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OCR
Oxford Cambridge and RSA

GCSE (9–1)

Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/05 November 2022 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 answers 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 OCR.

Paper 5 series overview

There was a small entry for the November paper with many more candidates taking the Foundation option than the Higher option. The marks ranged from 3 to 88 with most candidates able to access parts of the paper. There were a few more able candidates aiming for the higher grades 7 to 9 but the majority appeared to be aiming for grades 4 or 5.

Presentation of work was variable. A significant number of candidates still use random approaches in their working to some of the unstructured problem-solving questions, like Questions 5, 7 and 10, where a more structured approach would have helped in obtaining method marks.

The questions that were generally better answered by all included:

- Question 1, percentage increase,
- Question 3, probability,
- Question 4 (a), ratio,
- Question 6 (a), (b) and (d), time series graphs,
- Question 4 (b), percentage, where many were able to obtain method marks.

The more able candidates answered the following questions well:

- Question 2, inequalities,
- Question 5, reasoning with fractions,
- Question 7, angle problems involving algebra,
- Question 8, plans and elevations,
- Question 9, ordering,
- Question 11, decimal to fraction conversion,
- Question 15, surds and indices,
- Question 18, algebraic manipulation and working with quadratics.

The questions that candidates found most challenging included:

- Question 6 (c), reasoning with scale,
- Question 12, combined probability and reasoning,
- Question 13, geometric reasoning to prove triangles are similar,
- Question 16 (b), estimating instantaneous speed,
- Question 17, Area of a triangle and use of exact trigonometric values,
- Question 19, sketching graphs of functions,
- Question 20, Pythagoras' in three dimensions,
- Question 21, graphs and related equations.

Candidates who did well on this paper generally did the following:	Candidates who did less well on this paper generally did the following:
• possessed a good breadth of knowledge across the curriculum • presented secure arithmetic procedures when calculating with ratio, fractions, decimals, surds and percentages • showed concise well-structured working to multi-step unstructured problems • used appropriate instruments such as compasses and ruler when representing plans and elevations.	• did not display a secure knowledge of the curriculum • used random unstructured working on multi-mark questions • made arithmetic errors when performing calculations involving ratio, fractions, decimals and percentages.

Question 1

1 Jamie was paid £14.00 per hour.
Jamie receives a pay increase of 20%.

Work out how much Jamie is now paid per hour.

£ ..... **[3]**

This was a well answered question. Those that struggled did not use efficient non-calculator strategies to calculate 20%. Some, for example, attempted to multiply by 1.2 or 0.2 which created processing issues where errors were made.

Assessment for learning

When working with percentage increase and decrease without a calculator, using a multiplier is often not the best strategy as it involves decimal multiplication.

Relating the increase to known percentage facts or fractions, such as 10% = $\frac{1}{10}$, will make sure the arithmetic is easier to deal with.

Question 2

2 Find all the possible integer values that satisfy the inequality $-4 \leqslant x - 3 < 1$.

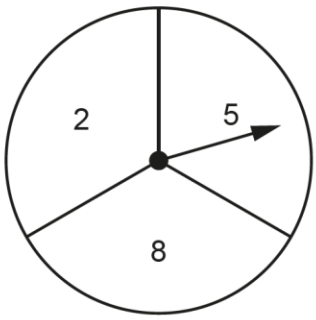
..... **[3]**

More able candidates used a structured approach and solved the inequality algebraically and then considered values of x that satisfied the interval.

Others attempted trials and often did not obtain one or more of the solutions. A significant number gave the integers that satisfied the inequality $-4 \leq x < 1$.

Question 3 (a)

3 Azmi has a fair spinner numbered 2, 5 and 8.



Azmi spins the spinner twice and adds the two scores to get a total.

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

		First spin		
	Total	2	5	8
Second spin	2	4	7	
	5	7	10	
	8		13	16

[1]

Almost all candidates gave three correct entries to the table.

Question 3 (b)

(b) Find the probability that the total is a square number.

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

Almost all candidates gave the correct probability.

