
apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors; use vectors to construct geometric arguments and proofs (G25)

AO2

2.4b – present proofs (5 marks)

(Total for Question 22 is 5 marks)

23



Find an equation of the line that passes through C and is perpendicular to AB .

use the form $y = mx + c$ to identify **parallel and perpendicular lines**; find the equation of the line through two given points or through one point with a given gradient (A9)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (2 marks)

AO1

1.1 – accurately recall facts, terminology and definitions (1 mark)

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 23 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS

Set 1 Paper 2H

- 1 Make t the subject of the formula $w = 3t + 11$

understand and use standard mathematical formulae; rearrange formulae to change the subject (A5)

AO1
1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

Common question across both tiers

(Total for Question 1 is 2 marks)

- 2 Three companies sell the same type of furniture.

The price of the furniture from Pooles of London is £1480

The price of the furniture from Jardins of Paris is €1980

The price of the furniture from Outways of New York is \$2250

The exchange rates are

$$£1 = €1.34$$

$$£1 = \$1.52$$

Which company sells this furniture at the lowest price?

You must show how you get your answer.

use standard units of mass, length, time, money and other measures using decimal quantities where appropriate (N13)

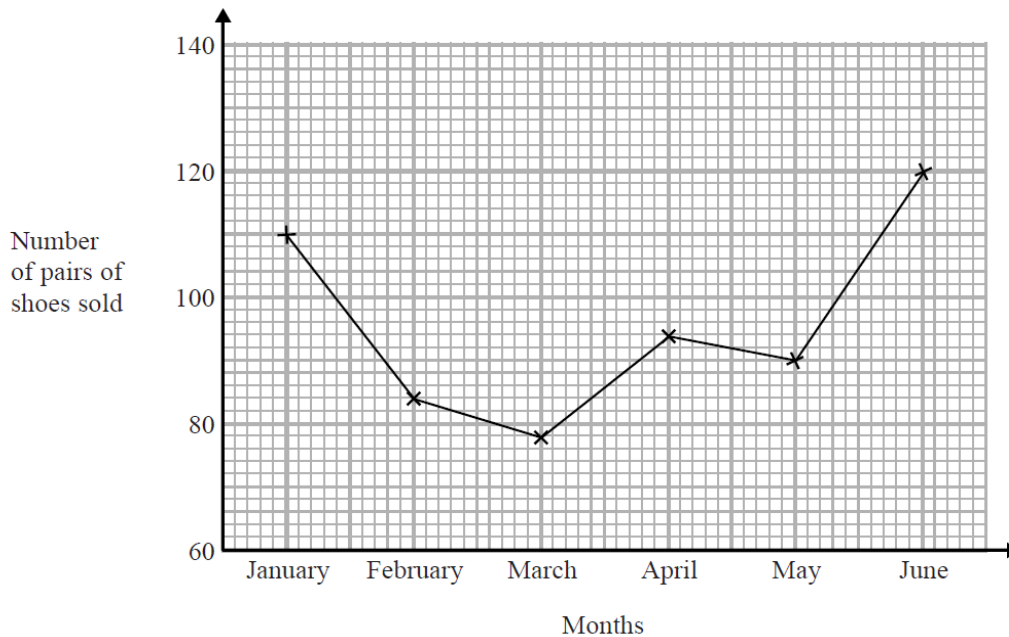
apply the four operations, including formal written methods, to integers and decimals understand and use place value (N2)

AO3
3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)
3.3 – Interpret results in the context of the given problem (1 mark)

Common question across both tiers

(Total for Question 2 is 3 marks)

- 3 The time-series graph gives some information about the number of pairs of shoes sold in a shoe shop in the first six months of 2014.



The sales target for the first six months of 2014 was to sell a mean of 96 pairs of shoes per month.

Did the shoe shop meet this sales target?

You must show how you get your answer.

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate graphical representation involving discrete, continuous and grouped data and appropriate measures of central tendency (S4)

interpret line graphs for time series data and know their appropriate use (S2)

AO2

2.1a – make deductions to draw conclusions from mathematical information (1 mark)

2.3a – interpret information accurately (1 mark)

AO1

1.3a – accurately carry out routine procedures (1 mark)

Common question across both tiers

(Total for Question 3 is 3 marks)

- 4 The grouped frequency table gives information about the heights of 30 students.

Height (h cm)	Frequency
$130 < h \leq 140$	1
$140 < h \leq 150$	7
$150 < h \leq 160$	8
$160 < h \leq 170$	10
$170 < h \leq 180$	4

- (a) Write down the modal class interval.

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (S4)

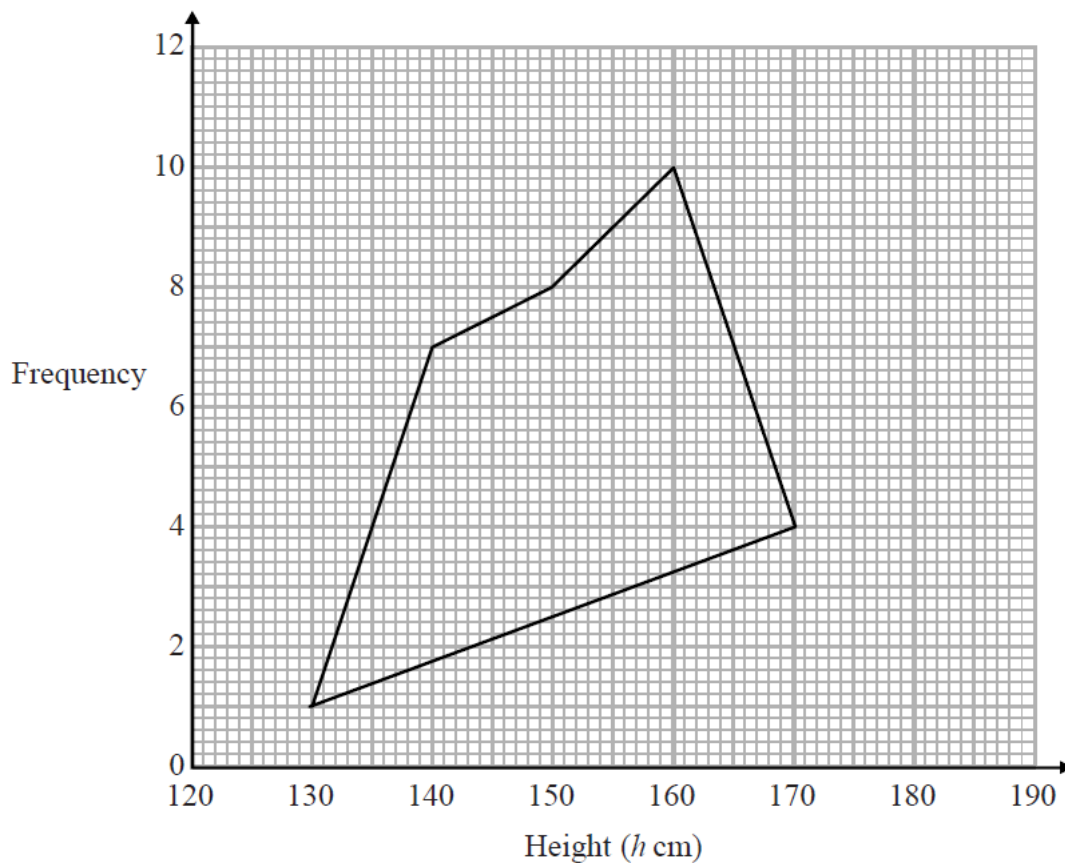
AO1

1.1 – accurately recall facts, terminology and definitions (1 mark)

Common question across both tiers

(1)

This incorrect frequency polygon has been drawn for the information in the table.



