Qualification Accredited

OCR
Oxford Cambridge and RSA

GCSE (9–1)

Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/06 November 2023 series

Version 1

ocr.org.uk/maths

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 and highlight good performance and where performance could be improved. A selection of candidate responses is 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 our secure Teach Cambridge site.

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, 5 and 6 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 2023 were entered for the Foundation tier, with only a small proportion taking the Higher tier exams. This was shown in the mark distributions of some of the questions in the second half of the paper, where candidates either knew what to do and gained full marks or they struggled to make a start. With a larger entry, one would expect a fuller range of ability and the full spread of marks to be used.

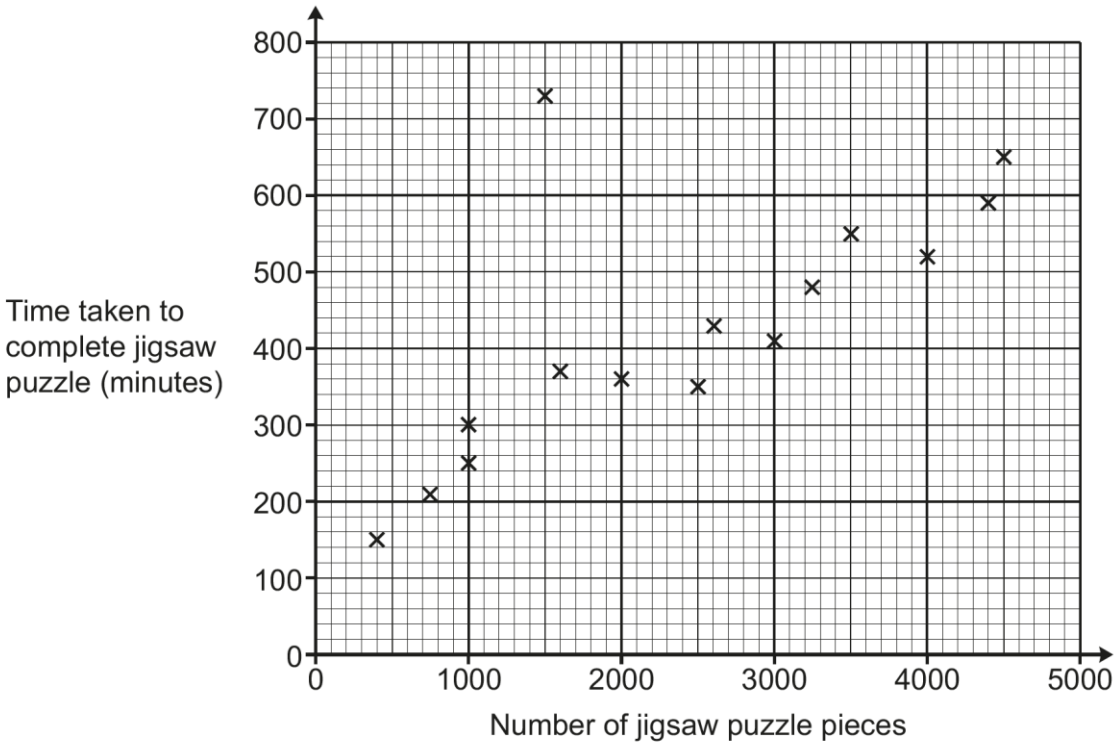
Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• attempted all questions • demonstrated good calculator skills by using functions such as roots, trig. and standard form correctly and maintained accuracy when using an interim response • performed almost all standard techniques and processes accurately • understood information presented in words or diagrams • used correct notation and terminology when presenting mathematical arguments • 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 on the formulae sheet • did not always use a calculator; instead, they often used 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 • did not show all steps in working, particularly when answering questions that stated 'show'.

Question 1 (a) (i)

1 Beth completes some jigsaw puzzles and records the following information.

- The number of pieces in the jigsaw puzzle.
- The time taken to complete the jigsaw puzzle, in minutes.

Beth shows this information in a scatter diagram.



(a) (i) Beth completes two more jigsaw puzzles.

- A 3000 piece jigsaw puzzle taking 460 minutes.
- A 1300 piece jigsaw puzzle taking 320 minutes.

Show this information on the scatter diagram. **[1]**

The vast majority of candidates were able to plot both points accurately. A small number of candidates either omitted the question or misinterpreted the scale.

Question 1 (a) (ii)

(ii) Describe the type of correlation shown on the scatter diagram.

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

Almost all candidates gave the correct response of 'positive'. Responses of 'rising' or 'increasing' were not accepted.

Question 1 (b) (i)

(b) One of Beth's jigsaw puzzles was described as "the most difficult jigsaw puzzle you will ever try".

(i) Circle the most likely jigsaw puzzle on the scatter diagram. **[1]**

Apart from a few candidates who omitted the question, virtually all identified the correct point.

Question 1 (b) (ii)

(ii) Give a reason why you chose this jigsaw puzzle.

.....

.....

..... **[1]**

Acceptable reasons needed to refer to both the long time needed to complete the jigsaw puzzle and the small number of pieces, or similar. Merely noting that the puzzle took the longest time or did not fit the trend were not sufficient.

Question 1 (c) (i)

(c) **(i)** Draw a line of best fit on the scatter diagram. **[1]**

Almost all lines were ruled and the great majority were within the tolerance for acceptance. A few candidates made the error of drawing a line from the bottom left of the graph to the right-hand end point.

Question 1 (c) (ii)

(ii) Use your line of best fit to estimate how many pieces are in a jigsaw puzzle that takes Beth 500 minutes to complete.

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

Most candidates correctly gave the number of pieces for their line. Those who were incorrect usually misinterpreted the horizontal scale.

Question 1 (d)

(d) Explain why Beth should **not** use her scatter diagram to estimate how long it will take to complete a jigsaw puzzle containing 8000 pieces.

