Qualification Accredited

Oxford Cambridge and RSA

GCSE (9–1)

Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/06 November 2024 series

Version 1

Contents

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, highlight good performance and where performance could be improved. A selection of candidate responses are also provided. 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 and the mark scheme can be downloaded from OCR.

Paper 6 series overview

J560/06 is a calculator paper and is the third and final paper in the Higher tier of the GCSE (9-1) Mathematics specification.

The breadth of content examined, and the distribution of marks allocated to AO1, AO2 and AO3 are similar to J560/04 and J560/05.

To do well on this paper, candidates need to be confident and competent in all of the specification's content. They also need to be able to:

- use and apply standard techniques (AO1)
- reason, interpret and communicate mathematically (AO2)
- solve problems within mathematics and in other contexts (AO3).

Questions 1, 2, 3, 4, 6 and 7 were also set on the Foundation tier paper J560/03.

As in previous November series, most candidates entered for GCSE (9-1) Maths in November 2024 were entered for the Foundation tier, with only a small proportion taking the Higher tier exams.

It is worth noting that there are quite a few comments regarding the use of trials and other inefficient methods in the commentaries below. This suggests that some of these candidates were either lacking familiarity or confidence in what should be routine Higher tier techniques.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• attempted all questions • demonstrated good calculator skills, used functions such as roots, trig. and standard form correctly, maintained accuracy when using an interim answer and evaluated formulae accurately • performed almost all standard techniques and processes accurately • understood information presented in words or diagrams, and used correct notation and terminology when presenting their own mathematics • set out work clearly and in an orderly manner • chose the most appropriate and efficient method in cases where there was a choice • crossed out redundant working that was abandoned in reaching their answer • showed all the stages in their working in questions worth more than two marks.	• did not use formulae correctly, even if given in the question or on the Formulae Sheet • did not always use a calculator; instead using inefficient non-calculator methods leading to arithmetic errors • rounded values too soon while working through a method, leading to a lack of accuracy in final responses • made errors in performing routine processes • misinterpreted questions and information or did not follow instructions • had limited facility and confidence in applying algebraic techniques • used methods that were inefficient or inappropriate, such as trial and improvement, rather than applying a more formal mathematical process • showed minimal working in responses to high-value questions.

Question 1 (a)

1 Sasha has these two sets of number cards.

Set A: 1 2 3 4   Set B: 8 9 10

One card is taken at random from each set.
Sasha adds the numbers on the two cards to get a total.

(a) Complete the table to show all the possible totals.

	Set A				
	Total	1	2	3	4
Set B	8		10	11	12
	9		11		13
	10	11	12		

[2]

The whole of the first question provided a very positive experience for candidates and many candidates scored full marks in this part.

Question 1 (b)

(b) Find the probability that the total is a prime number.
Give your answer as a fraction.

(b) .... **[2]**

Most candidates gave the correct answer of $\frac{5}{12}$. The candidate's table was followed through, with B1 for their correct numerator and B1 for their correct denominator. However, this was rarely implemented as almost all candidates had the correct table in part (a).

If a candidate had a correct table and $\frac{6}{12}$ was seen and subsequently simplified to $\frac{1}{2}$ then the candidate could be awarded B1 for the denominator 12. However, a candidate who just gave an answer of $\frac{1}{2}$ without any supporting evidence scored zero.

Assessment for learning

This is a good example of the importance of showing work. For each question candidates should consider the number of marks available. Here, there are 2 marks, so there will be a mark for some correct work even if the answer is wrong – in this case a B1 mark for either the correct numerator or the correct denominator.

Question 2

2 The price of a holiday increases from £320 to £340.

Work out the percentage increase in the price of the holiday.

.... % **[3]**

Most candidates scored full marks. Generally, the method adopted was to first find the price increase of £20 and to then divide this by the original amount of £320. Almost all of the candidates using this method converted their decimal answer into a percentage correctly.

A few candidates made the mistake of dividing by the final amount of £340. These candidates could still score M1 if either 340 – 320 or 20 was seen and used in reaching their final answer.

The more efficient method of $\frac{340}{320}$ was not seen often. A small number of these candidates gave 1.0625 as their final answer, scoring M2.

A small number of candidates used trial and improvement, increasing £320 by 4%, then 5%, then 6% and so on, in an attempt to find a percentage increase that gave an answer of £340. Such methods take up a lot of the candidate's time, and it was very rarely successful. This method scored zero unless the response ended up reaching the required 6.25%.

Question 3

3 A bag contains only blue, green and red counters in the ratio 7 : 3 : 2.
There are 76 more blue counters than green counters in the bag.

Work out the **total** number of counters in the bag.

.... **[4]**

More than half of the candidates scored full marks but most of the remaining candidates scored zero. Those who answered successfully almost always deduced that 76 was the number of counters equivalent to (7 – 3) or 4 parts. They then found that one part was worth 19 counters and so 7 + 3 + 2 or 12 parts needed 12 × 19 counters.

Less successful candidates merely wrote one or more ratios equivalent to 7 : 3 : 2, with 84 : 36 : 24 being particularly common as it arises from multiplying the given ratio by the sum of 7 + 3 + 2. Equivalent ratios scored zero unless there was clear indication that the candidate was using trials to find a difference of 76 in the numbers of blue and green counters. For example, in the 84 : 36 : 24 case, it was necessary to state that this difference was 48. This might then lead the candidate to increase their numbers of counters to increase that difference. The correct answer of 228 from trials scored full marks, otherwise trials scored a maximum of M1.