Question 4 (a)

4 Layla and Jamal open a box of sweets.
Layla and Jamal share all of the sweets in the ratio 2 : 3.

(a) Write down the fraction of the sweets that Layla receives.

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

Almost all candidates gave the correct fraction. A common incorrect response was $\frac{2}{3}$.

Question 4 (b)

(b) Layla eats some of **her** sweets.
She is then left with 18% of the sweets that were in the box.

Work out the percentage of **her** sweets that Layla has eaten.

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

More able candidates usually gave the correct answer from $\frac{40-18}{40}\times 100$.

Many were able to score partial marks by showing 40 – 18 = 22 or for converting 18% or $\frac{2}{5}$ to an equivalent form.

A common error was to attempt to find 18% of 40.

Question 5

5 Ashley goes on a journey.

She travels by taxi for $\frac{1}{8}$ of the journey.

She travels by train for $\frac{4}{5}$ of the journey.

She walks for the remaining 900 m of the journey.

Find the length of this journey in kilometres.
You must show your working.

..... km **[6]**

This question was answered well by more able candidates.

Most were able to access the problem in part by adding $\frac{1}{8}$ and $\frac{4}{5}$ and most did this successfully to get $\frac{37}{40}$. Some divided by 3 and then either attempted to multiply by 40 (or 37 in a few cases) with processing errors. A number of candidates could not convert their distance in metres to kilometres. For some, a more random approach to the method was shown that did not progress towards the answer.

Several candidates incorrectly started by trying to find $\frac{1}{8}$ or $\frac{4}{5}$ of 900.