(b) Write down two things wrong with this incorrect frequency polygon.

(2)

interpret and construct tables, charts and diagrams and know their appropriate use (S2)

AO2

2.5b – critically evaluate a given way of presenting information (2 marks)

Common question across both tiers

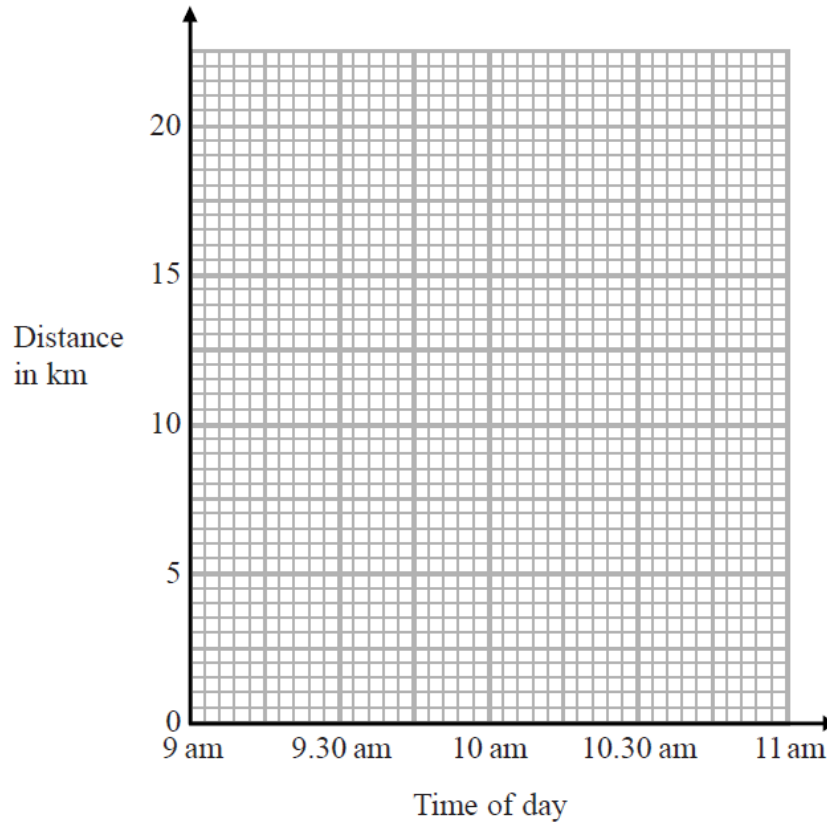
(Total for Question 4 is 3 marks)

5 At 9 am, Bradley began a journey on his bicycle.

From 9 am to 9.36 am, he cycled at an average speed of 15 km/h.

From 9.36 am to 10.45 am, he cycled a further 8 km.

(a) Draw a travel graph to show Bradley's journey.



plot and interpret graphs in real contexts to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration (A14)
 use compound units such as speed (R11)

AO2
 2.3a – interpret information accurately (1 mark)
 2.3b – communicate information accurately (2 marks)

Common question across both tiers

(3)

From 10.45 am to 11 am, Bradley cycled at an average speed of 18 km/h.

(b) Work out the distance Bradley cycled from 10.45 am to 11 am.

use compound units such as speed
(R11)

AO1
1.3a – accurately carry out routine
procedures (2 marks)

Common question across both tiers

(2)

(Total for Question 5 is 5 marks)

- 6 Toby invested £7500 for 2 years in a savings account.
He was paid 4% per annum compound interest.

How much money did Toby have in his savings account at the end of 2 years?

set up, solve and interpret the answers
in growth and decay problems,
including compound interest (R16)

AO1
1.3a – accurately carry out routine
procedures (2 marks)

Common question across both tiers

(Total for Question 6 is 2 marks)

Set 1 Paper 2H

- 7 Becky has some marbles.
Chris has two times as many marbles as Becky.
Dan has seven more marbles than Chris.

They have a total of 57 marbles.

Dan says,

“If I give some marbles to Becky, each of us will have the same number of marbles.”

Is Dan correct?

You must show how you get your answer.

translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution
(A21)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

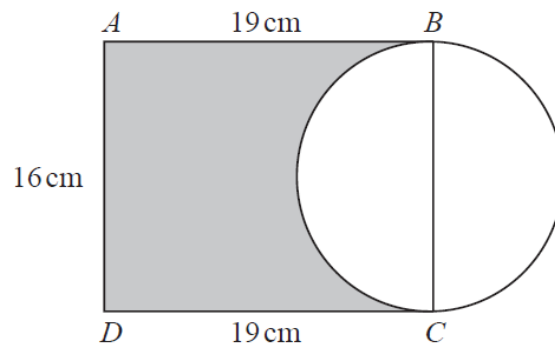
AO2

2.1a – make deductions to draw conclusions from mathematical information (1 mark)

Common question across both tiers

(Total for Question 7 is 3 marks)

- 8 Here is a diagram showing a rectangle, $ABCD$, and a circle.



BC is a diameter of the circle.

Calculate the percentage of the area of the rectangle that is shaded.

Give your answer correct to 1 decimal place.

know the formulae for area of a circle;
calculate: areas of circles and
composite shapes (G17)
express one quantity as a percentage of
another (R9)

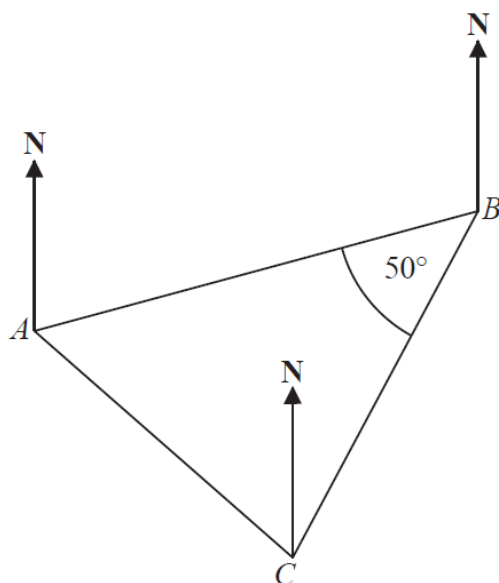
AO3
3.1b – translate problems in
mathematical contexts into a series of
processes (3 marks)
AO1
1.3b – accurately carry out set tasks
requiring multi-step solutions (1 mark)

Common question across both tiers

(Total for Question 8 is 4 marks)

Set 1 Paper 2H

- 9 The diagram shows the positions of three points, A , B and C , on a map.