Question 4 (a)

4 A farmer has 60 pear trees.
The table shows the heights, h metres, of the pear trees.

Height (h metres)	**Frequency**		
$1 < h \leqslant 2$	5		
$2 < h \leqslant 3$	8		
$3 < h \leqslant 4$	32		
$4 < h \leqslant 5$	15		

(a) Calculate an estimate of the mean height of the 60 pear trees.

(a) .... m **[4]**

This is a standard style of 'mean of grouped data' question. The full range of marks was seen, with roughly one-third of the candidates scoring full marks and roughly one-third scoring zero.

Candidates scored one mark for identifying the midpoints of the height intervals, and one mark for finding the sum of the products of the midpoints and frequencies. They could then score a further method mark for dividing their total by 60. One arithmetic error was permitted in the award of the method marks.

A few candidates used the end of each interval rather than the midpoints. Other candidates divided by 4 instead of 60. Either of these errors led to a maximum award of 2 marks out of 4.

Some candidates mistakenly calculated frequency densities or cumulative frequencies. They could still score a mark if showing the midpoints, but otherwise these candidates scored zero.

Question 4 (b)

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

....

.... **[1]**

To score this mark, responses needed to refer to the exact heights not being given. Merely stating that the data is grouped or that midpoints have been used in the calculation was insufficient.

Question 5

5 Rearrange this formula to make f the subject.

$$e = \frac{k}{f}$$

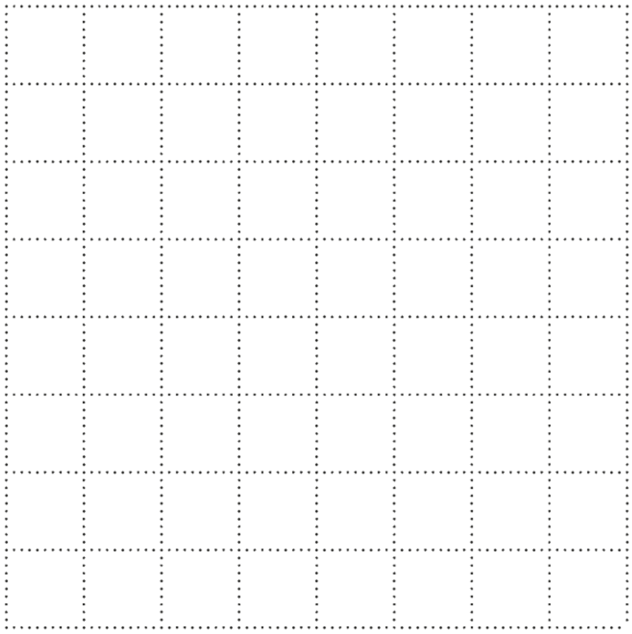
.... **[2]**

The majority of the candidates scored full marks, and some candidates scored one mark for reaching $ef = k$. For full marks candidates needed to write their answer as a formula, $f = \frac{k}{e}$, and not just $\frac{k}{e}$.

Question 6 (a)

6 $\overrightarrow{AB} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$ and $\overrightarrow{BC} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$.

(a) On the grid below, draw $\overrightarrow{AB}$.



[2]

Only a quarter of the candidates scored both marks and over half scored zero or omitted the question. Lack of the direction arrow was common. Some candidates drew a right-angled triangle with $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$ as the hypotenuse which was condoned on this occasion. A common error scoring zero was to draw $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$.

Question 6 (b)

(b) Work out $\overrightarrow{AC}$.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ **[2]**

The majority of candidates scored zero or omitted the question. A few candidates went beyond the expected arithmetic method of $\begin{pmatrix} 3 \\ -1 \end{pmatrix} + \begin{pmatrix} 2 \\ 6 \end{pmatrix}$ and drew this correctly on the grid as two sides of a vector triangle. This may have helped them visualise the vector sum but was not necessary.

A common error was to subtract the two vectors giving $\begin{pmatrix} -1 \\ 7 \end{pmatrix}$ or $\begin{pmatrix} 1 \\ -7 \end{pmatrix}$.

Question 6 (c)

(c) Write down $\overrightarrow{BA}$.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ **[1]**

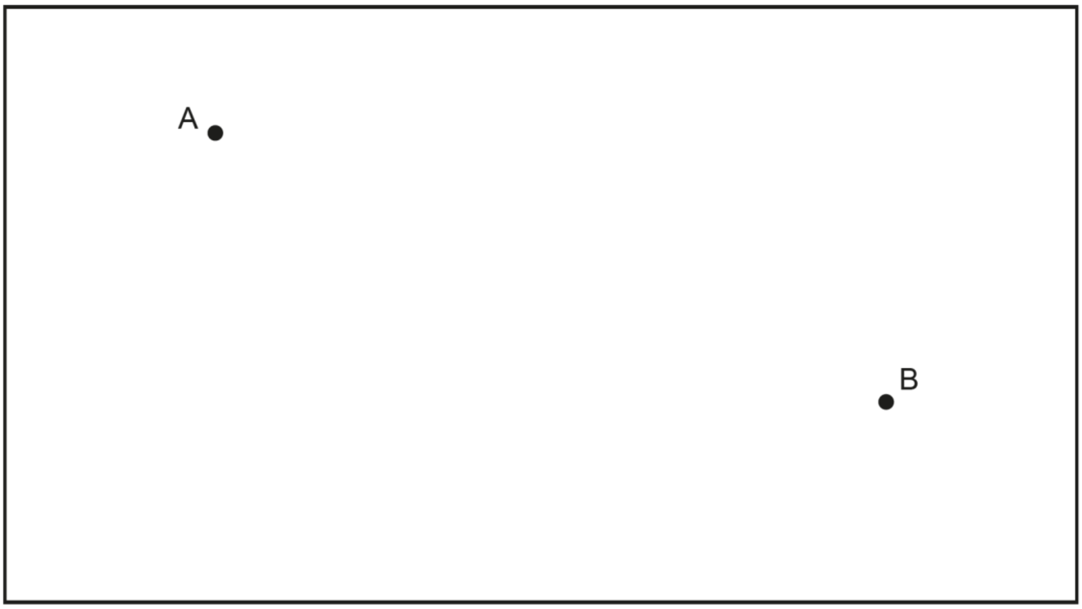
Agan, many of the candidates scored zero or omitted the question. $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$ was the most common wrong answer.