Exemplar 1

$\frac{1}{8} + \frac{4}{5} = \frac{5}{40} + \frac{32}{40} = \frac{37}{40}$

$\frac{3}{40} = 900m$

$\frac{1}{40} = 300m$

$\frac{40}{40} = 300 \times 40 = 12000$

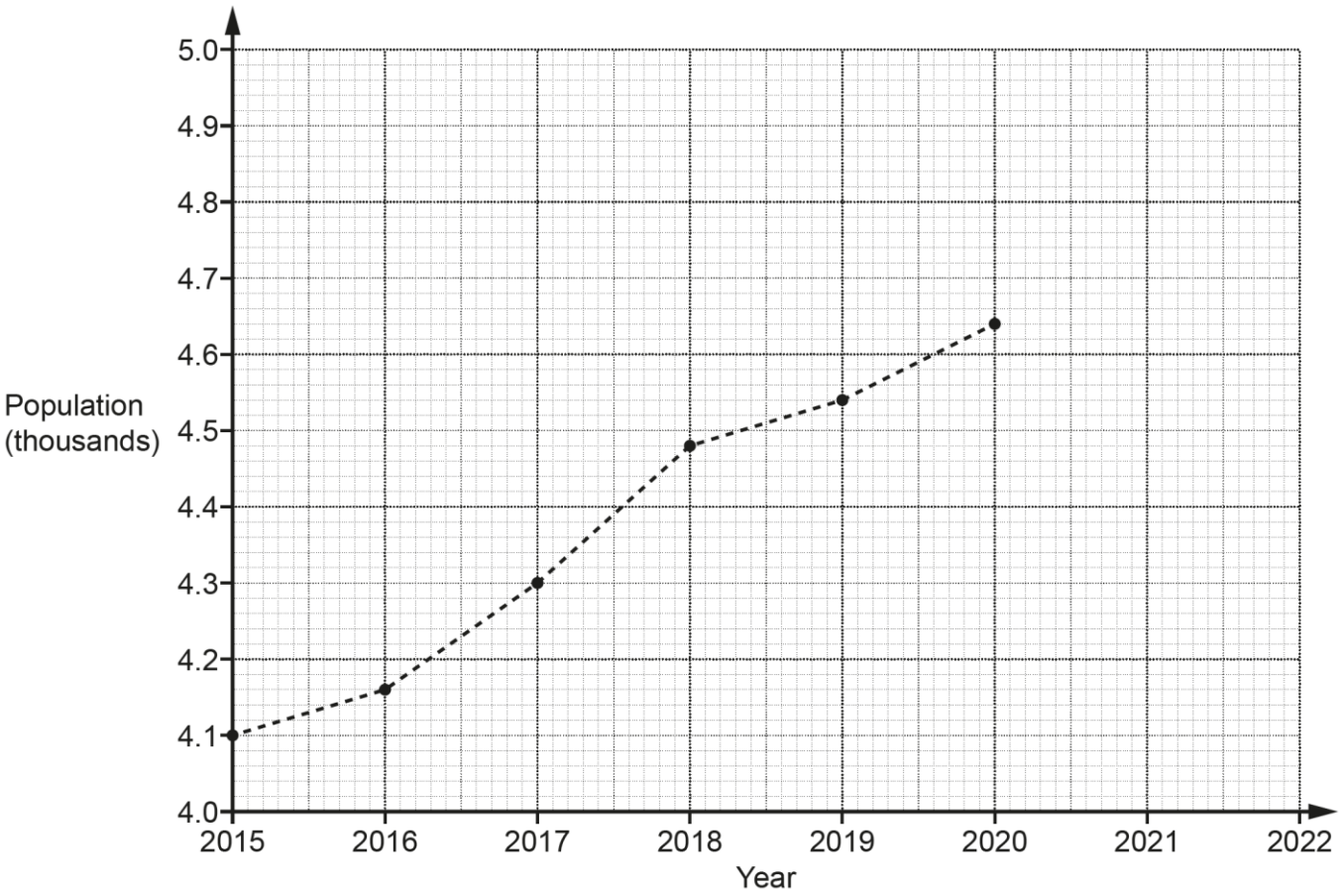
$12000\,m = 12km$

12 km **[6]**

This exemplar illustrates a clear systematic approach to working, with each stage set out line by line leading to the correct response.

Question 6 (a)

6 The graph shows information about the population of a village.



(a) The population of the village in 2021 was 4740.
Plot this point on the graph. **[1]**

Almost all candidates correctly plotted the point correctly.

Question 6 (b)

(b) Work out the increase in the population of the village between 2016 and 2018.

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

Almost all candidates gave the correct increase of 320. A few gave 3.2 and did not interpret the scale. A few were unable to interpret each small division as 20 when making their readings of the population in 2016 and 2018.

Question 6 (c)

(c) Rowan says that there was a huge increase in the population of the village between 2015 and 2020.

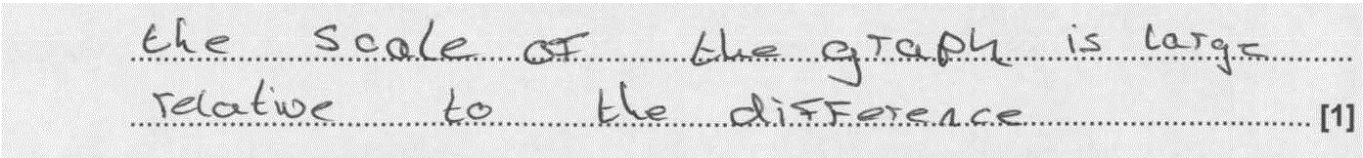
Describe how Rowan may have been misled by the graph.

.....

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

Many gave an answer that lacked detail. The most successful described the truncated vertical scale and stated that the vertical scale does not start at zero or only part of the vertical scale is shown. Some made a vague reference to the scale but did not explain how this affected the steepness of the graph.

Exemplar 2



This response lacks detail. A clear reference to how the vertical scale affects the steepness of the graph is needed.

Question 6 (d)

(d) Blake says that the population of the village will be greater than 4800 in 2022.

Write down an assumption Blake has made.