.....

.....

..... **[1]**

Many statements lacked clarity. Acceptable responses noted that 8000 pieces was beyond the given data, or similar, or commented that the trend may not continue.

Assessment for learning

Candidates need to be clear that they are referring to the limitations of the data rather than the limitations of the graph or scale. Use of the word 'data' is helpful, whereas use of 'it' can be ambiguous.

Question 2

2 A restaurant menu has 4 main courses and 3 side dishes.
For their meal, each customer chooses 1 main course and 1 side dish.

Main course	
Beef burger	£6
Lasagna	£7
Veggie burger	£5
Turkey stew	£6

Side dish	
Salad	£2
Chips	£3
Garlic bread	£1

Work out the percentage of possible meals that cost less than £8.

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

Almost all candidates identified that there were 12 different possible combinations. A wide range of presentation style was in evidence including lists, tables, arrow diagrams and some just applied the product rule of 4 × 3. Most also identified the four combinations that cost less than £8 and then proceeded correctly to $\frac{4}{12}$ and then 33.3%. However, a significant number of candidates identified either combinations that cost less than or equal to £8, or combinations that cost more than £8. If working was clear and otherwise correct, these candidates were given M1 M0 M1 A0.

Question 3

3 Write these numbers in order of size, starting with the smallest.

0.36% $\frac{1}{333}$ 0.03 3.1×10^{-3}

..... , ... , ... , ... **[4]**

smallest

The greatest success was achieved by candidates changing each value to its decimal equivalent, but many could not do this correctly for 0.36%. A few candidates tried to convert to fractions, but rarely managed to have a common denominator across all four values.

Candidates who showed no working could gain four marks if correct, but most responses without working were incorrect and so gained zero. If working was shown, B1, B2 and B3 were available to candidates who made some correct conversions.

Assessment for learning

Even if a question does not say 'you must show your working', it is wise to assume that a four-mark question (such as this one) will have up to three marks available for the working or method.

Question 4

4 Casey's mobile phone gives a weekly report showing the amount of time they use their phone.

This week the report says that the phone was used

- for 217 minutes
- 24% more than last week.

Calculate Casey's phone usage last week.

..... minutes **[3]**

Candidates who recognised that this question required a reverse percentage to find the original amount usually gained full marks. Some candidates showed working as 217 ÷ 1.24, while others used a breakdown approach of 124% = 217, then 1% = 1.75, then 100% = 175.

Most other candidates found 76% of 217, which gained no marks.

Question 5 (a)

5 A sheet of A4 card weighs 1.19×10^{-2} kg.

(a) Work out the weight of 500 sheets of the A4 card.

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

Nearly all candidates showed the correct calculation and response. Most of these appeared to use the standard form facility on their calculator.

Candidates who did not gain marks usually selected an incorrect operation.

Question 5 (b)

(b) Card is classified using W, the weight in grams per square metre (gsm).

$$W = \frac{\text{weight in grams}}{\text{area in square metres}}$$

A sheet of A4 card is a rectangle that is 21 cm by 29.7 cm.

Calculate W for this A4 card.

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

This question provided a good spread of marks.

Candidates needed to convert the weight given in standard form in kilograms into a weight in grams by multiplying by 1000. Some omitted this step, some multiplied by 100, and some divided by 1000. Candidates also needed to find the area of the rectangle in square metres, having been given the dimensions in centimetres. Those who first converted the dimensions into metres before finding the area were far more successful than those finding the area first and then converting, with many of the latter incorrectly thinking that $100\,cm^2 = 1\,m^2$. Candidates then needed to use their weight and area in the given formula. The mark scheme gave M1 if the figures 119 and 6237 were used appropriately in the formula.

Assessment for learning

When finding an area or volume in units other than those of the given dimensions, it is usually a good strategy to change the units of the dimensions before finding the area or volume.

Question 6

6 The area of this rectangle can be written as $ax^2 + bx - 10$.

Not to scale

Find the values of a, b and c.
You must show your working.

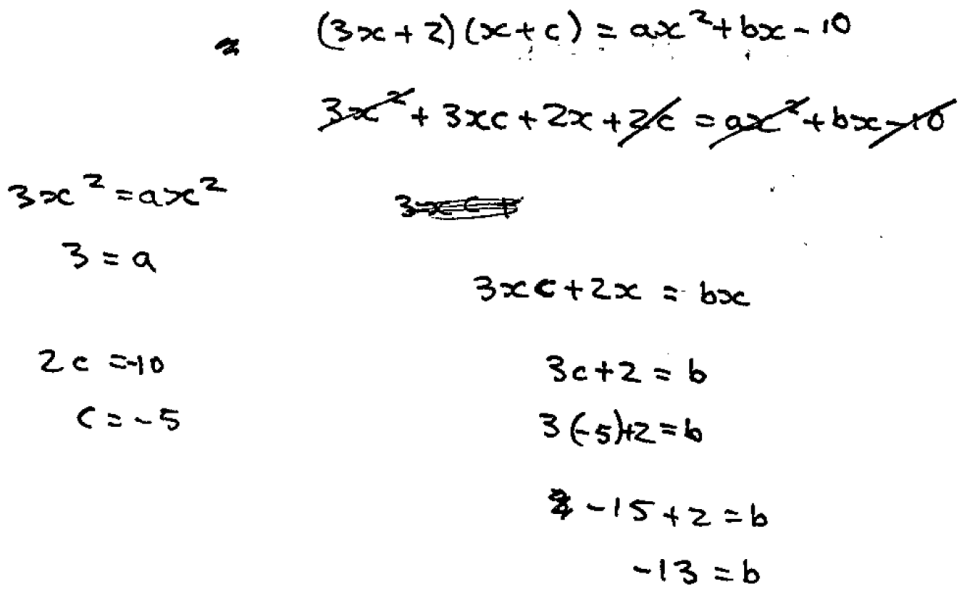
$a =$ ..... , $b =$ ..... and $c =$ ..... **[5]**

For full marks, the question stated working must be shown and for some, this prompt enabled them to find a way into the question.