Question 7

7 The diagram represents a rectangular field.
A and B are two trees.

A straight path goes across the field.
The path is always the same distance from A and B.

Construct the route followed by the path.
Show all your construction lines.



[2]

In this question many of the candidates scored either zero or scored full marks for drawing correct construction arcs and an accurate perpendicular bisector of AB that reached the boundaries of the field.

Question 8 (a)

8 **(a)** 198 and 495 are written below as the product of their prime factors.

$198 = 2 \times 3^2 \times 11 \qquad 495 = 3^2 \times 5 \times 11$

Work out the highest common factor (HCF) of 198 and 495.

(a) .... **[2]**

Candidates often put the prime factors onto a Venn diagram. Most were then successful in finding the HCF.

A few candidates gave answers of 990 (the LCM) or 10 (the product of the prime factors not in the overlap region of the Venn diagram).

Question 8 (b) (i)

(b) A five-digit passcode is created using the lowest common multiple (LCM) followed by the highest common factor (HCF) of two numbers.
The two numbers chosen are 198 and 495.

(i) To try and find the passcode, a computer hacker multiplies the highest common factor (HCF) of 198 and 495 by 5 and uses this as the lowest common multiple (LCM) in the passcode.
The computer hacker's passcode is incorrect.

Write down the omission in the computer hacker's method.

....

.... **[1]**

Very few candidates answered the question asked, which was to 'write down the omission'. Having multiplied 3^2 and 11 to obtain the HCF, the hacker then multiplies only by 5. The omission in the method is that the hacker still needs to multiply by 2 to find the LCM.

Question 8 (b) (ii)

(ii) Work out the correct five-digit passcode.

(ii) .... **[2]**

About a quarter of candidates scored full marks and another quarter scored 1 mark, usually for finding the LCM. The correct answer was 99099 but follow through of the HCF from part (a) was also allowed. However, many of the wrong answers seemed to be chosen randomly and made no use of part (a).

Question 9 (a)

9 The next term in a Fibonacci sequence is found by adding together the previous two terms.

In a particular Fibonacci sequence:
- the first term is 3
- the second term is x.

(a) Show that the fifth term in the sequence is $6+3x$. **[2]**

About a quarter of candidates scored full marks and another quarter scored 1 mark for writing the third term as $3 + x$. A common wrong expression for the third term was $3x$.

This was a 'show that' demand with the answer given, so just putting $6 + 3x$ in a list of terms was insufficient for the second mark. Instead, candidates needed to show it being the result of the third term + the fourth term, written as $3 + x + 3 + 2x = 6 + 3x$ or similar as per the mark scheme.

Candidates who merely replaced x with a value to generate a sequence scored zero.

Question 9 (b)

(b) The sixth term in the sequence is 74.

Find the value of x.

(b) x = ... **[4]**

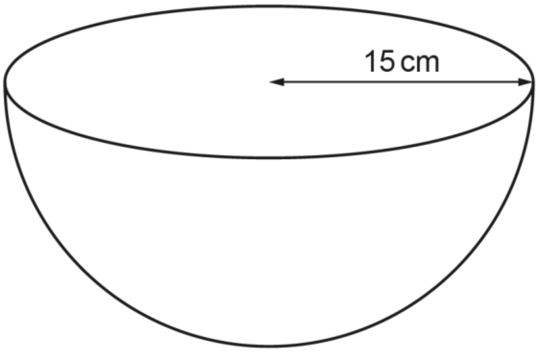
Candidates who had shown correctly how to obtain the fifth term in part (a), usually also found the sixth term as $9 + 5x$, scoring M1. Writing this as part of the equation $9 + 5x = 74$, scored M2 rather than M1. Many candidates solved the equation correctly and thus scored full marks.

A few candidates resorted to trial and improvement either to solve their equation or to generate several Fibonacci sequences starting with 3 and various trial values for x. A final answer of $x = 13$ scored full marks but there were no part marks available for trials.

Candidates who had an incorrect equation could score a follow through mark as long as their equation was of comparable difficulty to the correct one.

Question 10

10 A bowl in the shape of a hemisphere with radius 15 cm is used to collect raindrops.



Assume each raindrop has the volume of a sphere of radius 3×10^{-4} cm.

Calculate how many raindrops it takes to completely fill the bowl.
Give your answer in standard form.
You must show your working.

[The volume V of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

.... **[6]**

This question provided good differentiation between candidates. Many candidates scored at least 1 mark, and there was a good spread of candidates scoring 3 or more marks.

Candidates needed to find the volume of the hemispherical bowl (2 marks), the volume of a raindrop (2 marks), and perform the division giving the exact answer in standard form (2 marks).

Candidates scoring 1 mark usually found the volume of a spherical bowl and stopped. Candidates who completed the demand using this incorrect volume could score up to 4 marks out of 6. A few candidates changed the given formula from r^3 to r^2 and so scored zero.

A very common error was to use the radius of the raindrop instead of finding its volume. Such candidates avoided the use of standard form in a calculation and were limited to the 1 or 2 marks available for the volume of the bowl.