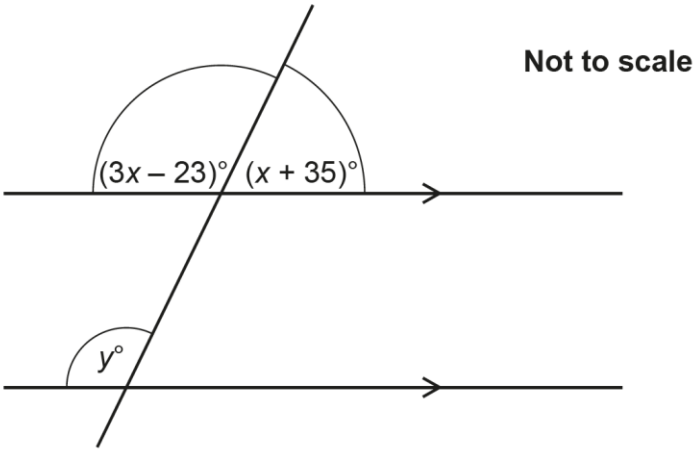
.....

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

This was very well answered with almost all referring in some way to the trend continuing to increase.

Question 7

7 The diagram shows a straight line crossing a pair of parallel lines.



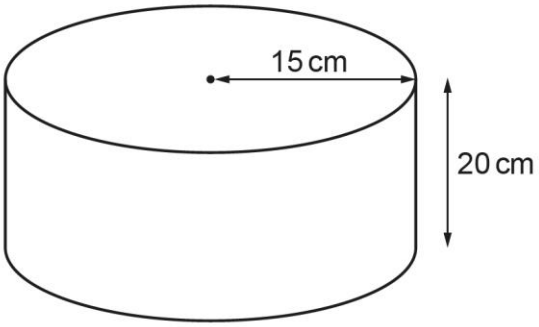
Find the value of y.
You must show your working.

$y =$ ..... **[5]**

Candidate attempts were very variable and only the most able answered this question well.

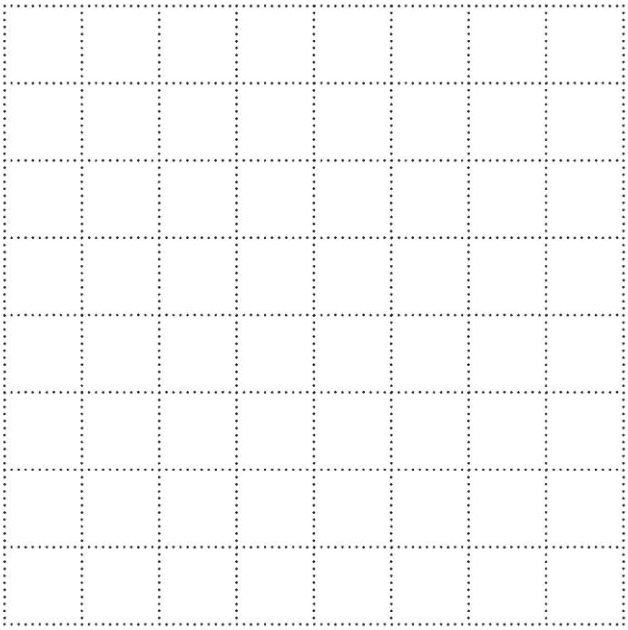
Question 8 (a)

8 The diagram shows a cylinder with radius 15 cm and height 20 cm.



Not to scale

(a) On the grid below, draw the plan view of the cylinder.
Use the scale 1 cm represents 5 cm.



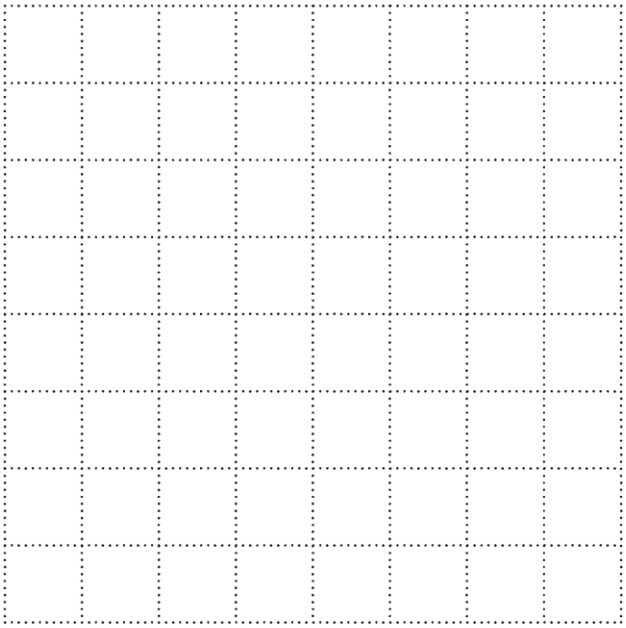
[2]