Most candidates recognised the need to multiply the two dimensions together and by writing that intent down as $(3x + 2)(x + c)$ they gained M1. Without further working, candidates could then often deduce that $a = 3$ to gain B1 and then sometimes that $c = -5$, to gain another B1.

Candidates had more of a struggle when finding the value of b. Those who expanded the brackets usually obtained the equivalent of $(3c + 2)x$ and were given M1, with a fuller expansion not being necessary to find b. Those realising that $c = -5$ could then make the substitution to find the value of b for the final B1 mark.

Exemplar 1

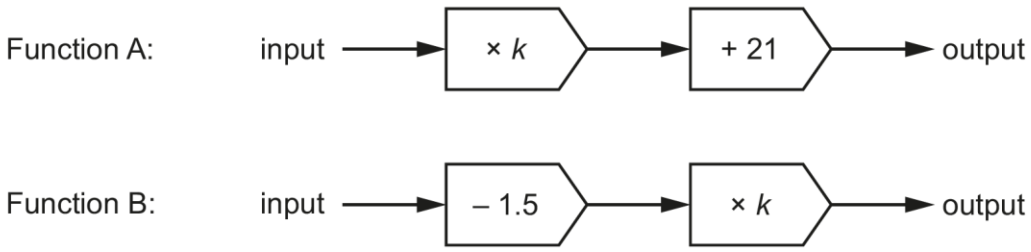


$a =$ 3 , $b =$ -13 and $c =$ -5 **[5]**

The candidate shows intent to multiply the two dimensions of the rectangle, gaining M1. Although not a requirement, they decide to expand the brackets fully, gaining another M1 for the correct coefficient(s) of x. That enables them to see the equating of coefficients steps more clearly than perhaps trying to deduce values in their head. So, equating the x^2 coefficients immediately gives them $a = 3$ and they can see that $2c = -10$, hence $c = -5$. Finally, they equate the coefficients of x as $3c + 2 = b$, substitute in $c = -5$, and thus find $b = -13$.

Question 7

7 Here are two functions.



5 is input into Function A.
5 is also input into Function B.
The output of Function A is 10 times the output of Function B.

Work out the value of k.
You must show your working.

$k =$ ..... **[5]**

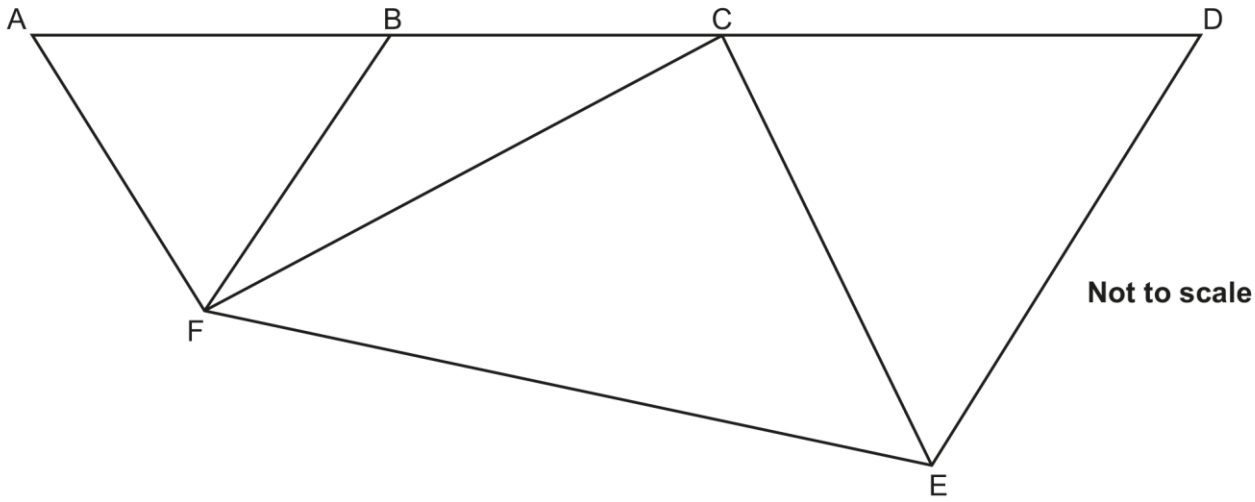
Some basic algebraic errors were shown in responses to this question.
Function A leads to $5k + 21$, but it was common for this to be incorrectly simplified to $26k$ in subsequent working.
Function B leads to $3.5k$, but it was common for this to be treated as $5 – 1.5k$, or as $50 – 15k$ after multiplying by 10.

It was anticipated that candidates would set up and solve the equation $5k + 21 = 35k$. Instead, it was common for trial values of k to be substituted into Function A and Function B. This was usually unsuccessful in reaching the correct answer of $k = 0.7$ as many candidates only trialled integer values. Some credit was given depending on correct evaluations and whether the values of k used in the two functions were consistent.

Other candidates tried setting up simultaneous equations, such as $5k + 21 = 10B$ and $3.5k = A/10$, but generally abandoned this at $147 = 70B – A$ or sooner. If the left-hand side of these equations were correct, these candidates could still gain M1 M1.

Question 8

8 The diagram shows four triangles that are joined together.



- Points A, B, C and D lie on a straight line.
- Triangles ABF and CDE are equilateral triangles.
- Triangle BCF is an isosceles triangle with BF = BC.

Show that triangle CEF is a right-angled triangle.
Give a reason for each stage of your working.
Use the template below to help present your work. You may not need all of the lines.

Angle ..... = ...° because .....

.....