If candidates worked to full accuracy, they should have reached the answer 6.25×10^{13}. A few candidates rounded interim values, but usually scored 5 marks.

The mark scheme shows an anticipated alternative, more efficient, method that avoids the need to calculate the two volumes. However, with such a small entry, this method was not seen.

Question 11 (a)

11 (a) Here is a function.

Complete the diagram below to show the **inverse** of the function.

[2]

The great majority of candidates scored the mark for the two inverse operations of – 3 and ÷ 2, but less than half of these gave those operations in the correct order.

Question 11 (b)

(b) Here is another function.

When the input is 5, the output is 8.5.
When the input is 10, the output is 11.

Find the value of m and the value of p.

(b) m = ...

p = ... **[5]**

About half of the candidates scored full marks and a quarter scored zero.

The anticipated approach was to write the information as a pair of fairly simple simultaneous equations, scoring 2 marks with a further 3 marks for their correct solution. However, the most often seen methods were a variety of types of trials, some with a structure and others very random. If successful, trials scored 5 marks but if unsuccessful then zero was given.

Question 12 (a)

12 (a) Find all the possible integer values of x that satisfy the inequality $10 < 3x - 2 \leqslant 21$.

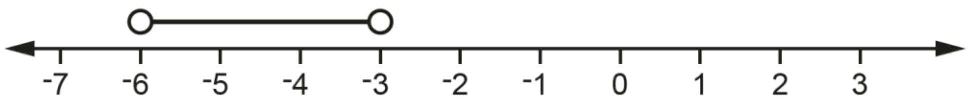
(a) .... **[3]**

Generally, candidates either understood the notation and scored 2 or 3 marks, or they did not and scored zero. Some candidates omitted the question, despite is being a standard style of question.

Candidates scoring 2 marks rather than 3 included those who listed 4 in their answer and those who obtained 12 < 3x < 23 or better, with two separate inequalities being accepted.

Question 12 (b)

(b) An inequality is shown on the number line below.



Taylor says,

You can write this inequality as {x: −3 < x < −6}.

Explain why Taylor is **not** correct.

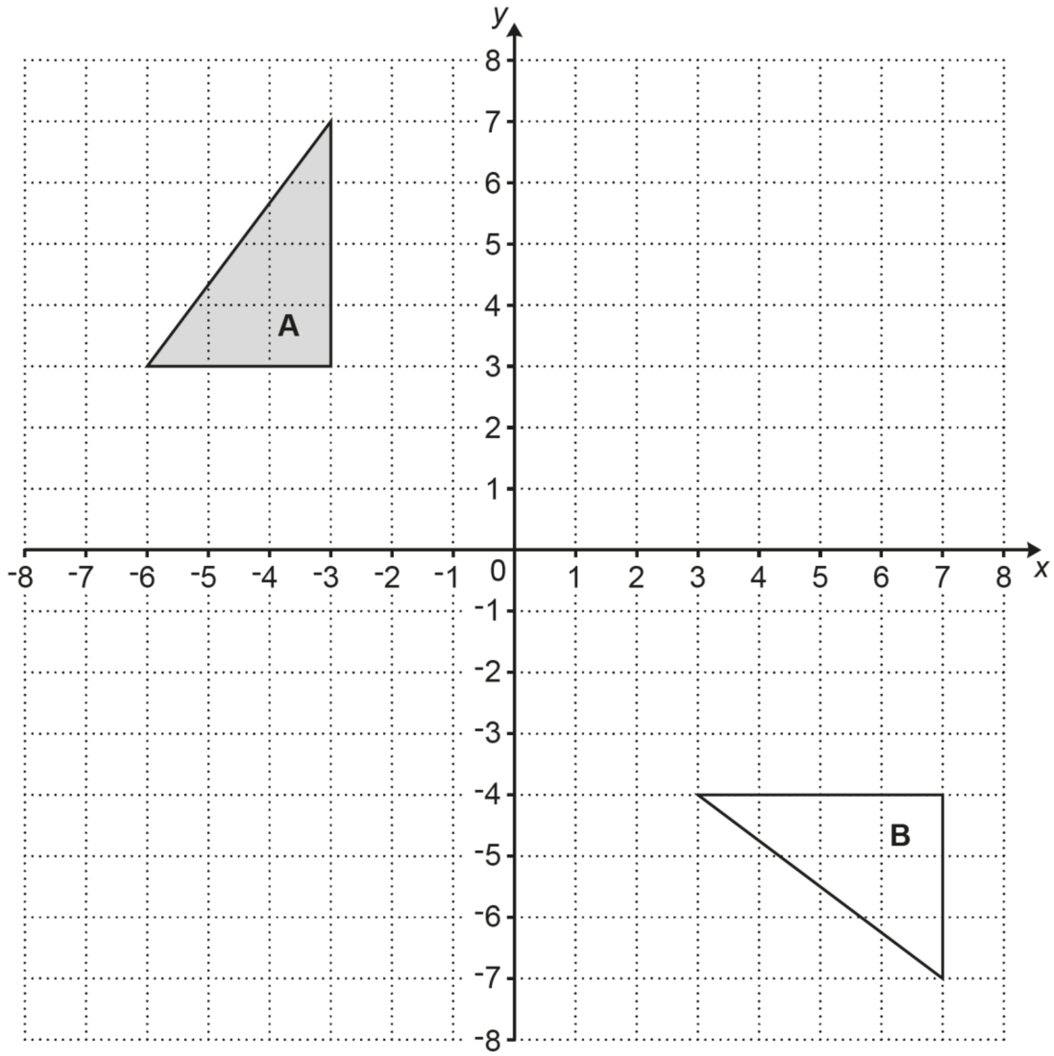
....

