

GCSE (9-1)

Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/03 November 2018 series

Version 1

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Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

Paper J560/03 series overview

J560/03 is the third and final paper in the foundation tier of the GCSE (9-1) Mathematics specification.

Use of calculators

In this paper it is expected that calculators will be used. It is important that accuracy is maintained in calculations and also with values which are transferred between processes.

Many candidates provided some working leading to their answers in questions. This was, in the best cases, logically structured and annotated. In questions where a blank space is provided for an answer, if candidates change their initial response, it is important that this is crossed out so that the correct version may be marked. Where candidates are asked to show that an assertion or result is true or false, it is important that candidates structure their responses and reach a clear conclusion.

Most candidates completed most questions throughout the paper.

More candidates appeared prepared for this assessment than in November 2017. However, performance was generally limited to the middle range of marks. Few candidates could make a worthwhile attempt at question 18 onwards but many scored well in the early questions. As previously, a large number of candidates did not appear to have the use of a pair of compasses or did not know the construction for bisecting a line.

Few candidates demonstrated any familiarity with trigonometry or with the angle properties of polygons.










Candidates should practice solving problems and also giving coherent reasons, using mathematical justifications. Although not featuring significantly in this paper, candidates are still unsure of the relationships between metric units.


Candidates would benefit from a better understanding of algebraic processes. This lack of understanding was noticeable in substituting values in a formula and also in solving equations. In the majority of cases trial and improvement was used to solve an equation, rarely leading to a successful conclusion.

Question 1(a)

- 1 In a survey, people were asked to choose their favourite type of pizza. The pictogram shows some of the results.

8 people chose Margherita.

Margherita	 
Pepperoni	   
Napolitana	 
Veggie	
Hawaiian	

Key:  represents people.

(a) Complete the key.

[1]

This question was usually answered correctly. A few candidates gave the answer for one quarter of the key and said 1.

Question 1(b)

(b) How many people chose Pepperoni?

(b) [1]

Again, the response was often correct with a few candidates making addition or subtraction errors.

Question 1(c)

- (c) There were 36 people in the survey.
All of these people chose one of the pizzas in the pictogram.

Complete the pictogram for Veggie.

[3]

The chart was usually completed correctly. A few candidates again made arithmetic errors but often picked up marks where they correctly recorded numbers in rows. Rarely did errors relate to an error in the key.

Question 2

- 2 Work out.

$$5 \times (2 + 4)$$

..... [1]

This was often correct. A few cases of $10 + 20$ were seen as answers.

Question 3(a)

- 3 (a) Write $\frac{3}{8}$ as a decimal.

(a) [1]

Again, this was done well. A few candidates truncated or rounded this exact answer without showing 0.375 and scored 0. A reasonably common wrong answer was 0.38 with 0.24 and 2.666 also seen.

Question 3(b)

- (b) Write 42% as a fraction.
Give your answer in its simplest form.

(b) [2]

Many correct answers were seen. A minority of candidates scored 1 mark only for $\frac{42}{100}$ as their answer and some found this fraction and wrote 0.42 in the answer space.

Question 4

- 4 Tia thinks of a number.
She finds the square root and subtracts 4.
Her answer is 1.

What number is she thinking of?

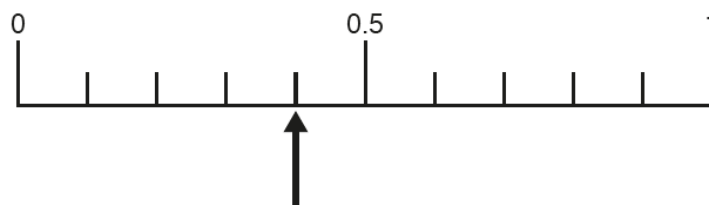
..... [2]

A pleasing number of candidates got this straightforward problem correct, and many showed structure to their solutions. Common wrong answers were 5 and 5^2 for which 1 mark was gained.

Question 5(a)

- 5 A fair spinner has five sides.
Each side is labelled **A** or **B**.

This diagram shows a probability scale.



The arrow shows the probability that the spinner lands on an **A**.

- (a) Circle the word that best describes this probability.

Likely

Impossible

Unlikely

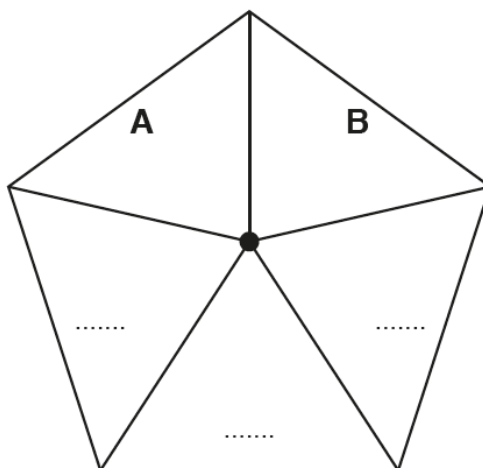
Certain

[1]

Most candidates did well here, though there was clear indecision between likely and unlikely with some changing their minds and deleting rings then, occasionally, returning to the original.