Angle ..... = ...° because .....

.....

Angle ..... = ...° because .....

.....

Angle ..... = ...° because .....

.....

Angle ..... = ...° because .....

.....

Angle ..... = ...° because .....

.....

Angle ..... = ...° because .....

.....

[5]

Marks were given as one mark for each complete, correct, relevant statement. There are five specific angles that need to be found in order to show what the question requires. Other angles (such as FAB and CEF) are not necessary to answer the question and so received no credit. The statements were accepted in any order.

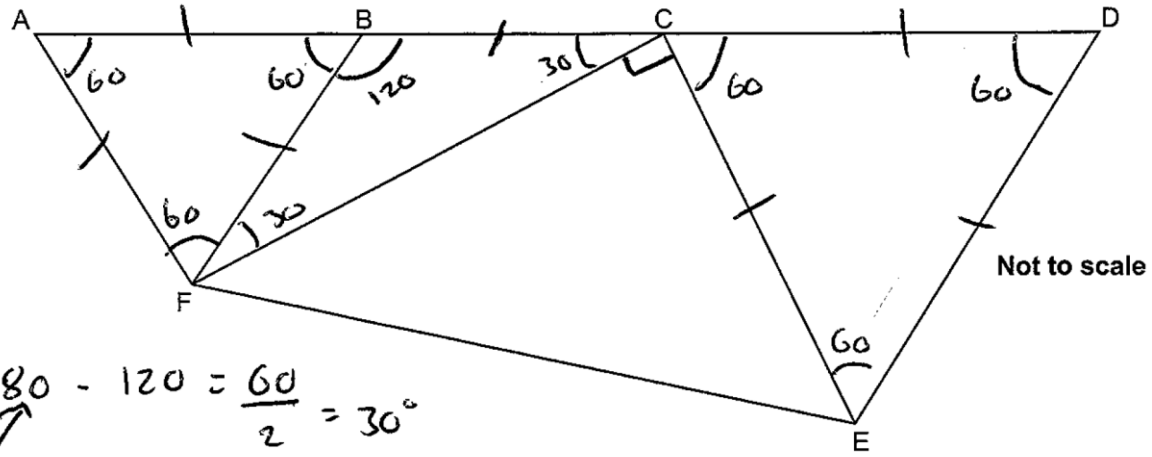
Correct notation was required, such as angle 'ABF' rather than angle 'B'. This question used the command words 'show that', so for the final mark it was a requirement to present the arithmetic 180 – 30 – 60 (or similar) that justifies angle FCE as being a right angle.

Candidates have struggled in the past to present their working and reasons clearly. The provided template appeared to help candidates achieve marks.

Assessment for learning

Content statement 8.01b of the specification requires standard labelling of angles, such as 'angle ABC'. If there is just one triangle (for example, as is often the case in trigonometry) then 'angle B' is unambiguous, but on diagrams like the one presented here, three-letter notation is needed.

Exemplar 2



180 - 120 = 60/2 = 30°

180 -

- Points A, B, C and D lie on a straight line.
- Triangles ABF and CDE are equilateral triangles.
- Triangle BCF is an isosceles triangle with BF = BC.

Show that triangle CEF is a right-angled triangle.
Give a reason for each stage of your working.
Use the template below to help present your work. You may not need all of the lines.

Angle FAB = 60° because angles in an equilateral triangle are all the same (180/3 = 60)

Angle ~~CDE~~ DCE = 60° because angles in an equilateral triangle are all the same (180/3 = 60)

Angle FBC = 120° because angles on a line add up to 180° (180 - 60 = 120)

Angle BCF = 30° because ~~angles~~ ~~on~~ angles in a triangle add up to 180°, isosceles triangles have 2 equal angles

Angle BFC = 30° because angles in a triangle add up to 180°, isosceles triangles have 2 equal angles

Angle FCE = 90° because angles on a straight line add up to 180° (30 + 60 = 90, 180 - 90 = 90)

Angle FCE = 90° because right-angles = 90°

There is no credit for the first statement as FAB is not needed to answer the question set. Instead, the candidate should have referenced angle ABF. In the second statement, angle DCE is relevant, 60˚ is correct and the equilateral triangle reason is correct, and so a mark is given. Likewise, the third and fourth statements are relevant, correct and explained, gaining another mark each. The fifth statement does not receive a mark because angle BFC is not relevant to the question. Finally, angle FCE is justified to be a right angle (or 90˚) with a reason and supporting calculation.

In total four of the five marks have been given. The mark for angle ABF has not been given as the reason has not been given despite 60° being marked on the diagram.

Had their reasons been insufficient or omitted, or incorrect angle notation used, candidates could still receive SC2 or SC1 marks for correct angles marked on the diagram.

Question 9

9 A large box of chocolates contains dark, milk and white chocolates.
When Riley opens the box, the ratio of dark to milk to white chocolates is 3 : 2 : 4.
Riley's family eat 6 of the dark chocolates, none of the milk chocolates and all of the white chocolates.
The ratio of dark to milk chocolates is now 9 : 8.

How many **white** chocolates did Riley's family eat?

..... white chocolates **[4]**

This was an accessible question for some candidates, but most struggled to make worthwhile progress despite similar questions being set previously. There are many approaches possible (as detailed on the mark scheme), but the most common and successful was using equivalent ratios.

Correct solutions came from noting that the number of milk chocolates is unchanged and therefore the first step is to write down the two ratios equivalent to those in the question that have the same number of milk chocolate parts, e.g. 12 : 8 : 16 and 9 : 8, which gained M2. That gives a difference of 12 – 9 = 3 dark chocolates, so scaling up the two ratios to have a difference of six dark chocolates gives 24 : 16 : 32 and 18 : 16, from which the answer 32 can be extracted.

A few correct algebraic methods were also seen from candidates, but most used incorrect starting equations.