.... **[1]**

Many candidates appeared unfamiliar with the set notation in this question, with comments such as 'there should not be a colon' seen. Acceptable responses needed to show a recognition either in words that '-6 is smaller than -3' or similar, or in symbols such as it should be -6 < x < -3.

Question 13

13 Triangle **A** and triangle **B** are shown on the coordinate grid.



Triangle **A** is mapped onto triangle **B** using a combination of two transformations:

- a transformation T, followed by
- a translation of $\begin{pmatrix} 8 \\ -5 \end{pmatrix}$.

Describe fully transformation T.

....

.... **[4]**

The candidates that were most successful translated triangle B by $\begin{pmatrix}-8\\5\end{pmatrix}$ to give the image of triangle A after transformation T. For full marks T needed to be stated as a rotation with both the centre and angle being given.

The most common error was to give more than one transformation in the answer, for example, rotate 90° anticlockwise about the origin and then translate by $\begin{pmatrix}10\\-1\end{pmatrix}$. Such attempts almost always scored zero, although B1 was still available if the image of triangle A after transformation T had been shown.

Question 14 (a)

14 $N = 4a^6$.

Write the following in the form ka^m.

(a) N^{-1} = ... a .... **[2]**

Few candidates had both *k* and *m* correct and just over half had neither correct. The most common wrong answers were -4 for *k* and 6 for *m*.

Question 14 (b)

(b) $N^{\frac{3}{2}}$ = ... a .... **[2]**

The mark distribution was almost identical to part (a). *m* was correct more often than *k*. The most common wrong answers were 6 for *k* and 6 for *m*.

Question 15

15 Prove that $1.8\dot{6}$ converts to the fraction $\frac{28}{15}$.
You must show your working. **[3]**

June 2024 Paper 6 Question 17 assessed the same topic but by way of showing an equivalence. On other occasions, simply converting a recurring decimal to a fraction has been set. The use of 'prove' here increases the requirement for formality, rigour and precision in the candidate's response.

In particular, candidates should be starting from $1.8\dot{6}$ and, assuming they use x to represent $1.8\dot{6}$ at the start, should have a concluding statement that $x = \frac{168}{90} = \frac{28}{15}$ or similar.

An interesting and clever alternative method is on the mark scheme. It was not seen fully but there were candidates attempting a similar approach but working backwards from $\frac{28}{15}$.

Exemplar 1

$1.8\dot{6} = x$

$18.\dot{6}\dot{6} = 10x$

$186.\dot{6}\dot{6} = 100x$

$100x - 10x = 90x$

$186.\dot{6}\dot{6} - 18.\dot{6}\dot{6} = 168$

$168 = 90x$

$\frac{168}{90} = x$

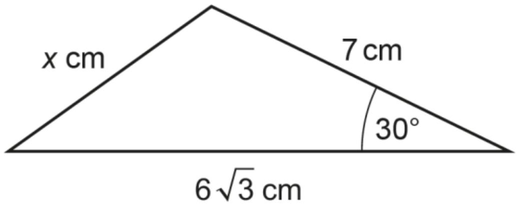
$\frac{168 \div 6}{90 \div 6} = \frac{28}{15}$

$\frac{28}{15} = x$

The exemplar demonstrates the level of detail and precision required for this proof. Nothing is omitted. The candidate defines x as representing $1.8\dot{6}$ and then states the values of $10x$ and $100x$. The duplication of the recurring dot is condoned, as was the use of 18.6…, etc. They then show their subtractions over the next three lines, although this could have acceptably been condensed into two lines. Although not necessary to state '÷ 6', it was a requirement for completing the proof to refer back to x and to link their fraction with $\frac{28}{15}$, such as making the concluding statement that '$x = \frac{168}{90} = \frac{28}{15}$' and not just '$\frac{168}{90} = \frac{28}{15}$'.

Question 16

16 Work out the exact value of x in this triangle.



Not to scale

x = ... **[4]**

Many candidates used trigonometry or Pythagoras in a right-angled triangle, scoring zero or B1 if the exact form of cos 30 was seen. Correct substitution into the cosine rule, with x or x^2 as the subject, scored M2. Many of these cosine expressions were written accurately but not evaluated properly with answers to $((6\sqrt{3})^2 + 7^2 - 2 \times 6\sqrt{3} \times 7)\cos 30$ or similar being very common. Other candidates used decimal approximations such as 0.866 for cos 30 and 10.39 for $6\sqrt{3}$ when the question asks for the exact value.

Assessment for learning

When presented with geometric diagrams, right angles will normally be indicated by notation and may also be referred to in the text, unless their identification is part of the assessment (e.g. angle in a semicircle).