Question 5(b)

- (b) Here is the spinner with two sides labelled.



Label the other sides with **A** or **B** to give the correct probability of landing on an **A**. [2]

Many correct answers were seen but very little working. Candidates tended to score 2 or 0 marks. The common wrong answer was **A, A, B** with a few candidates answering **A, A, A**. Few related 0.4 to $\frac{2}{5}$ and then to 2 "out of" 5.

Question 6

- 6 Write the following in order of size, starting with the smallest.

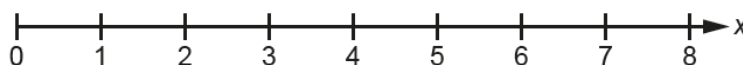
0.41 0.403 0.438 0.4374

..... [2]
smallest

Many candidates used the technique of adding zeros to each decimal and then ranking. Often this was successful though occasionally the result was a reversed order. A common error was to put 0.41 before 0.403 and frequently as the largest number.

Question 7(a)

- 7 (a) Show the inequality $x > 3$ on this number line.



[2]

This was the first question where candidates did not do so well. Hollow circles over 3 were quite often filled in and lines to the right, if without an arrow, sometimes terminated too soon. Blobs over 8 were a common error indicating that candidates did not appreciate the continuous nature of the number line.

Sometimes candidates wrote $>$ above 3 and sometimes made a mark but drew no line. Blobs above 4 were reasonably common and so were lines with no circles.

Question 7(b)

- (b) Simplify.

$$4a + 3c + 7a - 5c$$

(b) [2]

Many good answers were seen. A significant number of candidates left answers in the form $11a + -2c$ and only scored one mark. Candidates must reduce signs to a single operation. In some cases the answer was $11a - 2$. Pleasingly, very few candidates went on from a correct expression to write $22ac$ or such like.

Question 7(c)

(c) Solve.

$$\frac{2x}{3} = 4$$

(c) $x =$ [2]

Responses to this question revealed a lack of understanding of the standard processes needed to solve equations. Most candidates attempted to use trial and improvement or flow diagrams, and 12 was a common wrong answer. Unless candidates show intermediate stages, method marks cannot be credited and a false trial is not an intermediate stage.

Question 8(a)

8 This table shows the ticket price for each person to visit a zoo in winter.

Type of ticket	Ticket price
Adult (aged 18 and over)	£18
Child (aged 3 to 17)	£14
Child (aged below 3)	Free

(a) A family of two adults, one child aged 8 and one child aged 1 visit the zoo in winter.

What is the total cost of the tickets?

(a) £ [2]

This part was usually correct and often with clear working. Some candidates only gave the price for one adult and one child.

Question 8(b)

(b) In summer, the zoo increases the prices.

An Adult ticket increases by 20%.

A Child ticket increases by 15%.

How much more does it cost the family to visit in the summer than in the winter?

(b) £ [4]

This part was less well answered but many candidates still scored well. Increases of 20% and 15% were often worked out correctly, though multipliers were rarely seen. A common error was to give the answer £59.30, rather than the increase.

A significant number of candidates made numerical slips but, as most had showed working, these could be picked up and the method mark credited, where appropriate.

Question 9(a)

9 Danisha is going to visit two of these places.

London Eye (LE) Buckingham Palace (BP) Tower of London (TL) British Museum (BM)

(a) List all the combinations of these places that she can visit.

One combination is already shown in the table.

You may not need all the rows.

LE	BP

[2]

Many correct and systematically ordered lists were seen. A common error was to repeat the given result or, through lack of system, to repeat another pairing (or all other pairings) in reverse order.

Question 9(b)

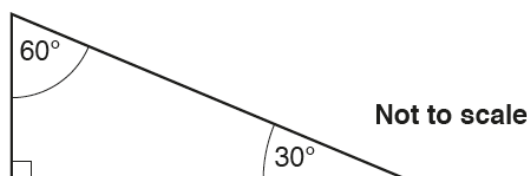
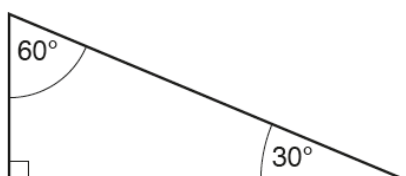
(b) What fraction of the combinations include the London Eye (LE)?

(b) [1]

Some good responses were seen. Commons errors were to count each cell as an outcome and to get a denominator of, for example, 12 from a list of 6 pairs or to miss out the given result from the total.

Question 10(a)

10 Here are two identical tiles.



(a) Sketch two quadrilaterals that can be made by joining the tiles.
Write the mathematical name of each quadrilateral.

Quadrilateral 1:

Quadrilateral 2:

Name:

Name: [4]

Many candidates gained 2 marks for drawing and naming a rectangle. Sketches were rarely carefully done with the intention of reproducing the given triangles, and examiners often had to judge whether the given diagram was possible. Common errors were to redraw the rectangle as a square, to join the long edge of a triangle to a shorter edge (but make them look the same), to draw triangles and not quadrilaterals or to use four triangles to make a rhombus.