Question 10 (a)

10 (a) x and y are related by the equation $xy = 36$.

Tick the correct statement.

- ☐ y is directly proportional to x
- ☐ y is inversely proportional to x
- ☐ y is not proportional to x **[1]**

This was a multiple-choice question, but few candidates recognised the equation as a rearrangement of the more usual $y = \frac{36}{x}$ form for inverse proportion.

Question 10 (b)

(b) y is inversely proportional to x^4.
$y = 2.5$ when $x = 2$.

Find a formula linking x and y.

(b) ..... **[3]**

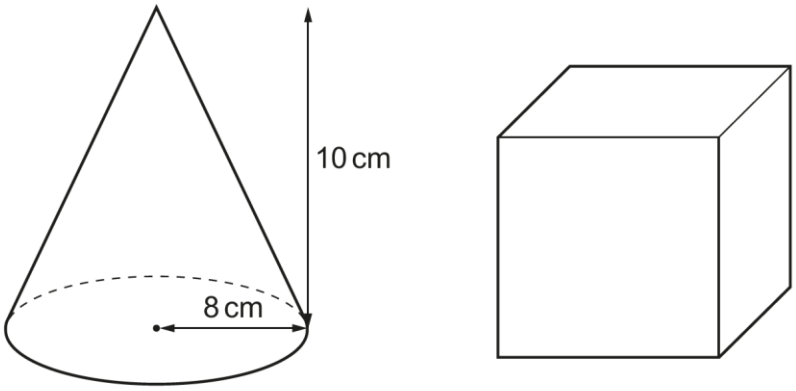
This question had a high omission rate. Similar questions have been set in the past and were answered well. Some candidates did not interpret the information given in the question correctly, instead treating this part as $y = \frac{k}{x}$.

Some candidates found success by writing $y = \frac{k}{x^4}$ algebraically then substituting the values and finding k as 40, but for full marks it is necessary to write down the response to the question asked, i.e. $y = \frac{40}{x^4}$ or equivalent.

Candidates either appeared confident on this topic and were able to pick up full marks, or struggled to show understanding and received few marks.

Question 11

11 The diagram shows a cone and a cube.
The cone has radius 8 cm and height 10 cm.



The volume of the cone is equal to the volume of the cube.

Work out the length of one side of the cube.

[The volume V of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

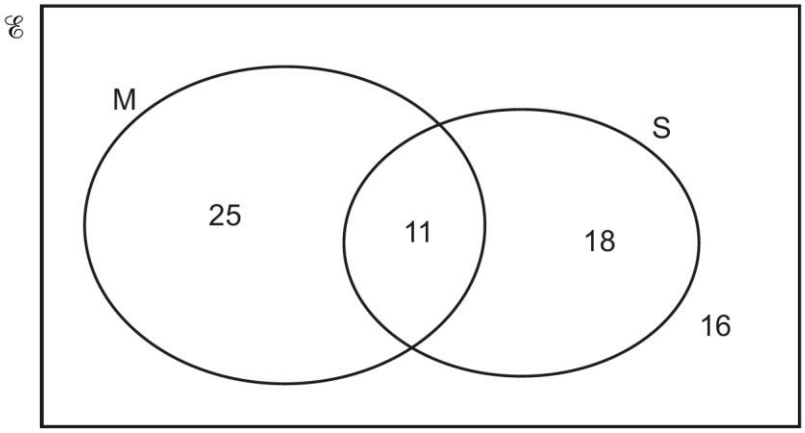
..... cm **[4]**

Most of the candidates correctly substituted into the volume formula and most evaluated it accurately, gaining two marks. A good number of candidates continued correctly by attempting to find the cube root of the volume. Others made errors, either finding the square root, dividing by six (the number of faces) and then finding the square root, or dividing by twelve (the number of edges).

Question 12 (a)

12 A cafe owner recorded information about customer orders for coffee.
They recorded whether the customer asked for milk (M) and whether the customer asked for sugar (S).

The results are shown in this Venn diagram.



(a) One of the customers is chosen at random.

Find the probability that the customer asked for sugar.

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

Most candidates gave the correct response. Common errors were to think there were only 18 customers asking for sugar rather than 11 + 18, or to not count the 16 who had neither milk nor sugar as customers.

Question 12 (b)

(b) One of the customers is chosen at random.

Find the probability that the customer asked for sugar given that they asked for milk.

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

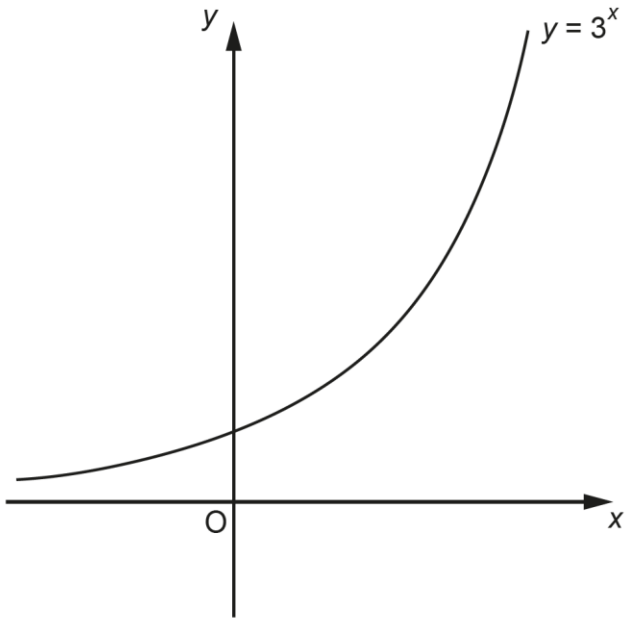
Most candidates gave the correct numerator of 11, but some did not appreciate the conditional nature of the demand and so had a denominator of 70 again rather than 36.