The bearing of B from A is 070°

Angle ABC is 50°

$AB = CB$

Work out the bearing of C from A .

measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings (G15)
derive and use the sum of angles in a triangle (G3)

AO1

1.2 – use and interpret notation correctly (1 mark)

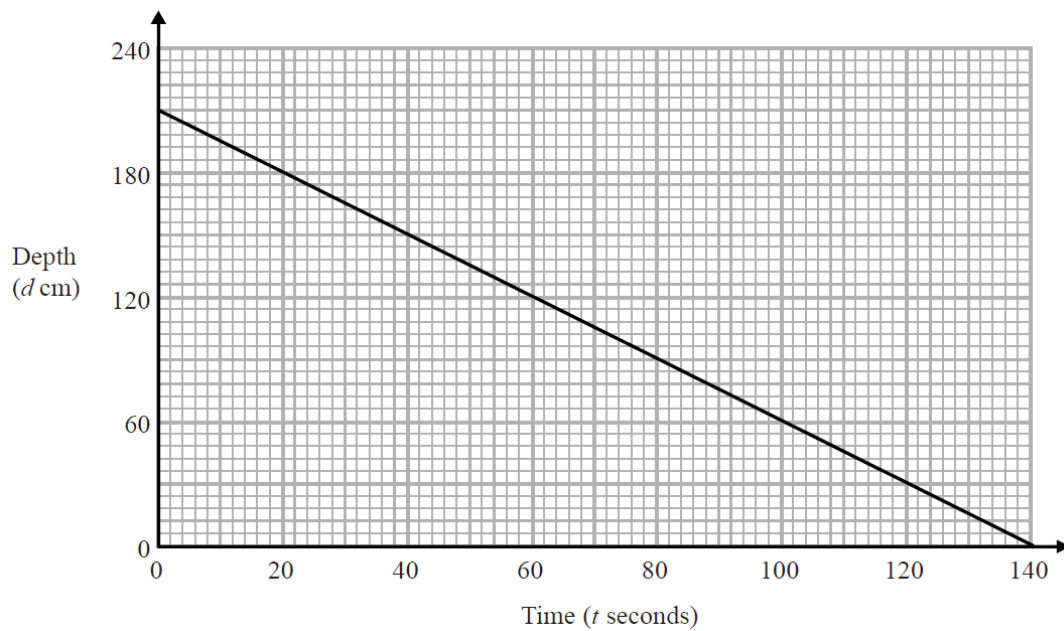
1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (1 mark)

(Total for Question 9 is 3 marks)

10 The graph shows the depth, d cm, of water in a tank after t seconds.



(a) Find the gradient of this graph.

interpret the gradient of a straight line graph as a rate of change (R14)

AO2
2.3a – interpret information accurately (1 mark)

AO1
1.3a – accurately carry out routine procedures (1 mark)

New to IMA1

(2)

(b) Explain what this gradient represents.

interpret the gradient of a straight line graph as a rate of change (R14)

AO2
2.3a – interpret information accurately (1 mark)

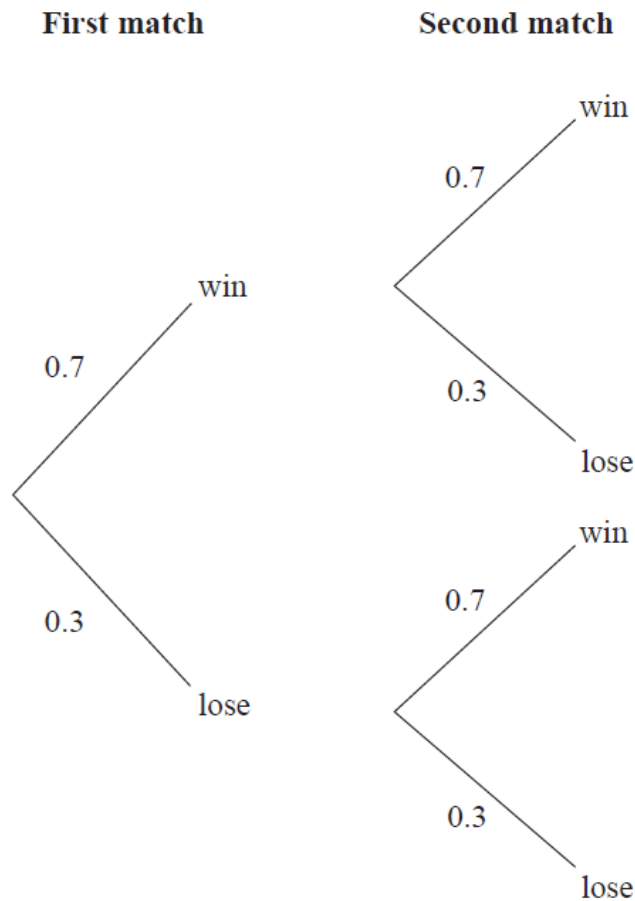
New to IMA1

(1)

(Total for Question 10 is 3 marks)

11 Finlay plays two tennis matches.

The probability that he will win a match and the probability that he will lose a match are shown in the probability tree diagram.



(a) Work out the probability that Finlay wins both matches.

calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions (P8)

AO1
1.3a – accurately carry out routine procedures (2 marks)

(2)

- (b) Work out the probability that Finlay loses at least one match.

calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions (P8)

apply the property that the probabilities of an exhaustive set of outcomes sum to one (P4)

AO1

1.3a – accurately carry out routine procedures (2 marks)

(2)

(Total for Question 11 is 4 marks)

- 12 (a) Find the reciprocal of 2.5.

recognise and use relationships between operations, including inverse operations (N3)

AO1

1.1 – accurately recall facts, terminology and definitions (1 mark)

(1)

- (b) Work out $\sqrt[3]{\frac{4.3 \times \tan 39^\circ}{23.4 - 6.06}}$

Give your answer correct to 3 significant figures.

use conventional notation for priority of operations, including brackets, powers, roots and reciprocals (N3)

calculate with roots (N7)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

(2)

(Total for Question 12 is 3 marks)

13 Show that

$$(3x - 1)(x + 5)(4x - 3) = 12x^3 + 47x^2 - 62x + 15$$

for all values of x .

simplify and manipulate algebraic expressions by collecting like terms and expanding products of two or more binomials (A4)

argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments and proofs (A6)

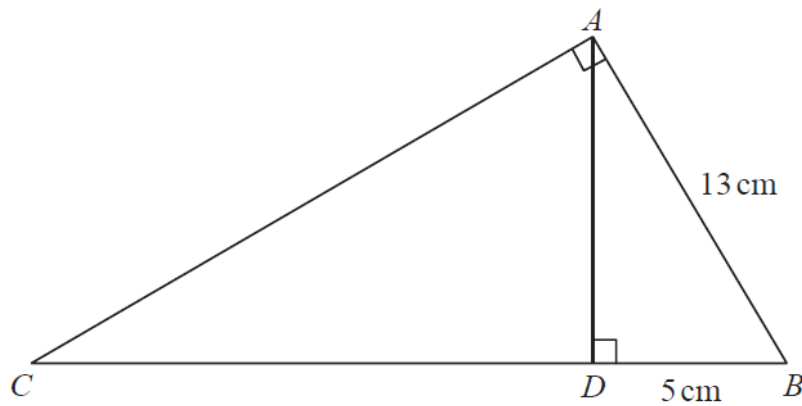
AO2

2.2 – Construct chains of reasoning to achieve a given result (3 marks)

New to IMA1

(Total of Question 13 is 3 marks)

14 ABC and ABD are two right-angled triangles.



Angle $BAC = \text{angle } ADB = 90^\circ$

$AB = 13 \text{ cm}$

$DB = 5 \text{ cm}$

Work out the length of CB .

apply the concepts of congruence and similarity, including the relationships between lengths, areas and volumes in similar figures (G19)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (2 marks)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 14 is 3 marks)

Set 1 Paper 2H

- 15 A pendulum of length L cm has time period T seconds.
 T is directly proportional to the square root of L .