Question 10(b)

- (b) The two tiles can also be joined to make two triangles.

Work out the interior angles of each triangle.

(b) Triangle 1:°°°

Triangle 2:°°°

[2]

Only higher ability candidates did well here. 30, 60 and 90 was a common wrong answer. 90 was also often included in some of the other combinations, which sometimes added up to well over 360°.

Diagrams were not always seen; where diagrams were given, candidates sometimes included the two right angles in their answers.

Question 11(a)

- 11 Gill uses the formula

$$h = 2fg$$

- (a) Find the value of h when $f = 1$ and $g = 3$.

(a) $h =$ [1]

A number of correct answers were seen. Some candidates found 6 from wrong working, such as $1 + 2 + 3$, and scored no marks. Regrettably, a significant number of candidates substituted 1 and 3 to give $h = 213$.

Question 11(b)

- (b) Find the value of g when $h = 18$ and $f = 6$.

(b) $g =$ [2]

Again, poor substitutions were common. Very few candidates attempted to solve $18 = 2 \times 6 \times g$ using a method other than trial and improvement and, as the value is 1.5, few gained full marks. Some tried to solve $18 = 26g$.

Question 12(a)

12 Fill in each missing number.

(a) $0.36 \times 20 = \dots\dots\dots \times 10$ [1]

This was not well answered with 7.2 and 72 being common wrong answers. Many candidates appeared to just enter the answer to the initial calculation.

Question 12(b)

(b) $14 \div 50 = \dots\dots\dots \div 100$ [1]

Again, this was not well answered. 0.28 was a common wrong answer.

Question 13(a)

13 (a) Work out 2^4 .

(a) [2]

Most candidates answered this part correctly, and working was often seen. A few candidates gave 32 as the answer suggesting that the “power” key had not been used but rather too much repeated doubling.

Question 13(b)

(b) Find the value of n .

$$100 = 4 \times 5^n$$

(b) $n = \dots\dots\dots$ [2]

Many correct answers were seen. Occasionally 5 was given as the answer, from an incorrect first step of $100 = 20^n$.

Question 14

- 14 30 people choose their favourite sport.
 Matt wants to show their choices in a pie chart.
 4 of the people chose 'tennis'.

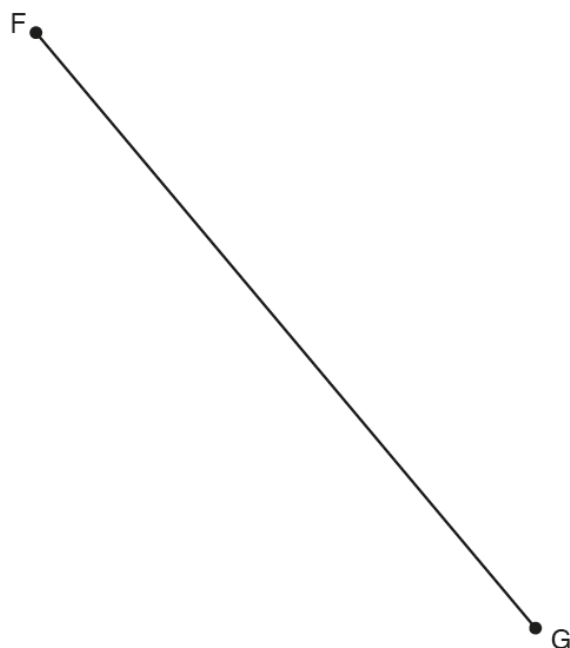
Work out the angle of the sector for 'tennis'.

$\dots\dots\dots^\circ$ [3]

It was pleasing to see many correct answers of 48° . However, many candidates worked out the answer in stages, often making numerical errors but gaining a method mark. Few used the efficient process of $\frac{4}{30} \times 360$. A common error was to take 4 from 30 and to try to work out the angle using 26.