Assessment for learning

The phrase 'given that' is often used to provide information about a conditional situation.

Question 13 (a)

13 (a) The graph of $y = 3^x$ is sketched below.

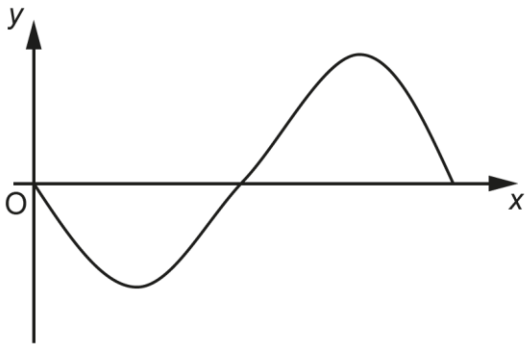


On the same axes, sketch the graph of $y = 2^x$. **[3]**

Few candidates gained three marks, but most made an attempt at the question. Many drew the correct shape but had all of their curve beneath the given curve; this gained B1. Few candidates drew their curve to pass through the same *y*-intercept as the given curve, despite some labelling their intercept as (0, 1).

Question 13 (b) (i)

(b) Charlie sketches this graph.



Charlie says

The equation of my graph is y = sinx.

(i) Explain how you know that Charlie is **not** correct.

.....

.....

..... **[1]**

Most acceptable responses noted that $y = \sin x$ should initially be an increasing curve or have positive values of y.

Question 13 (b) (ii)

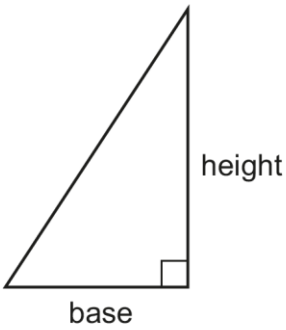
(ii) Write down a possible equation for Charlie's graph.

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

This question had a high omission rate. $y = -\sin x$ was the most common correct equation, but a few alternatives, such as $y = \sin(-x)$, were seen.

Question 14

14 Here is a right-angled triangle.



Not to scale

The area of the triangle is $100\,cm^2$, correct to the nearest $10\,cm^2$.
The length of the base of the triangle is 8 cm, correct to the nearest cm.

Calculate the largest possible height of the triangle.

..... cm **[4]**

Many candidates did not treat this as a bounds question and a very common wrong answer was 25 from 100 ÷ 4, which gained no marks.

Those who did use bounds usually selected the appropriate values of 105 and 7.5.

However, it was also very common across the whole ability range to omit the $\frac{1}{2}$ from the area of a triangle calculation, leading to only a few candidates achieving full marks.

Question 15 (a)

15 (a) Sasha and Taylor are asked to find how many solutions the equation $5(x+2)^2 = 45$ has.

Here is **Sasha**'s answer.

$5(x+2)^2 = 45$
$(x+2)^2 = 9$
$x+2 = 3$
$x = 1$

There is one solution.

Here is **Taylor**'s answer.

$5(x+2)^2 = 45$
$(x+2)^2 = 9$
$x+2 = 3$ or $x+2 = -3$
$x = 1$ or $x = -5$

There are two solutions.

Decide who is correct, Sasha or Taylor, and give the reason for your decision.

..... is correct because .....

..... **[1]**

Many candidates thought Sasha was correct. Those correctly identifying Taylor sometimes could not give a correct reason for doing so. The reason given should have noted ±3 arising at the square root stage. However, those candidates who verified that Taylor's two solutions worked had a basis for their choice and so gained the mark. Those candidates who merely said that all quadratics have two solutions had not related their statement to this question and, in fact, were making an incorrect generalisation.

Question 15 (b)

(b) Solve this equation algebraically.
Give your answers correct to **2** decimal places.
You must show your working.

$x^2 - 5x + 3 = 0$

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

The quadratic formula was given on the formula sheet and candidates of all abilities made an attempt to substitute into it. Most identified *a*, *b* and *c* correctly, but errors occurred in writing and evaluating the parts involving the *b* term as it was negative. About a third of candidates both substituted and evaluated correctly, but some of these did not give the final answer to the requested accuracy.

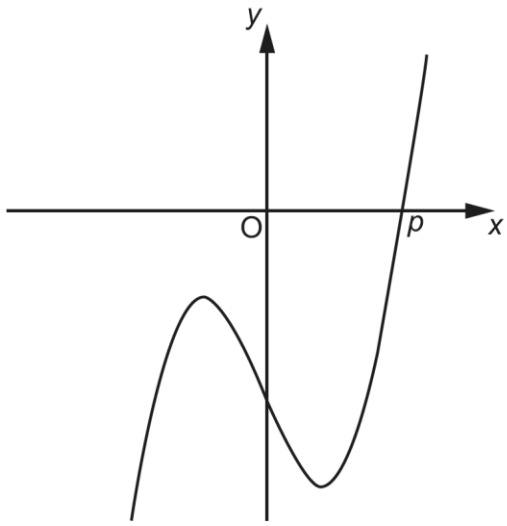
A few candidates used the method of completing the square, then solving the equation. These tended to be the higher performing candidates and most attempts were successful.

Assessment for learning

When substituting negative values into formulae (the quadratic formula, in particular), it is a good idea to write them in brackets, e.g. (-5), before doing any simplifying. Calculators are also more likely to give a correct answer if brackets are used, e.g. $(-5)^2$ will be given as 25, whereas -5^2 may be given as -25.

Question 16 (a)

16 The graph of $y = x^5 - 70x - 150$ is sketched below.
The root of the equation $x^5 - 70x - 150 = 0$ is p.



(a) Show that $3 < p < 4$. **[3]**

Similar questions have been set in the past and have been answered reasonably well. However, on this occasion, many of the candidates omitted the entire question.