The length of the pendulum is increased by 40%.

Work out the percentage increase in the time period.

understand that X is inversely proportional to Y is equivalent to X is proportional to $1/Y$; **construct and interpret equations that describe direct and inverse proportion** (R13)

AO3

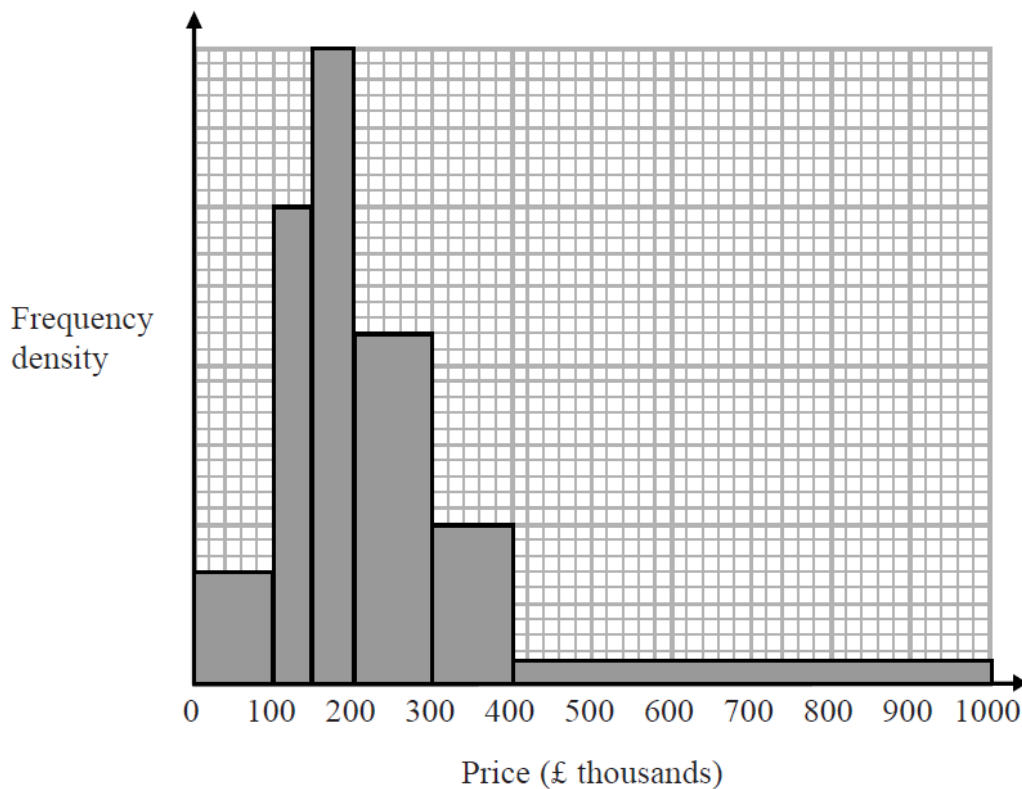
3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 15 is 3 marks)

16 The histogram gives information about house prices in a village in 2015.



20 houses in the village have a price between £300 000 and £400 000.

Work out the number of houses in the village with a price under £200 000.

construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use (S3)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (1 mark)

AO2

2.3a – interpret information accurately (1 mark)

AO1

1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 16 is 3 marks)

17 Here are the first 5 terms of a quadratic sequence.

1 3 7 13 21

Find an expression, in terms of n , for the n th term of this quadratic sequence.

deduce expressions to calculate the n th term of linear **and quadratic** sequences (A25)

AO2

2.1a – make deductions to draw conclusions from mathematical information (2 marks)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

New to 1MA1

(Total for Question 17 is 3 marks)

18 $f(x) = 3x^2 - 2x - 8$

Express $f(x + 2)$ in the form $ax^2 + bx$

interpret the succession of two functions as a ‘composite function’ (the use of formal function notation is expected) (A7)

AO2

2.2 – Construct chains of reasoning to achieve a given result (2 marks)

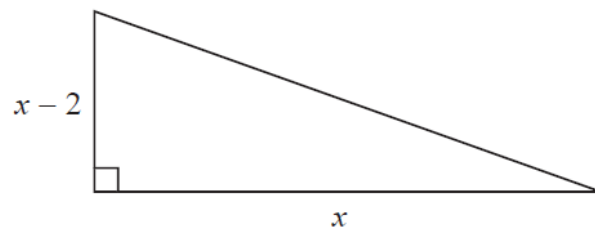
AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

New to 1MA1

(Total for Question 18 is 3 marks)

19 Here is a right-angled triangle.



All measurements are in centimetres.

The area of the triangle is 2.5 cm^2 .

Find the perimeter of the triangle.

Give your answer correct to 3 significant figures.

You must show all of your working.

translate simple situations or procedures into algebraic expressions or formulae; derive an equation, solve the equation(s) and interpret the solution (A21)

know and apply formulae to calculate:
area of triangles (G16)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (4 marks)

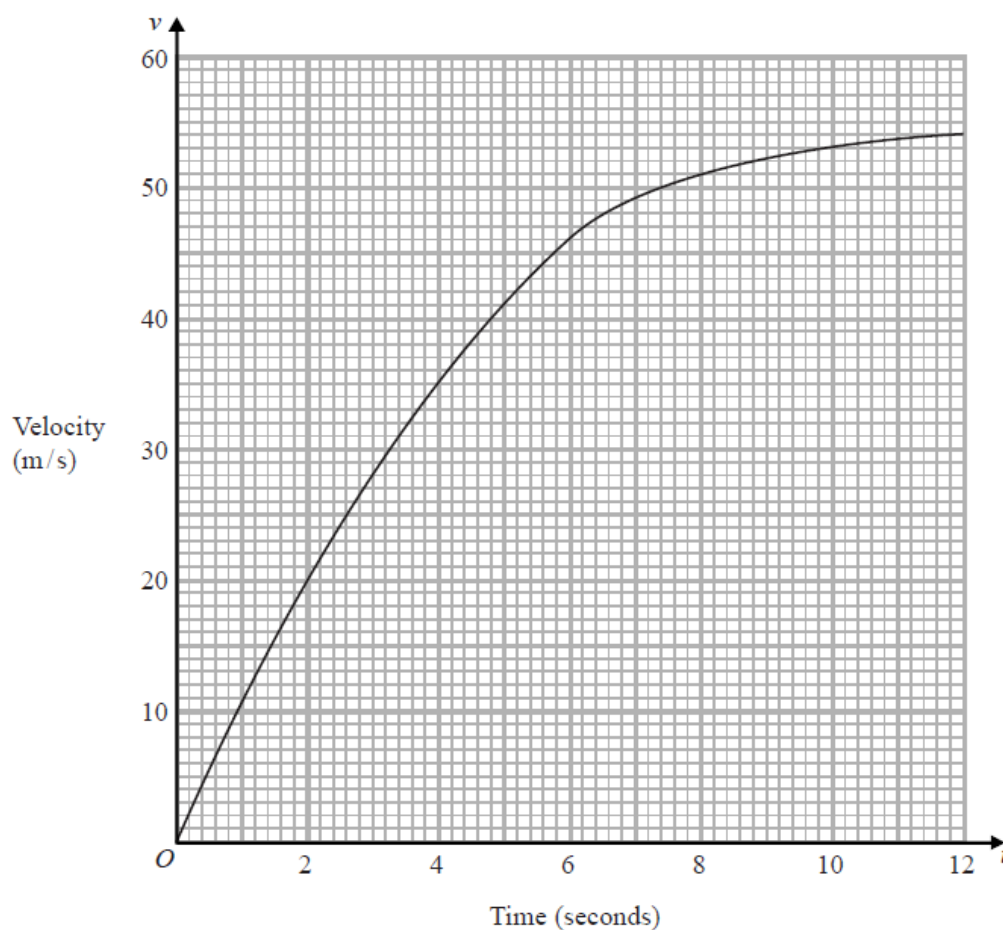
3.4a – evaluate methods used (1 mark)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 19 is 6 marks)

- 20 The graph shows information about the velocity, v m/s, of a parachutist t seconds after leaving a plane.