Question 15

15 Using ruler and compasses only, construct the perpendicular bisector of FG.

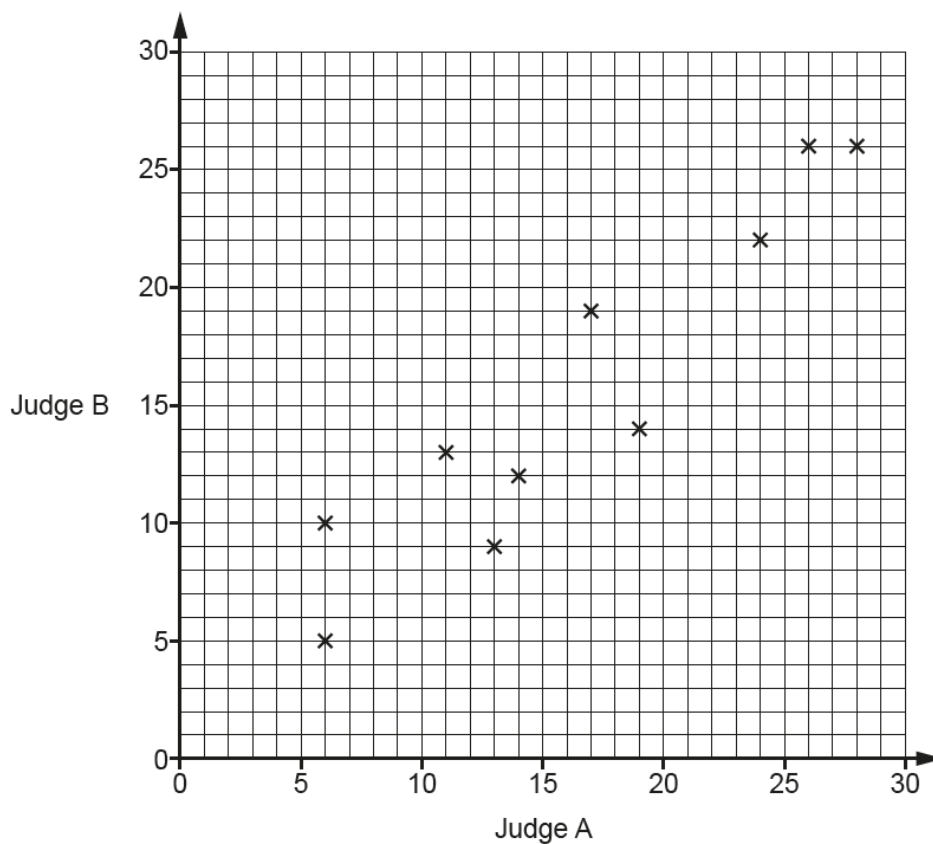


[2]

This question was very poorly done and was often not attempted. Compass skills were not good with arcs wrongly centred and thickly drawn. Sometimes the arcs met only at the midpoint and so were useless. The bisector was sometimes seen without arcs and was often too short for purpose.

Question 16(a)

- 16** In a dance competition, two judges each award scores out of 30.
The scatter diagram shows the scores awarded to the first 10 dancers.



- (a) Here are the scores for the next two dancers.

Judge A	21	7
Judge B	18	8

Plot their scores on the scatter diagram.

[1]

Plotting was quite well done when candidates read the values correctly. The common error was to plot (21, 7) and (18, 8) instead of (21, 18) and (7, 8).

Question 16(b)

- (b) Dancers who are awarded a score of more than 20 by **both** judges receive a medal.

For the 12 dancers, express the ratio of medal winners to non-medal winners in its simplest form.

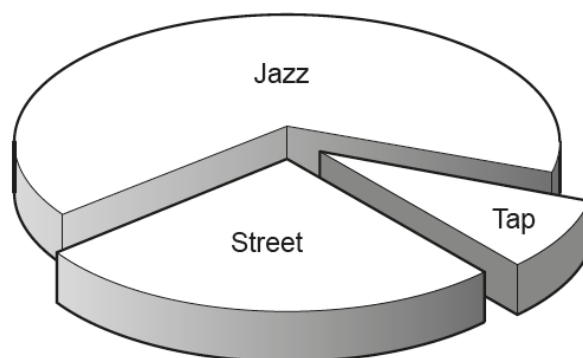
(b) : [3]

A large number of incorrect answers were seen to this question. Many candidate did identify 3 or 9 dancers correctly to score 1 mark. Some gave 3 : 9 without simplifying to score 2 marks. Wrong answers included 3 : 12 and 4 : 12. A very few wrote 3 : 1 instead of 1 : 3 and scored 2 marks.

Question 16(c)

- (c) This chart shows the types of dance performed by the 12 dancers.

3 performed a street dance, 8 performed a jazz dance and 1 performed a tap dance.



Why is this diagram misleading?

.....

 [1]

Candidates found it difficult to phrase a response to this question. Most who scored a mark noted the 3D nature of the diagram. Many said that there were no numbers on the sectors or that they had been separated.

Question 17(a)

- 17 The police record the speed of vehicles passing a speed checkpoint. The speeds are recorded in the table below.

Speed (s mph)	Number of vehicles		
$0 < s \leq 20$	5		
$20 < s \leq 40$	8		
$40 < s \leq 50$	37		
$50 < s \leq 60$	47		
$60 < s \leq 80$	3		

- (a) Calculate an estimate of the mean speed of the vehicles.

(a) mph [4]

Few fully correct answers were seen to this standard question. However, many candidates gained at least 1 mark for identifying the midpoints of each interval. A number went on to multiply these by the frequency and sum the outcomes. A large number of candidates made errors in either the products or the sum. Candidates who found the sum often gained a method mark if they used their sum to achieve their answer. Incongruously, a number got this far and then decided to add the midpoints and divide by 5, thus losing any method marks. A number of candidates incorrectly added the frequencies and 100 was not always the sum. Others used the maximum value in each interval but could still gain 2 marks.

Exemplar 1

4 marks

- 17 The police record the speed of vehicles passing a speed checkpoint. The speeds are recorded in the table below.