Candidates needed to evaluate y for $x = 3$ and $x = 4$ as -117 and 594 and note that a change of sign had occurred.

Question 16 (b)

(b) Find a smaller interval that contains the value of p.
You must show calculations to support your answer.

(b) ..... $< p <$ ..... **[3]**

Part (a) says that $3 < p < 4$, so even if the candidate could not show this for themselves, they could still attempt (b). To find a smaller interval, candidates needed to evaluate y for one value of x within that interval and then interpret the answer as a new interval. For example, $x = 3.5$ evaluates to 130 and so a smaller interval is $3 < p < 3.5$, or $x = 3.1$ evaluates to -81 and so another smaller interval is $3.1 < p < 4$.

Part marks were available, with M1 for substituting an appropriate value of x and M1 for the correct evaluation. However, many candidates either gained full marks or no marks.

Question 17

17 Hiro invests £2500 for 2 years in a bank account paying r% per year compound interest.
At the end of 2 years, the amount in the bank account is £2704.

Calculate r.

$r =$ ..... **[4]**

Nearly all candidates attempted this question. About half gained no marks and about a third gained full marks.

Two successful methods were seen. The most straightforward was to set up and solve $2500x^2 = 2704$, which leads to $x = 1.04$ therefore the answer is 4%. The other started with substitution into the formula given on the formula sheet, leading to $2500(1 + \frac{r}{100})^2 = 2704$ and resulting in $r = 4$.

Either of the above equations gained M1. Valid working to solve the equation was given further method marks.

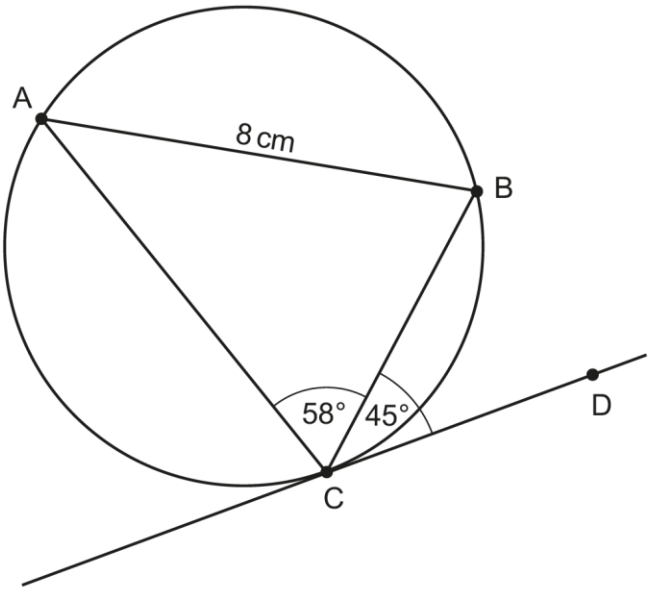
A common error was to treat the question as simple interest, i.e. 2704 – 2500 = 204, then 204/2500 = 8.16% and then 4.08%. This gained no marks because it has simplified the demand.

Misconception

Simple interest and compound interest appear fairly regularly in questions on both the Foundation and Higher tiers. Candidates appear to engage well with these questions, but confusion between the two is likely to result in loss of marks.

Question 18

18 A, B and C are points on the circumference of a circle.



Not to scale

Points C and D lie on a tangent to the circle at C.
Angle BCD = 45°.
Angle ACB = 58°.
AB = 8 cm.

Find the length of BC.

..... cm **[4]**

Lower performing candidates did not make worthwhile progress, as knowledge of circle theorems and the sine rule needed to be combined to answer the question.

Angle CAB is 45° from the alternate segment theorem, although the reason was not required for the award of the mark. However, it was common to misuse the theorem and give the angle as 77°. A few candidates assumed this was an isosceles triangle and therefore worked out the angle as 64°.

The sine rule work was performed very well by those attempting to finish the question. Many of those candidates who had an incorrect value for angle CAB were still able to use it correctly in the sine rule and so gained two marks out of four.

Question 19

19 A fitness centre records how long each customer spends in the gym.
This **cumulative frequency** table summarises the results.

Time (t minutes)	Cumulative frequency
$t \leqslant 10$	6
$t \leqslant 20$	24
$t \leqslant 30$	35
$t \leqslant 40$	48
$t \leqslant 50$	60
$t \leqslant 60$	74

Calculate an estimate of the mean time the customers spend in the gym.
You must show your working.
You may use the table above to help present your work.

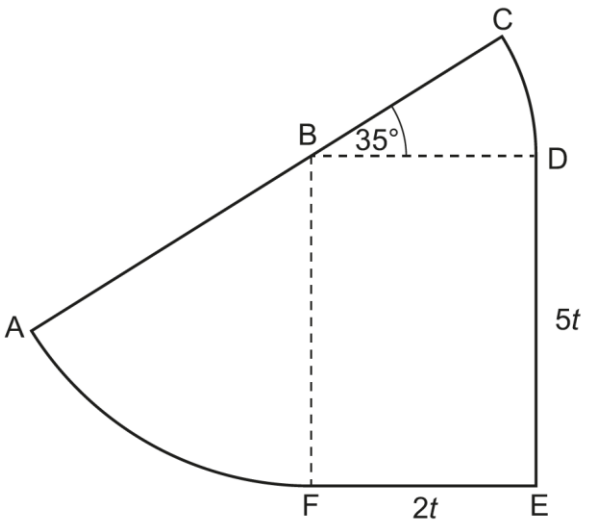
..... minutes **[5]**

Few candidates were able to complete this question correctly, although just under half managed to gain some of the part marks.

Candidates could gain B1 for the correct mid-points of each interval, but many subsequently used the end points of each interval. Candidates needed to find the frequency of each interval to gain further marks, with B1 given for the correct frequencies and then M1 for multiplying these by the mid-points and summing the answers. Finally, candidates needed to divide by 74 (the number of customers), but many instead divided by 6 (the number of intervals) or 60 (the end of the final time interval).