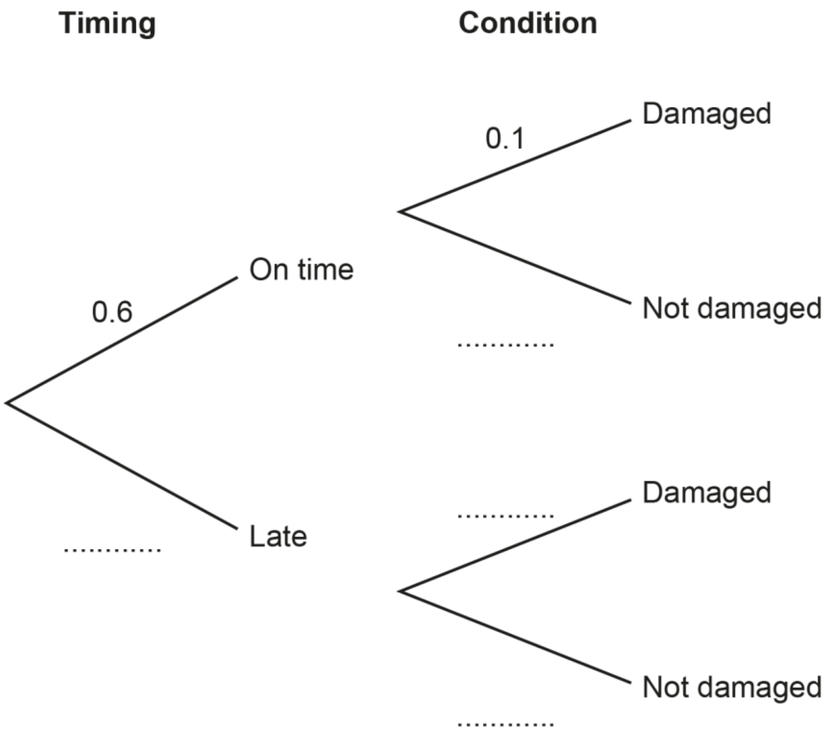
Mistakes were made and marks lost by finding $b^2 + c^2 - 2bc$, an unnecessary and incorrect step in the evaluation. Instead, candidates should type the whole expression for a^2 into their calculator, write down that answer, and then show the square root step.

Question 17 (a)

17 An online company is tracking the timing and condition of its deliveries.

The probability that a parcel arrives on time is 0.6.
When the parcel arrives on time, the probability that it is damaged is 0.1.
When the parcel arrives late, the probability that it is damaged is 0.3.

(a) Use the information to complete the tree diagram.



[3]

Most candidates completed the tree diagram correctly.

Misconception

The few candidates who got this wrong often confused the probability tree with that of a frequency tree, thus producing probabilities on the second set of branches of the given 0.1 with 0.5, and the given 0.3 with 0.1.

Question 17 (b)

(b) Given that a parcel arrives damaged, find the probability that it also arrived on time.

(b) .... **[4]**

Very few candidates recognised the 'given that' in the question, which should trigger thoughts of conditional probability. Over half of candidates scored 1 mark for either 0.6 × 0.1 = 0.06 or for 0.4 × 0.3 = 0.12 or 2 marks for summing these two answers to get 0.18. There was little evidence of an attempt to use this as the denominator in $\frac{0.06}{0.18}$ which leads to the answer $\frac{1}{3}$.

Question 18

18 *y* is inversely proportional to x^2.

Find the percentage decrease in *y* when *x* is increased by 25%.

.... % **[4]**

Few candidates progressed beyond 1 mark for 1.25 or for $y = \frac{k}{x^2}$. The more efficient method shown in the mark scheme was seldom seen. However, some candidates did make further progress by using a made-up pair of values for *x* and *y* to find their *k*, increase their *x* by 25% and use it to find the corresponding value of *y*, and then work out the percentage decrease in their *y* values. A few candidates succeeded in reaching the correct answer at the end.

Exemplar 2

$\cancel{y = kx^2}$

$\cancel{y = k\,10^2}$

$\cancel{y = 100}$

$\cancel{y = 12.5^2}$

$\cancel{y = \frac{k}{x^2}}$

$\cancel{y = \frac{k}{1.25x^2}}$

$\cancel{y = 1.5625x}$

$$y = \frac{k}{x^2}$$

$$y = \frac{10}{10^2}$$

$$y = 0.1$$

$$y = \frac{10}{\cancel{1.25(10^2)}\ (12.5)^2}$$

$$y = \frac{8}{125}$$

$$\frac{0.1 - \frac{8}{125}}{0.1} = \frac{9}{25}$$

$$= 0.36$$

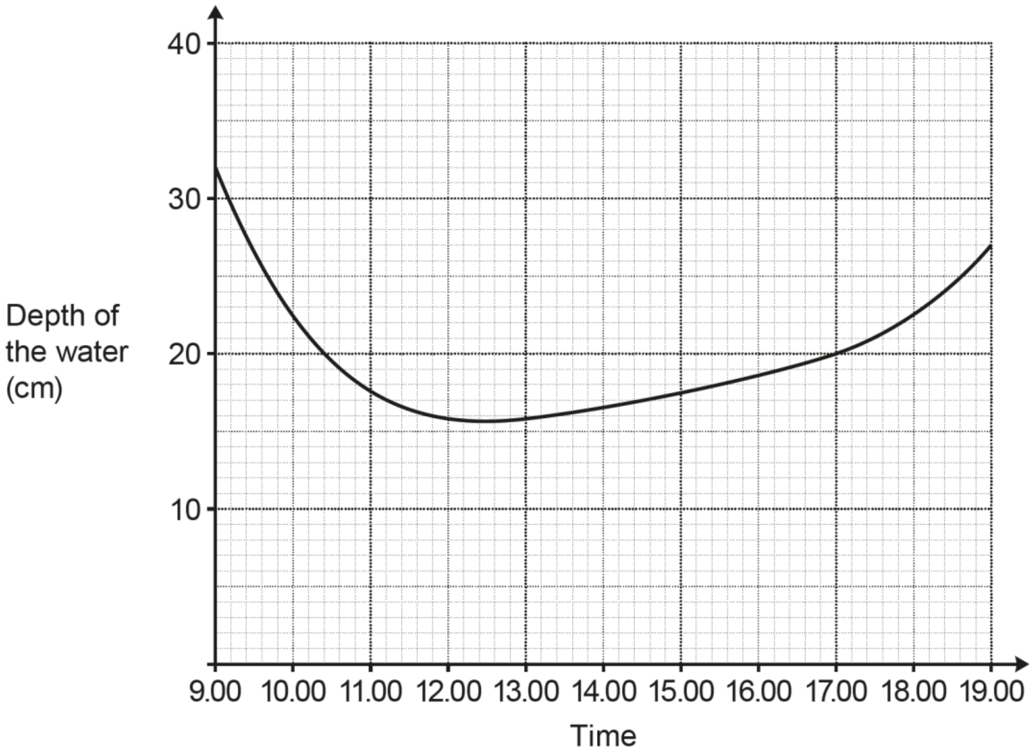
$$\times 100 = 36\%$$

~~0.36~~ 36 % [4]