Speed (s mph)	Number of vehicles	mp	f x mp
$0 < s \leq 20$	5 +	10	50
$20 < s \leq 40$	8 +	30	240
$40 < s \leq 50$	37 +	45	1665
$50 < s \leq 60$	47 +	55	2585
$60 < s \leq 80$	3 +	70	210
<u>100</u>			

- (a) Calculate an estimate of the mean speed of the vehicles.

$$\begin{array}{r}
 50 + \\
 240 \\
 1665 \\
 2585 \\
 210 \\
 \hline
 4750 \\
 + 2 +
 \end{array}$$

$$4750 \div 100 = \underline{47.5}$$

(a) 47.5 mph [4]

This exemplar shows a completely correct solution.

Exemplar 2

1 mark

- 17 The police record the speed of vehicles passing a speed checkpoint. The speeds are recorded in the table below.

Speed (s mph)	Number of vehicles		
$0 < s \leq 20$	5	10 10	
$20 < s \leq 40$	8	30 20	
$40 < s \leq 50$	37	45	
$50 < s \leq 60$	47	55	
$60 < s \leq 80$	3	70	
		100	210

- (a) Calculate an estimate of the mean speed of the vehicles.

$$\begin{array}{r}
 47 \\
 37 \\
 38 \\
 55 \\
 33 \\
 \hline
 100
 \end{array}$$

$$\begin{array}{r}
 70 \\
 55 \\
 45 \\
 30 \\
 10 \\
 \hline
 210
 \end{array}$$

$$210 \div 5 = 42$$

(a) 42. mph [4]

In this exemplar, the midpoints are found and this is credited one mark. They are not used correctly in the solution and, as such, no further method marks are earned.

Question 17(b)

- (b) Explain why it is not possible to use the information from this table to calculate the **exact** value of the mean speed.

.....

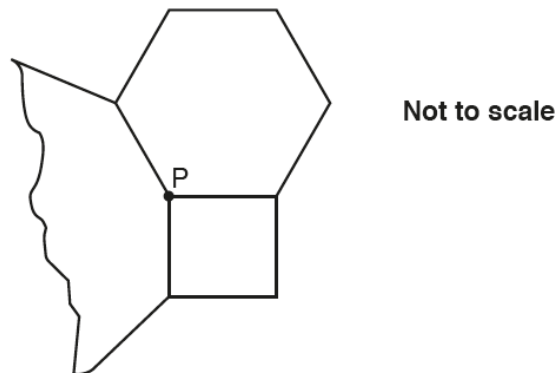
 [1]

It was pleasing to see many correct responses that the exact speeds were not given. Many candidates commented on the method and did not score. Others wrote much more than was needed.

Candidates should practice writing succinct responses. They should present these to their peers and be used to receive constructive feedback.

Question 18(a)

- 18 The diagram shows a square, a regular hexagon and part of another regular polygon meeting at point P.



- (a) Show that the size of one interior angle of a regular hexagon is 120° .

[2]

Very few correct answers were given. Most candidates assumed 120° and did something with this value. Distinction between interior and exterior angles was lacking. Diagrams with the interior angles of the hexagon shown as 60° were not uncommon. Some candidates wrote 'angles in a hexagon add to 720° ' without showing where this came from. Others wrote $6 \times 120 = 720$ and then $720 \div 6 = 120$ to score 0 marks.

In a "Show that" question, candidates must start from basic axioms and show the result.

A very small number of candidates stated that the exterior angles sum to 360° and wrote $360 \div 6 = 60$ as the first step in the response.

Exemplar 1

1 mark

$$360 \div 6 = 60$$

~~360 \div 6 = 60~~

$$60 \times 6 = 360$$

In this exemplar, one correct step in the argument is seen.

Exemplar 2

0 marks

$$P = 360^\circ$$

$$360^\circ - 90 = 270^\circ$$

$$270 - 120 = 150^\circ$$



This exemplar is typical of responses where candidates assume 120 but make no progress.

Exemplar 3

0 marks

all angles of a hexagon add up to 720°

$$720 \div 6 = 120^\circ$$

The assertion that the angles in a hexagon sum to 720° is correct but this needs to be shown and not stated.

Question 18(b)

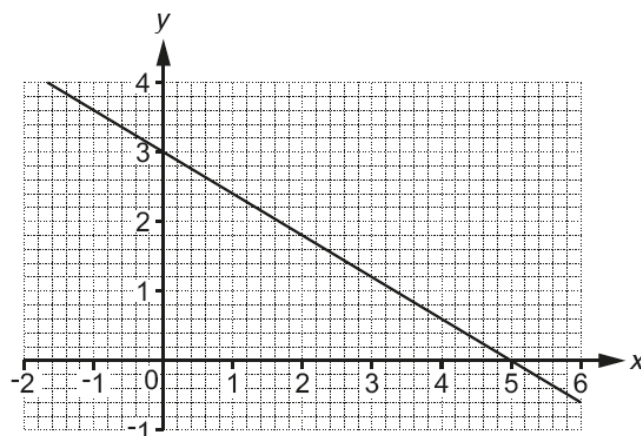
(b) Find the number of sides of the other regular polygon.