- (a) Work out an estimate for the acceleration of the parachutist at $t = 6$

calculate or estimate gradients of graphs and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts (A15)

AO2

2.3a – interpret information accurately (1 mark)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

New to 1MA1

(2)

- (b) Work out an estimate for the distance fallen by the parachutist in the first 12 seconds after leaving the plane.
Use 3 strips of equal width.

calculate or estimate gradients of graphs and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts (A15)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

AO2

2.3a – interpret information accurately (1 mark)

New to 1MA1

(3)

(Total for Question 20 is 5 marks)

Set 1 Paper 2H

21 The number of bees in a beehive at the start of year n is P_n .

The number of bees in the beehive at the start of the following year is given by

$$P_{n+1} = 1.05(P_n - 250)$$

At the start of 2015 there were 9500 bees in the beehive.

How many bees will there be in the beehive at the start of 2018?

set up, solve and interpret the answers in growth and decay problems, including compound interest and work with general iterative processes (R16)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

3.3 – Interpret results in the context of the given problem (1 mark)

New to IMA1

(Total for Question 21 is 3 marks)

$$22 \quad D = \frac{x}{y}$$

$x = 99.7$ correct to 1 decimal place.

$y = 67$ correct to 2 significant figures.

Work out an upper bound for D .

**apply and interpret limits of accuracy,
including upper and lower bounds
(N16)**

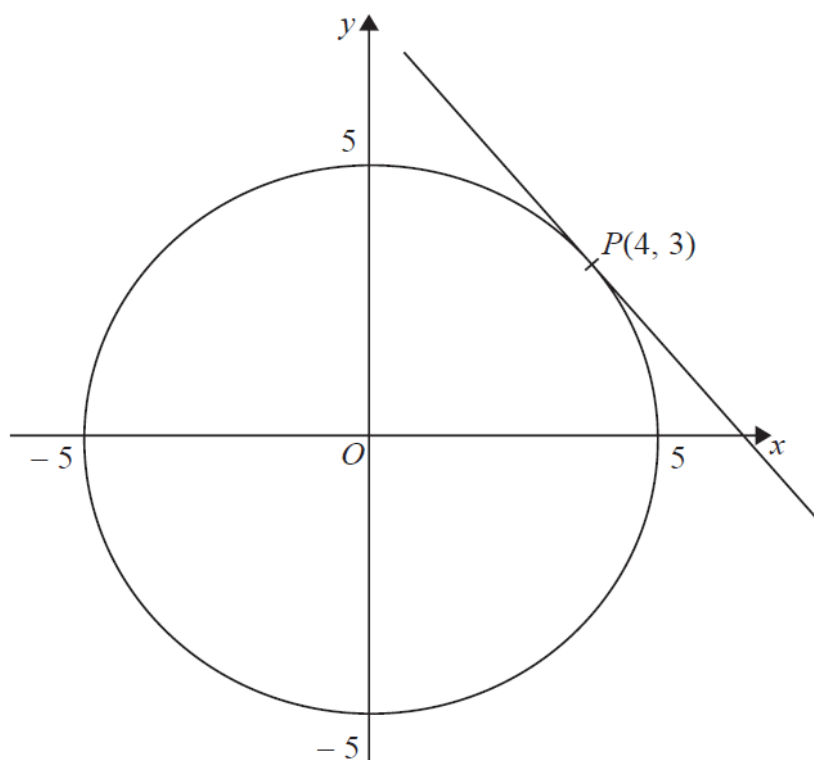
AO1

1.1 – accurately recall facts,
terminology and definitions (1 mark)

1.3b – accurately carry out set tasks
requiring multi-step solutions (2 marks)

(Total for Question 22 is 3 marks)

- 23 Here is a circle, centre O , and the tangent to the circle at the point $P(4, 3)$ on the circle.



Find an equation of the tangent at the point P .

recognise and use the equation of a circle with centre at the origin; find the equation of a tangent to a circle at a given point (A16)

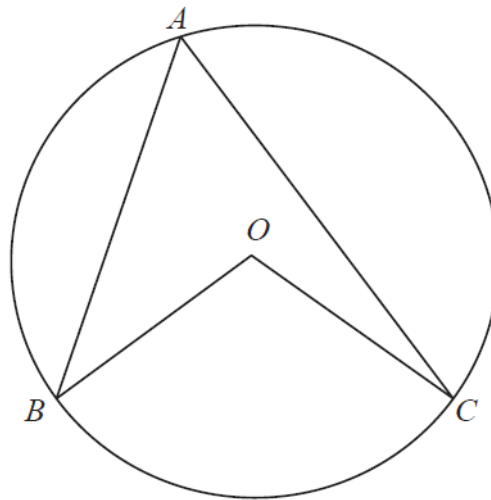
AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

New to IMA1

(Total for Question 23 is 3 marks)

24 A , B and C are points on the circumference of a circle centre O .



Prove that angle BOC is twice the size of angle BAC .

apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results (G10)

AO2

2.4b – present proofs (4 marks)

New to 1MA1

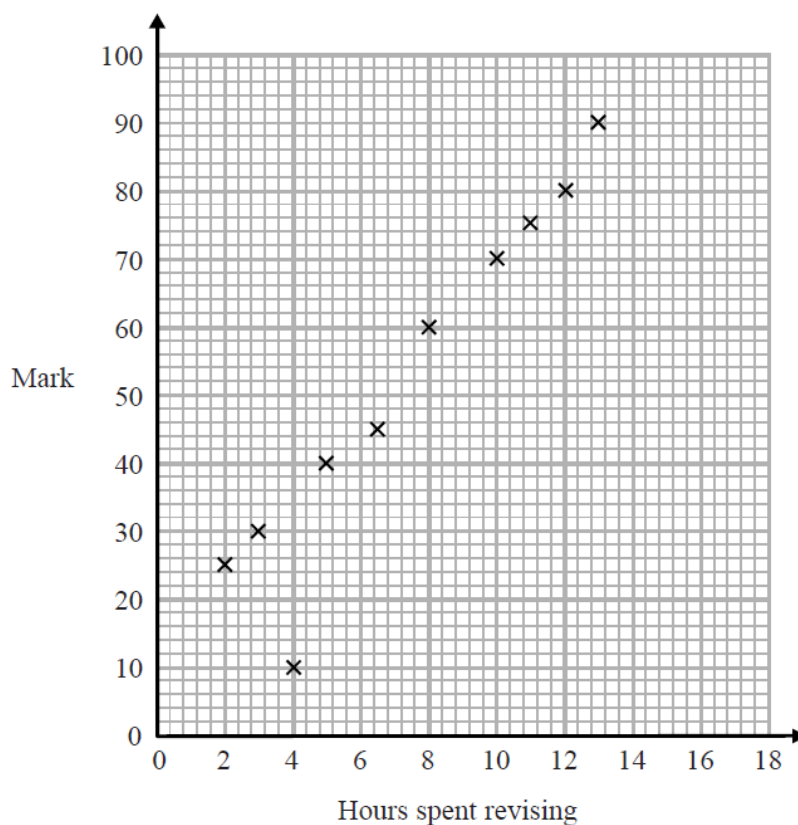
(Total for Question 24 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS

Set 1 Paper 3H

- 1 The scatter diagram shows information about 10 students.