This exemplar shows a variation of the method described above where the candidate has exhibited some thought in the careful selection of values to use. The candidate makes sure they get a mark at the start by expressing the information algebraically. Rather than finding *k* for their chosen *x* and *y* values as above, this candidate chose 10 as the value of both *x* and *k* enabling instead *y* to be quickly found. They then increase *x* by 25% to 12.5 and calculate the new *y* value. The decrease in *y* as a fraction, decimal and percentage are then found.

Question 19 (a)

19 This graph shows the depth of the water, in centimetres, at a particular point in a river over a period of 10 hours.



(a) Work out the average rate of change in the depth of the water over the 10 hours.

(a) .... cm per hour **[2]**

Only about a quarter of candidates scored any marks. Those scoring 1 mark showed the correct method but either had one wrong value or evaluated their gradient incorrectly.

Misconception

'Average rate of change', like 'average speed', is found by using the start and end points of the time period. It is not 'the average' of lots of graph readings.

Question 19 (b)

(b) Use the graph to estimate the rate of change in the depth of the water at 17.00.
You must show working to support your estimate.

(b) .... cm per hour **[4]**

Only some candidates drew a tangent at 17.00. These tangents were generally well drawn, scoring 1 mark, but some candidates did not make any further progress. Those that continued often showed the two points they were using on the tangent in order to make their estimate, including constructing a right-angled triangle to help do this, enabling another mark, and a third mark if attempting to find the gradient correctly. There were some errors in the use of time at this stage, for example, a reading of 14.2 being unnecessarily changed to 14 hours and 12 minutes and then 14.12 being used in the gradient calculation.

Question 20

20 $(4x+a)(4x-a)(x^2+2) = 16x^4 + bx^2 - 50$

Find the **two** possible pairs of values for a and b.
You must show your working.

Pair 1: a = ... and b = ...

Pair 2: a = ... and b = ... **[6]**

The question provided a test of candidates' ability to expand brackets, and many did manage to either expand one pair of brackets correctly or to find the constant term as $-2a^2$, either of which scored M1. Half of these candidates were also able to get the correct coefficient for x^2 as $32 - a^2$. Other candidates making an attempt often lost terms in their expansions so that terms did not cancel out as they should, or they miscopied their work from one line to the next.

Few candidates knew what to do with their expansion, with many attempting to make their expansion equal to the question's right-hand side and then rearranging to equal 0 before abandoning their work. The few successful candidates matched the constant terms as $-2a^2 = -50$, hence $a = 5$ and -5, and b could then be found by matching the coefficients of x^2 as $32 - a^2 = b$.

Exemplar 3

$a = 5$

$\times$	$4x$	$+5$
$4x$	$16x^2$	$20x$
-5	$-20x$	-25

$\times 6$	$16x^2$	-25
x^2	$16x^4$	$-25x^2$
$+2$	$32x^2$	-50

$16x^4 + 7x^2 - 50$

$a = -5$

	$4x$	-5
$4x$	$16x^2$	$-20x$
5	$+20x$	25

~~$16x^2$ $+25$~~

x^2 32

$+2$

$(16x^2 - 25)(x^2 + 2) = 16x^4 + 7x^2 - 50$

Pair 1: a = 5 and b = 7

Pair 2: a = -5 and b = 7 **[6]**

There is not a lot of working shown here but it is an interesting response. Only a few candidates from this entry scored full marks on this question and this was one of them.

The order of the working is not clear and on first sight, it looks like trials or a fluke. However, if that were the case it is unlikely the candidate would find a as both 5 and -5. Closer inspection, suggests there is a bit more going on here, perhaps not written, which at least suggests there are alternative ways of answering this question using deduction and insight similar to the technique of factorisation by inspection covered in A Level Maths.

This candidate has been very efficient, showing less working than to be expected in a 'you must show your working' question. However, this response is covered in the minimum requirement for full marks by the alternative method on the mark scheme. The candidate has likely multiplied the constant terms in their head, reaching the equivalent of $-2a^2 = -50$, mentally processed this to $a^2 = 25$ and hence they reach $a = \pm 5$. Only then do they put pen to paper. The two grid expansions of $(4x + a)(4x - a)$ with $a = 5$ and $a = -5$ are conducted on the left-hand side of the page. These both produce $16x^2 - 25$ (condoning the sign omission in one of the grids as this is really a check rather than new work). So, the candidate then has $(16x^2 - 25)(x^2 + 2)$ which is then expanded by the grid method, enabling them to see that $b = 7$.

Overall, the candidate has performed the most relevant parts of the mark scheme's main method without the need to find the full expansion. However, it would have been helpful to examiners to see $-2a^2 = -50$.