(b) [4]

Correct answers were extremely rare, and method was rarely presented. Weaker candidates tried to count the jagged edges of the drawing, clearly not appreciating the demand.

Question 19(a)

19 (a) This graph shows part of a straight line.



Write down the y-intercept.

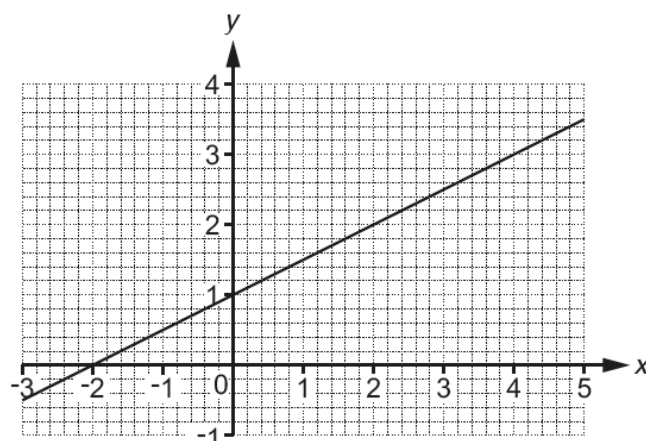
(a) [1]

The correct answer of 3 and the condoned answers of (0, 3) and $y = 3$ were quite often given.

(3, 5) or $y = 3$ and $x = 5$ were common errors.

Question 19(b)(i)

(b) This graph shows part of another straight line.



(i) Find the gradient of this line.

(b)(i) [2]

Very few candidates had any idea of how to answer this question. A few triangles were drawn on the line but these rarely had numbers written on them. Some higher ability candidates attempted $\frac{\text{change in } y}{\text{change in } x}$ but made errors such as 2 as the answer.

Question 19(b)(ii)

- (ii) This line is continued to the right.

Will the line pass through the point (200, 102)?
Show how you decide.

..... [3]

Even fewer candidates attempted this part than the previous part, and those that did had very little success.

No understanding of the slope of the graph and its “scaled up” effect was seen. Common responses were “Yes”, “No”, “Yes, it goes through the even numbers”, “Yes, because it carries on”. Some candidates talked about the numbers going negative.

Nearly all candidates failed to give, or use, the equation of the line.

Question 20(a)

- 20** A bee flies from its hive to a flower at a constant speed of 7.5 metres per second for 10 seconds. The bee then takes 15 seconds to fly back to the hive. Assume the bee always flies in a straight line.

- (a) Ignoring the time spent at the flower, work out the **overall** average speed of the bee in its flight from the hive to the flower and back.

(a) metres per second [4]

Very few correct answers were seen. A number of candidates did gain a method mark for working out the distance from the hive to the flower. Other than that, many random calculations were seen.

Question 20(b)

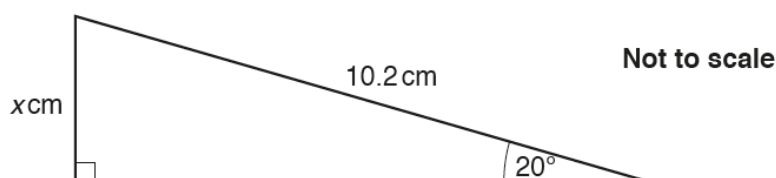
- (b) If the bee is not assumed to fly in a straight line, how might your answer be affected?

.....
 [1]

Some candidates realised that the speed would increase. However, many made false statements such as "It will take longer" ignoring the fact that the time was given as 15 seconds. Some statements were poorly constructed as "longer" could apply to time or distance.

Question 21

- 21 Here is a right-angled triangle.



Use trigonometry to work out the value of x .

$x =$ [3]

Many did not attempt the question, and there were very few correct answers seen. Some candidates attempted Pythagoras, others wrote in assumed angles.

A number of candidates attempted to use trigonometry but wrote statements such as $\cos(20 \times 10.2)$ or $\sin = \frac{20}{10.2}$ or $\sin(10.2) \times 20$, which produced a result remarkably close to the correct answer.

This is a topic that candidates would benefit from studying and practising.

Question 22

22 A newborn baby has an approximate mass of 3.5 kilograms.

A human cell has an approximate mass of 2.7×10^{-11} grams.

Use these values to estimate the number of human cells in a newborn baby.

Give your answer in standard form, correct to 2 significant figures.