For each student, it shows the number of hours spent revising and the mark the student achieved in a Spanish test.



One of the points is an outlier.

- (a) Write down the coordinates of the outlier.

use and interpret scatter graphs of bivariate data (S6)

AO2

2.3a – interpret information accurately (1 mark)

Common question across both tiers

(1)

For all the **other** points

- (b) (i) draw the line of best fit,
- (ii) describe the correlation.

recognise correlation and know that it does not indicate causation; draw estimated lines of best fit (S6)

AO1

1.3a – accurately carry out routine procedures (1 mark)

1.1 – accurately recall facts, terminology and definitions (1 mark)

Common question across both tiers

(2)

A different student revised for 9 hours.

- (c) Estimate the mark this student got

make predictions; interpolate and extrapolate apparent trends while knowing the dangers of so doing (S6)

AO2

2.1b – make inferences to draw conclusions from mathematical information (1 mark)

Common question across both tiers

(1)

Set 1 Paper 3H

The Spanish test was marked out of 100.

Lucia says,

“I can see from the graph that had I revised for 18 hours I would have got full marks.”

(d) Comment on what Lucia says.

make predictions; interpolate and extrapolate apparent trends while knowing the dangers of so doing (S6)

AO2
2.5a – assess the validity of an argument (1 mark)

Common question across both tiers

(1)

(Total for Question 1 is 5 marks)

2 The length, L cm, of a line is measured as 13 cm correct to the nearest centimetre.

Complete the following statement to show the range of possible values of L .

..... $\leq L <$

round numbers and measures to an appropriate degree of accuracy; use inequality notation to specify simple error intervals due to truncation or rounding (N15)

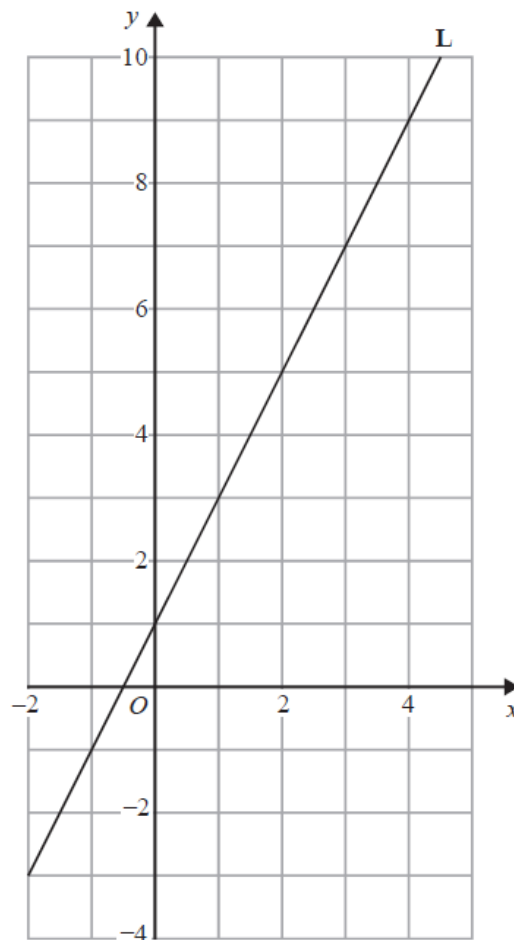
AO1
1.3a – accurately carry out routine procedures (2 marks)

New to 1MA1

Common question across both tiers

(Total for Question 2 is 2 marks)

3 Line L is drawn on the grid below.



Find an equation for the straight line L.

Give your answer in the form $y = mx + c$.

find the equation of the line through two given points or through one point with a given gradient (A9)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (2 marks)

AO2

2.3b – communicate information accurately (1 mark)

Common question across both tiers

(Total for Question 3 is 3 marks)

- 4 Jenny works in a shop that sells belts.

The table shows information about the waist sizes of 50 customers who bought belts from the shop in May.

Belt size	Waist (w inches)	Frequency
Small	$28 < w \leq 32$	24
Medium	$32 < w \leq 36$	12
Large	$36 < w \leq 40$	8
Extra Large	$40 < w \leq 44$	6

- (a) Calculate an estimate for the mean waist size.

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (S4)

AO1
1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

Common question across both tiers

(3)

Belts are made in sizes Small, Medium, Large and Extra Large.

Jenny needs to order more belts in June.

The modal size of belts sold is Small.

Jenny is going to order $\frac{3}{4}$ of the belts in size Small.

The manager of the shop tells Jenny she should **not** order so many Small belts.

(b) Who is correct, Jenny or the manager?

You must give a reason for your answer.

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (S4)

AO2

2.5a – assess the validity of an argument (2 marks)

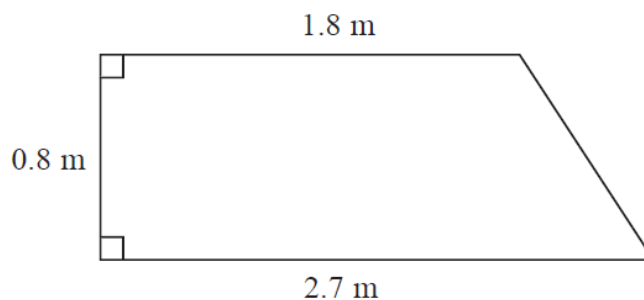
Common question across both tiers

(2)

(Total for Question 4 is 5 marks)

Set 1 Paper 3H

- 5 The diagram shows part of a wall in the shape of a trapezium.



Karen is going to cover this part of the wall with tiles.

Each rectangular tile is 15 cm by 7.5 cm.

Tiles are sold in packs.

There are 9 tiles in each pack.

Karen divides the area of the wall by the area of a tile to work out an estimate for the number of tiles she needs to buy.

- (a) Use Karen's method to work out an estimate for the number of packs of tiles she needs to buy.

know and apply formulae to calculate: area of triangles, parallelograms, trapezia (G16)

derive and apply the properties and definitions of special types of quadrilaterals (G4)

use standard units of mass, length, time, money and other measures using decimal quantities where appropriate (N13)

apply the four operations, including formal written methods, to integers and decimals; understand and use place value (N2)

change freely between related standard units (R1)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (4 marks)

AO2

2.3a – interpret information accurately (1 mark)

Common question across both tiers

(5)

Karen is advised to buy 10% more tiles than she estimated.

Buying 10% more tiles will affect the number of the tiles Karen needs to buy.

She assumes she will need to buy 10% more packs of tiles.

(b) Is Karen's assumption correct?