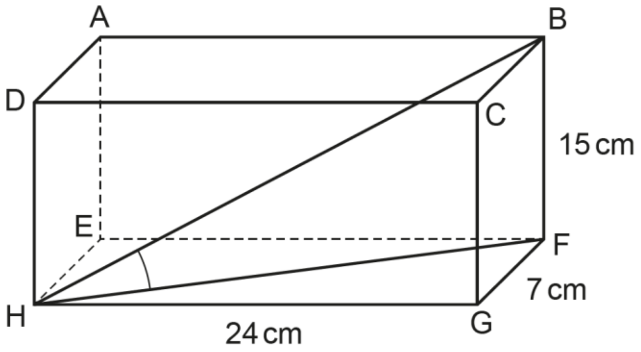
The candidate's approach gives rise to consideration of an accessible alternative method although not seen, where candidates produce the same lines of working but in reverse. Focussing on obtaining the right-hand side's required coefficient of x^4 and the required value of the constant can only lead to $(16x^2 - 25)(x^2 + 2)$ since there are no x^3 or x terms present on the right-hand side. This can then be expanded to give $b = 7$. Factorisation of $16x^2 - 25$ as $(4x + 5)(4x - 5)$ is within the specification, but candidates would then need to interpret this as meaning both $a = 5$ and $a = -5$.

Assessment for learning

In their struggles with this question, some candidates made multiple attempts, none of which produced an answer on the answer line. Therefore, as per the marking guidance this is treated as choice and the poorest attempt would be marked. Candidates should be advised in future similar situations to make the decision as to which attempt they wish to be marked and to cross-through the others.

Question 21

21 The diagram shows a cuboid ABCDEFGH.



Not to scale

FB = 15 cm, GF = 7 cm and HG = 24 cm.

Calculate the angle BHF.
You must show your working.

Angle BHF = ... ° **[5]**

About half of the candidates scored zero, but about a third scored full marks. Among the latter candidates, length BH was often found and used in a sin ratio in preference to using the more accessible FH in a tan ratio. Candidates who used Pythagoras to find either BH or FH correctly scored 2 marks.

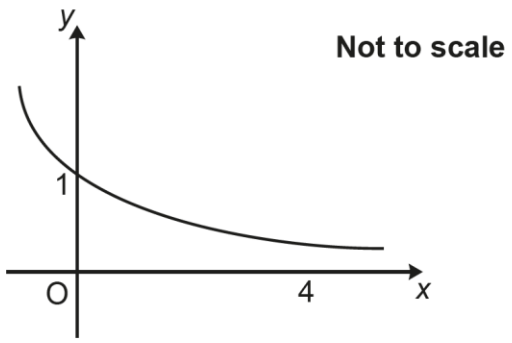
Question 22 (a) (i)

22 (a) For each graph below, select its possible equation from this list.

$y = \sqrt{x-4}$ $y = 4^x$ $y = x^4$ $y = \dfrac{4}{x}$

$y = \left(\dfrac{1}{4}\right)^x$ $y = -4x^2$ $y = 4\cos x$ $y = \sqrt{4^2 - x^2}$

(i)

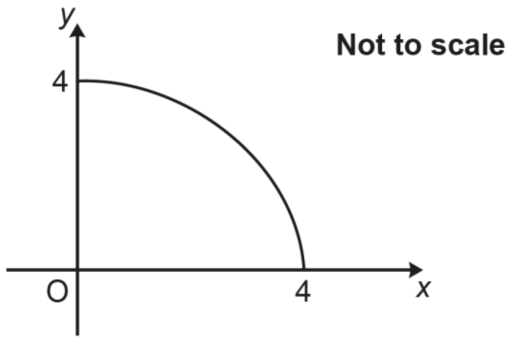


(a)(i) .... **[1]**

Nearly half of the candidates scored this mark. There was no common wrong answer, suggesting lots of guesses.

Question 22 (a) (ii)

(ii)

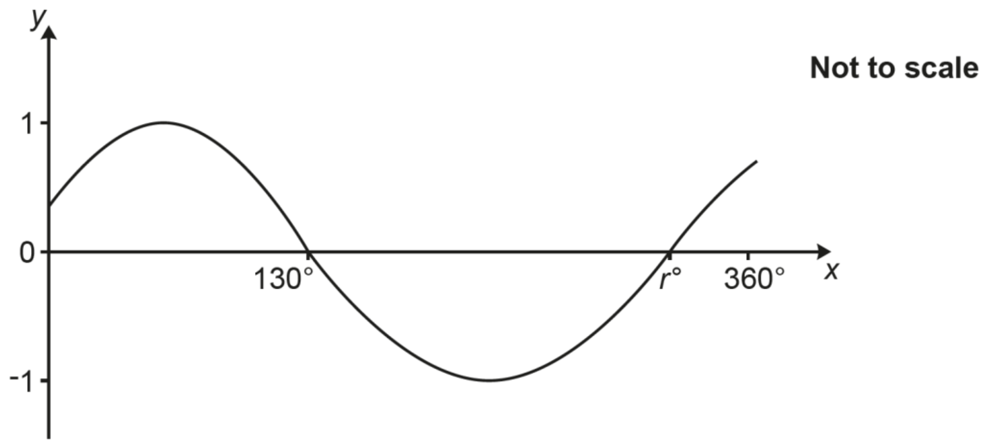


(ii) .... **[1]**

About a quarter of the candidates scored this mark. Again, there was no common wrong answer.

Question 22 (b)

(b) A graph is drawn on the axes below.



The equation of the graph is $y = \sin(x + p)$, where $0° \leqslant x \leqslant 360°$.
The x-intercepts are 130° and $r°$.

Write down the value of p and the value of r.

p = ...

r = ... **[2]**

Many candidates did not attempt this part. Some of the candidates scored 1 or 2 marks, with *r* being correct more often than *p*. Many different wrong answers for *r* were seen with no obvious rationale to support them. The correct answer for *p* was 50 but an interesting wrong answer seen a few times was 0.766 or 0.77, which is the value of sin 50.

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