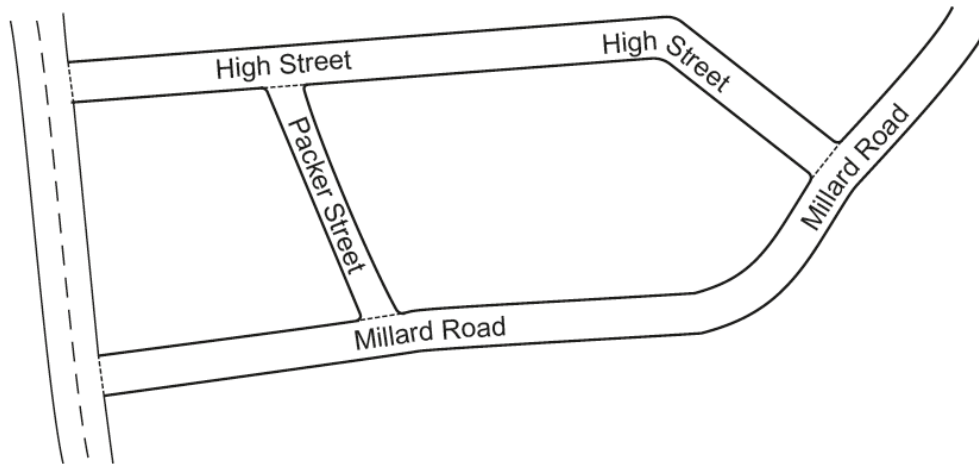
..... [5]

Some candidates gained a mark for stating that $3.5 \text{ kg} = 3500 \text{ g}$. Many attempted, unnecessarily, to change from standard form to ordinary numbers. Candidates need to be familiar with entering standard form numbers into a calculator.

Very few candidates divided the larger mass by the smaller mass. A common error was to multiply 3.5 by 2.7×10^{-11} .

Question 23(a)

23 This map shows part of a village.



Neil knows that Packer Street is 180 m long in real life.

(a) Neil measures the map.

He says

Packer Street is 3.5 cm long.

High Street is 11.2 cm long.

Therefore, I calculate that High Street is 576 m long in real life.

Use Neil's figures to show that the answer to his calculation is correct.

[3]

Some very good solutions were seen but only a few candidates annotated their work. Some candidates showed values such as 51.4 without showing the calculation leading to it. This could gain a mark but where the value was 51.5 no mark could be credited.

Some candidates rounded values in the process but, where this led to answers outside the acceptable range, marks were not credited.

It was pleasing to see working being presented by most candidates.

Question 23(b)

(b) Jodie measures the same map.

She says

I think Packer Street is longer than Neil's measurement of 3.5 cm.
Therefore, High Street must be longer than 576 m in real life.

Is Jodie's reasoning correct?
Show how you decide.

..... [2]

This question was not well answered, and most candidates had no strategy to answer it. Many just said, "Jodie is right/wrong because I measured it". Few appreciated that taking a longer length from the map would mean that each centimetre would represent a smaller number of kilometres in real life.

Question 23(c)

(c) On another map, Packer Street is 2.4 cm long.

Express the scale of this map in the form 1 : n .

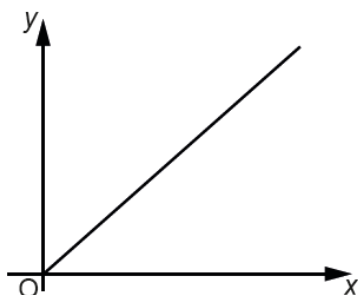
(c) 1 : [2]

Only a very few candidates gained the one mark for dividing the figures 18 by the figures 24. In most cases, the answer line was blank.

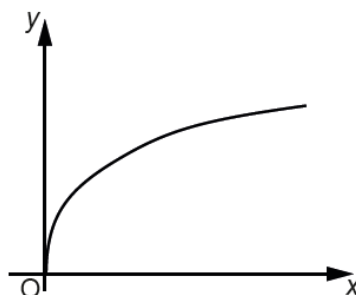
Question 24(a)

24 These graphs show different relationships between the variables x and y .

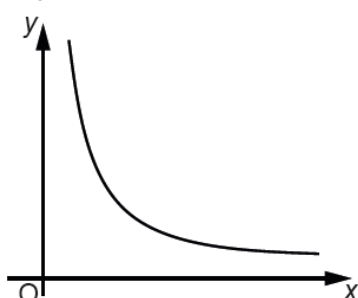
Graph A



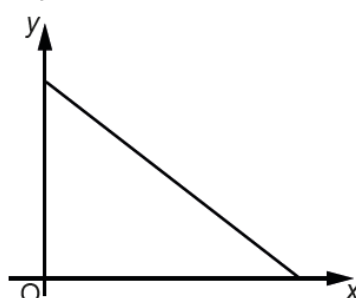
Graph B



Graph C



Graph D



Identify the graph which shows the following.

(a) y is directly proportional to x .

(a) Graph [1]

Many candidates chose the correct graph (A). The other graphs were selected in roughly equal proportions, with a slight bias to graph D.