You must show your working.

interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively; compare two quantities using percentages (R9)

AO3

3.1c – translate problems in non-mathematical contexts into a mathematical process (1 mark)

3.4 – Evaluate methods used and results obtained (1 mark)

Common question across both tiers

(2)

(Total for Question 5 is 7 marks)

6 Factorise $x^2 + 3x - 4$

simplify and manipulate algebraic expressions by factorising quadratic expressions of the form $x^2 + bx + c$ (A4)

AO1

1.3a – accurately carry out routine procedures (2 marks)

Common question across both tiers

(Total for Question 6 is 2 marks)

Set 1 Paper 3H

7 Here are the equations of four straight lines.

Line A $y = 2x + 4$

Line B $2y = x + 4$

Line C $2x + 2y = 4$

Line D $2x - y = 4$

Two of these lines are parallel.

Write down the two parallel lines.

use the form $y = mx + c$ to identify parallel lines (A9)

AO2
2.3a – interpret information accurately
(1 mark)

Common question across both tiers

(Total for Question 7 is 1 mark)

- 8 Ian invested an amount of money at 3% per annum compound interest.
At the end of 2 years the value of the investment was £2652.25.

(a) Work out the amount of money Ian invested.

set up, solve and interpret the answers in growth and decay problems, including compound interest **and work with general iterative processes** (R16)
solve problems involving percentage change, including percentage increase/decrease and original value problems, and simple interest including in financial mathematics (R9)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(3)

Noah has an amount of money to invest for five years.

Saver Account

4% per annum
compound interest.

Investment Account

21% interest paid at the
end of 5 years.

Noah wants to get the most interest possible.

Set 1 Paper 3H

(b) Which account is best?

You must show how you got your answer.

compare two quantities using percentages; solve problems involving percentage change, including percentage increase/decrease and original value problems, and simple interest including in financial mathematics (R9)

AO3

3.3 – Interpret results in the context of the given problem (1 mark)

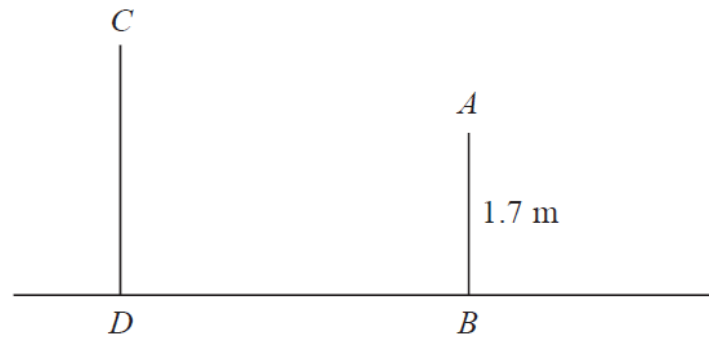
AO1

1.3a – accurately carry out routine procedures (1 mark)

(2)

(Total for Question 8 is 5 marks)

- 9 The diagram shows two vertical posts, AB and CD , on horizontal ground.



$$AB = 1.7\text{ m}$$

$$CD : AB = 1.5 : 1$$

The angle of elevation of C from A is 52°

Calculate the length of BD .

Give your answer correct to 3 significant figures.

know the formulae for the trigonometric ratios; apply them to find angles and lengths in right-angled triangles (G20)

compare lengths, areas and volumes using ratio notation; make links to similarity (including trigonometric ratios) and scale factors (R12)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

3.2 – Make and use connections between different parts of mathematics (1 mark)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

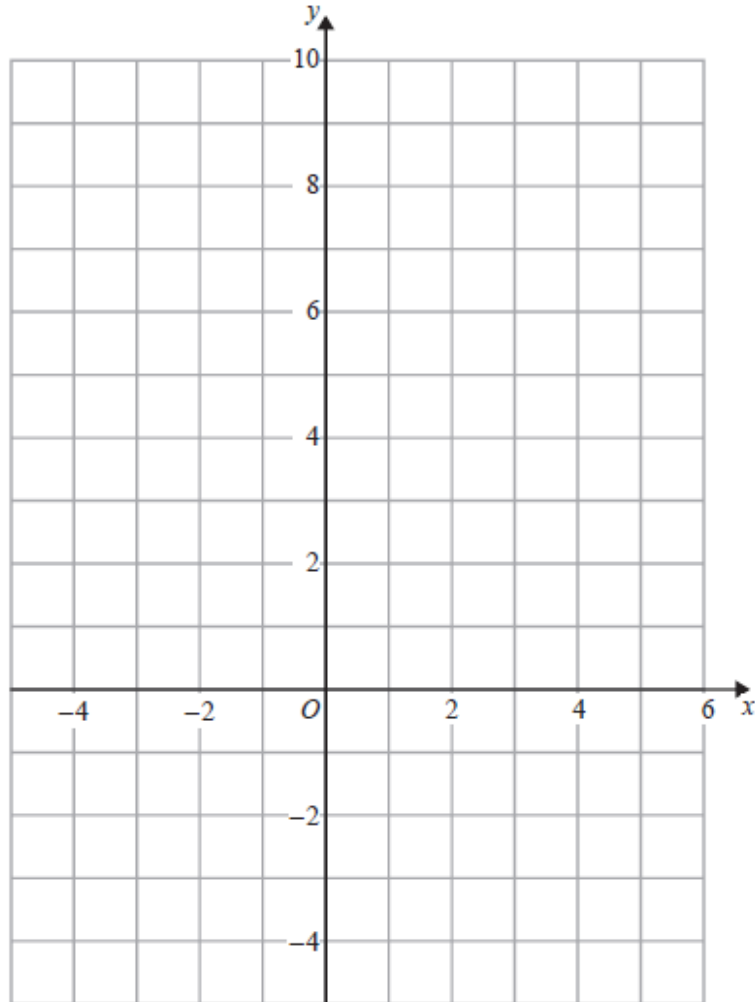
(Total of Question 9 is 4 marks)

Set 1 Paper 3H

10 On the grid, shade the region that satisfies all these inequalities.

$$x + y < 4 \quad y > x - 1 \quad y < 3x$$

Label the region **R**.



solve linear inequalities in one or two variable(s); represent the solution set on a graph (A22)

AO2

2.3a – interpret information accurately (2 marks)

2.3b – communicate information accurately (2 marks)

(Total for Question 10 is 4 marks)

- 11 Write $x^2 + 2x - 8$ in the form $(x + m)^2 + n$
where m and n are integers.

identify and interpret roots, intercepts, turning points of quadratic functions graphically; deduce roots algebraically and turning points by completing the square (A11)

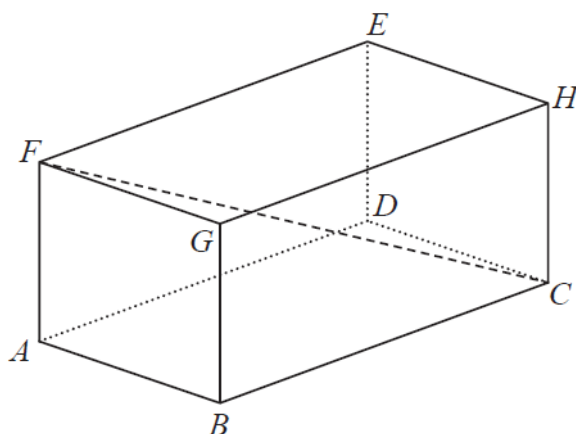
simplify and manipulate algebraic expressions by factorising quadratic expressions of the form $x^2 + bx + c$ (A4)

AO2

2.2 – Construct chains of reasoning to achieve a given result (2 marks)

(Total for Question 11 is 2 marks)

12 The diagram shows a cuboid $ABCDEFGH$.



$AB = 7$ cm, $AF = 5$ cm and $FC = 15$ cm.