Question 20 (a)

20 This shape is formed from a rectangle and two sectors of circles.



Not to scale

Points A, B and C lie on a straight line.
Angle CBD = 35°.
DE = $5t$ and EF = $2t$.

(a) Explain why BC = $2t$.
Give a reason for each step of your explanation.

.....

.....

..... **[2]**

Candidates needed to make clear use of BD as the connection between FE and BC alongside supporting reasons. For example, 'BD = FE because they are opposite sides of a rectangle and so BD = $2t$ and then BC = BD because they are both radii of the same sector/circle'.

Question 20 (b)

(b) Show that the perimeter of the shape is $\frac{23}{12}\pi t + 14t$. **[5]**

Part (a) served as a prompt for part (b) and most candidates making an attempt deduced that AB = 5*t*, which enabled them to gain a mark if showing the sum of the four straight sides leading to 14*t*. Candidates could also gain a mark for having both AB = 5*t* and angle ABF = 55°.

The remaining three marks were for the arc lengths of the two sectors and completing the summation of the perimeter to the given answer without error. Some candidates found the areas of the sectors, but then abandoned their work. Generally, those who made an attempt knew what they were doing and completed the task accurately.

Question 21

21 Simplify fully.

$$\frac{x^3 + 8x^2 + 15x}{x^3 - 9x}$$

..... **[5]**

Some candidates gained full marks, but most gained none. Part marks were given depending on the progress made in the factorising of the numerator and the denominator, plus any correct simplifications.

Exemplar 3

$$\frac{x^3+8x^2+15x}{x^3-9x}$$

$$\frac{x^3+8x^2+15x}{x^3-9x}$$

$$=\frac{x^3+8x^2+15x}{x(x^2-9)}$$

$$=\frac{x^3+8x^2+15x}{x(x^2-3^2)}$$

$$=\frac{x^3+8x^2+15x}{x(x+3)(x-3)}$$

$$=\frac{x(x^2+8x+15)}{x(x+3)(x-3)}$$

$$=\frac{x(x+3)(x+5)}{x(x+3)(x-3)}$$

$$=\frac{x+5}{x-3}$$

$$\frac{x+5}{x-3}$$ ..... **[5]**

The order in which the factorisations and simplifications take place is sometimes interchangeable. Many candidates performed more than one step at a time, but sometimes introduced an error; this can make it difficult to credit an intermediate step that may have taken place and is then subsequently spoilt. This exemplar shows very clearly, line-by-line, what each step is.

On the penultimate line of working, the candidate gives an expression that is M4 on the mark scheme, but progress leading to this should be checked for any errors that sometimes cancel themselves out. That is not the case here.

First the candidate deals with the denominator, taking *x* out as a factor and then they factorise the difference of two squares (M1). They then factorise the numerator (M2). The numerator and denominator have been factorised correctly and presented as a whole expression, so M4 is given. Finally, they simplify this expression correctly and stop. Some candidates however incorrectly cancelled *x* at the end to finish with $\frac{5}{-3}$.

Supporting you

Teach Cambridge

Make sure you visit our secure website **Teach Cambridge** to find the full range of resources and support for the subjects you teach. This includes secure materials such as set assignments and exemplars, online and on-demand training.

Don't have access? If your school or college teaches any OCR qualifications, please contact your exams officer. You can forward them this link to help get you started.

Reviews of marking

If any of your students' results are not as expected, you may wish to consider one of our post-results services. For full information about the options available visit the OCR website.

Access to Scripts

We've made it easier for Exams Officers to download copies of your candidates' completed papers or 'scripts'. Your centre can use these scripts to decide whether to request a review of marking and to support teaching and learning.

Our free, on-demand service, Access to Scripts is available via our single sign-on service, My Cambridge. Step-by-step instructions are on our website.

Keep up-to-date

We send a monthly bulletin to tell you about important updates. You can also sign up for your subject specific updates. If you haven't already, sign up here.

OCR Professional Development

Attend one of our popular professional development courses to hear directly from a senior assessor or drop in to a Q&A session. Most of our courses are delivered live via an online platform, so you can attend from any location.

Please find details for all our courses for your subject on **Teach Cambridge**. You'll also find links to our online courses on NEA marking and support.

Signed up for ExamBuilder?

ExamBuilder is the question builder platform for a range of our GCSE, A Level, Cambridge Nationals and Cambridge Technicals qualifications. Find out more.

ExamBuilder is **free for all OCR centres** with an Interchange account and gives you unlimited users per centre. We need an Interchange username to validate the identity of your centre's first user account for ExamBuilder.

If you do not have an Interchange account please contact your centre administrator (usually the Exams Officer) to request a username, or nominate an existing Interchange user in your department.

Active Results

Review students' exam performance with our free online results analysis tool. It is available for all GCSEs, AS and A Levels and Cambridge Nationals (examined units only).

Find out more.

Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our customer support centre.

Call us on
01223 553998

Alternatively, you can email us on
support@ocr.org.uk

For more information visit
ocr.org.uk/qualifications/resource-finder
ocr.org.uk
facebook.com/ocrexams
twitter.com/ocrexams
instagram.com/ocrexaminations
linkedin.com/company/ocr
youtube.com/ocrexams

We really value your feedback

Click to send us an autogenerated email about this resource. Add comments if you want to. Let us know how we can improve this resource or what else you need. Your email address will not be used or shared for any marketing purposes.

I like this **I dislike this**

Please note – web links are correct at date of publication but other websites may change over time. If you have any problems with a link you may want to navigate to that organisation's website for a direct search.

CAMBRIDGE
UNIVERSITY PRESS & ASSESSMENT