Question 24(b)

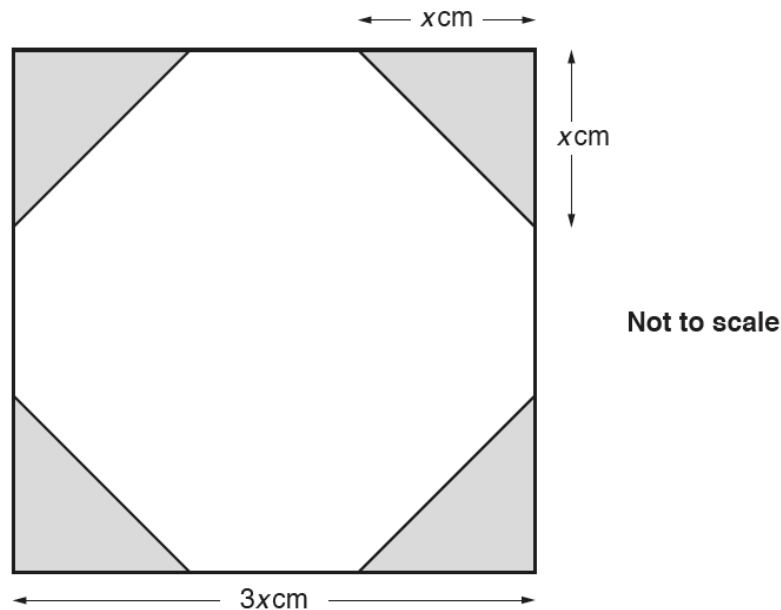
(b) y is inversely proportional to x .

(b) Graph [1]

Some candidates chose the correct graph (C) but fewer than in part (a). The other graphs were selected in roughly equal proportions.

Question 25

25 The diagram shows a square with four identical corners shaded.



The length of each side of the square is $3x$ cm.

The length of each shaded corner is x cm.

Use this information to show that $\frac{\text{shaded area}}{\text{unshaded area}} = \frac{2}{7}$.

Show all your working.

[5]

This was a question that demanded few advanced skills but plenty of thinking to devise a strategy.

The question was set up to be answered algebraically. Candidates who followed this route usually failed to use correct notation. The area was often given as $3x \times 3x = 9x^2 \text{ cm}^2$. After this, they were unable to find expressions for the shaded areas. Few realised that the four formed a square with area $2x^2$.

As the diagram was pretty well to scale, it invited a solution from division into nine equal squares. This again led to 2 shaded squares and $9 - 2 = 7$ unshaded squares which quickly led to the answer. Few achieved this.

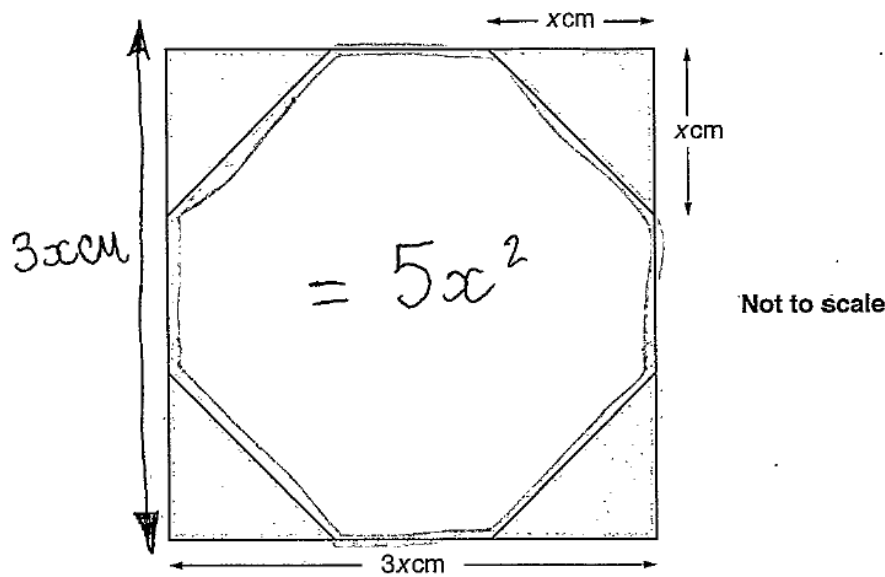
Another solution rested on assigning a value for x . Some candidates did this but did not state the value, leaving examiners to determine the value used. Many errors were made in the simplest calculations.

Commonly, candidates worked with perimeters or, perversely with angles. A few started with $\frac{2}{7}$ and converted to a decimal and stopped.

Exemplar 1

2 marks

- 25 The diagram shows a square with four identical corners shaded.



The length of each side of the square is $3x\text{ cm}$.
The length of each shaded corner is $x\text{ cm}$.

Use this information to show that $\frac{\text{shaded area}}{\text{unshaded area}} = \frac{2}{7}$.

Show all your working.

[5]

Area of whole square : ~~$9x^2$~~

1 Shaded Triangle = $x \times x = \frac{9x^2}{3} = x^2$

$$x^2 \times 4 = 4x^2$$

$$4x^2 - 9x^2 = 5x^2$$

$$\frac{4x^2}{5x^2} = \frac{2}{7}$$

Area of
Non-shaded

In this exemplar, the candidate scores 1 mark for the area of the square (seen halfway down the page) and a method mark for the subtraction of their area of four triangles from the area of the square. This is a rare case of annotation seen.

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