Calculate the volume of the cuboid.

Give your answer correct to 3 significant figures.

know the formulae for: Pythagoras' theorem; apply to find angles and lengths in right-angled triangles and, where possible, general triangles in two and three dimensional figures
(G20)

know and apply formulae to calculate volume of cuboids (G16)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

3.2 – Make and use connections between different parts of mathematics (1 mark)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 12 is 4 marks)

13 There are 14 boys and 12 girls in a class.

Work out the total number of ways that 1 boy and 1 girl can be chosen from the class.

apply systematic listing strategies,
including use of the product rule for counting (N5)

AO1
1.3a – accurately carry out routine procedures (2 marks)

New to 1MA1

(Total for Question 13 is 2 marks)

14 Write

$$4 - \left[(x+3) \div \frac{x^2 + 5x + 6}{x-2} \right]$$

as a single fraction in its simplest form.

You must show your working.

simplify and manipulate algebraic expressions (including those involving **algebraic fractions**) by factorising quadratic expressions of the form $x^2 + bx + c$ (A4)

AO2
2.2 – Construct chains of reasoning to achieve a given result (3 marks)

AO1
1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 14 is 4 marks)

15 A virus on a computer is causing errors.

An antivirus program is run to remove these errors.

An estimate for the number of errors at the end of t hours is $10^6 \times 2^{-t}$

(a) Work out an estimate for the number of errors on the computer at the end of 8 hours.

set up, solve and interpret the answers in growth and decay problems, including compound interest and work with general iterative processes (R16)

AO3
3.3 – Interpret results in the context of the given problem (1 mark)
AO1
1.3a – accurately carry out routine procedures (1 mark)

(2)

(b) Explain whether the number of errors on this computer ever reaches zero.

set up, solve and interpret the answers in growth and decay problems, including compound interest and work with general iterative processes (R16)

AO2
2.4a – present arguments (1 mark)

(1)

(Total for Question 15 is 3 marks)

- 16** The graph of $y = f(x)$ is transformed to give the graph of $y = -f(x + 3)$
The point A on the graph of $y = f(x)$ is mapped to the point P on the graph of $y = -f(x + 3)$

The coordinates of point A are $(9, 1)$

Find the coordinates of point P .

sketch translations and reflections of a given function (A13)

recognise, sketch and interpret graphs (A12)

AO2

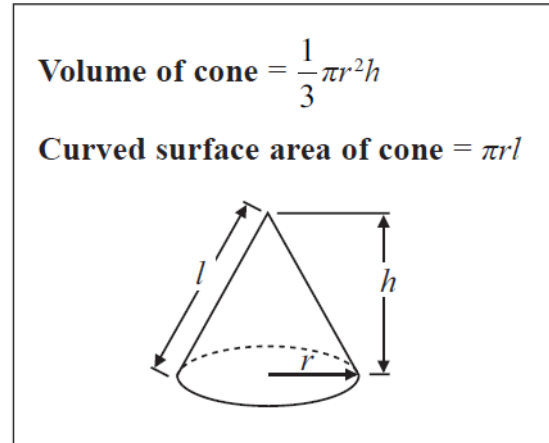
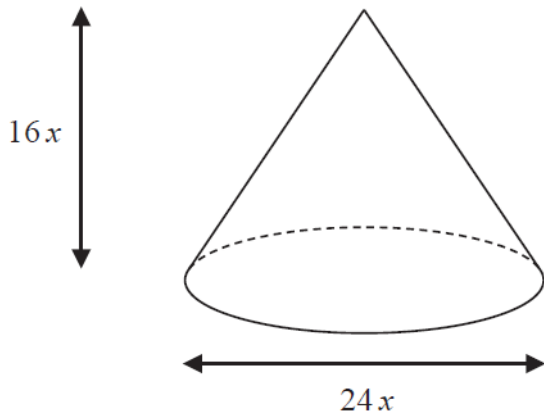
2.3a – interpret information accurately (1 mark)

AO1

1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 16 is 2 marks)

17 The diagram shows a solid cone.



The diameter of the base of the cone is $24x$ cm.

The height of the cone is $16x$ cm.

The curved surface area of the cone is 2160π cm².

The volume of the cone is $V\pi$ cm³, where V is an integer.

Find the value of V .

translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution
(A21)

know the formulae: volume of spheres, pyramids, cones and composite solids
(G17)

calculate exactly with multiples of π
(N8)

AO3

3.1b – translate problems in mathematical contexts into a series of processes (3 marks)

3.2 – Make and use connections between different parts of mathematics (1 mark)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 17 is 5 marks)

18 Thelma spins a biased coin twice.

The probability that it will come down heads both times is 0.09

Calculate the probability that it will come down tails both times.

calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions (P8)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

AO1

1.3b – accurately carry out set tasks requiring multi-step solutions (1 mark)

(Total for Question 18 is 3 marks)

19 (a) Write 0.000 423 in standard form.

(1)

(b) Write 4.5×10^4 as an ordinary number.

(1)

calculate with and interpret standard form (N9)

AO1

1.2 – use and interpret notation correctly (2 marks)

(Total for Question 19 is 2 marks)

Set 1 Paper 3H

20 Mark has made a clay model.

He will now make a clay statue that is mathematically similar to the clay model.

The model has a base area of 6 cm^2 .

The statue will have a base area of 253.5 cm^2 .

Mark used 2 kg of clay to make the model.

Clay is sold in 10 kg bags.

Mark has to buy all the clay he needs to make the statue.

How many bags of clay will Mark need to buy?

apply the concepts of congruence and similarity, including the relationships between lengths, areas and volumes in similar figures (G19)

AO3

3.1d – translate problems in non-mathematical contexts into a series of mathematical processes (2 marks)

3.3 – Interpret results in the context of the given problem (1 mark)

(Total for Question 20 is 3 marks)

- 21 (a) Show that the equation $3x^2 - x^3 + 3 = 0$ can be rearranged to give

$$x = 3 + \frac{3}{x^2}$$

understand and use standard mathematical formulae; rearrange formulae to change the subject (A5)

AO2
2.3b – communicate information accurately (2 marks)

(2)

- (b) Using

$$x_{n+1} = 3 + \frac{3}{x_n^2} \quad \text{with } x_0 = 3.2,$$

find the values of x_1 , x_2 and x_3

find approximate solutions to equations numerically using iteration (A20)

AO1
1.3b – accurately carry out set tasks requiring multi-step solutions (3 marks)

New to 1MA1

(3)

- (c) Explain what the values of x_1 , x_2 and x_3 represent.

find approximate solutions to equations numerically using iteration (A20)

AO3
3.4b – evaluate results obtained (1 mark)

New to 1MA1

(1)

(Total for Question 21 is 6 marks)

22 Here are the first five terms of an arithmetic sequence.

7 13 19 25 31

Prove that the difference between the squares of any two terms of the sequence is always a multiple of 24.

deduce expressions to calculate the n th term of linear sequences (A25)
simplify and manipulate algebraic expressions (A4)

AO2
2.4b – present proofs (5 marks)
AO1
1.3a – accurately carry out routine procedures (1 mark)

(Total for Question 22 is 6 marks)

TOTAL FOR PAPER IS 80 MARKS