Many candidates realised that a circle of radius 3 cm was required and although a number used compasses, many did not. Comparable circles drawn freehand were condoned but candidates are advised to always use compasses when drawing circles.

A small number incorrectly gave a rectangle or oval shape.

Question 8 (b)

(b) On the grid below, draw the front elevation of the cylinder.
Use the scale 1 cm represents 5 cm.



[2]

Many correctly deduced a rectangle although some were drawn with incorrect dimensions. Candidates should always use a ruler when drawing polygons.

Some gave the answers to part (a) and (b) in reverse and did not understand the terms 'plan' and 'front' elevation. Where this reversal was consistent, and both were otherwise correct then part credit was given as a special case.

Question 9

9 A student says that they have placed the following values in order starting with the smallest.

$\left(\frac{1}{10}\right)^2$ $\sqrt{0.25}$ 4^{-1}

Has the student done this correctly?
Show how you decide.

..... because .....

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

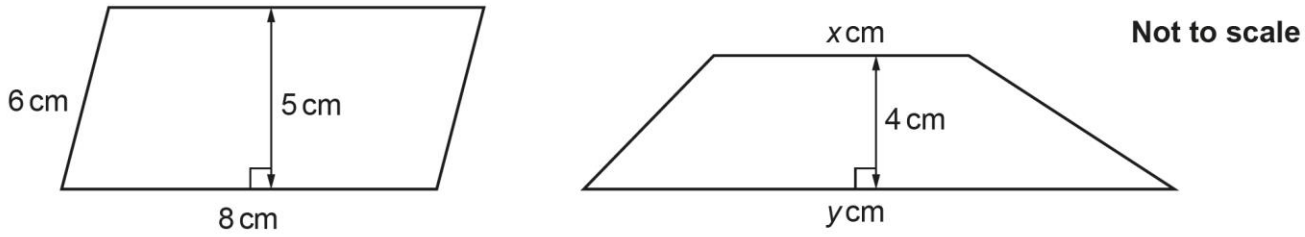
Most candidates earned partial credit for changing one or more of the values to a comparable form.

Common errors included $\left(\frac{1}{10}\right)^2 = 0.1$, $\left(\frac{1}{10}\right)^2 = \frac{2}{20}$. $4^{-1} = -4$.

Only a few correctly converted all three values and gave the right order.

Question 10

10 The parallelogram and the trapezium have the same area.



The ratio of x : y is 3 : 5.

Find the value of x and the value of y.
You must show your working.

$x =$ .....

$y =$ ..... **[6]**

Many candidates were able to find the area of a trapezium and some showed understanding of how to divide the sum of their $x + y$ in the ratio 3 : 5.

Most candidates could not find the correct area of the parallelogram. Many incorrectly gave the area as 6 × 8 = 48, and some worked it out as 6 × 8 × 5 = 240.

Many used random approaches to working and wrote down multiple methods without selecting which method to follow. In cases where there is a choice of methods and no selection, examiners will mark the method leading to the answer. If several methods lead to contradictory answers, then marks will not be given, even if one is correct. Candidates should be reminded to cross out incorrect workings and answers.

Question 11

11 Write $0.\dot{2}\dot{7}$ as a fraction in its simplest form.

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

More able candidates answered this question well. Common incorrect answers included $\frac{27}{100}$ and $\frac{27}{90}$.

A number misunderstood the recurring notation and wrote 27.77 … in their working.

Misconception

? The use of two dots above numbers in the decimal part of a number indicates that both numbers recur.

Question 12 (a)

12 The time, t seconds, taken by each of 60 students to complete a puzzle is recorded.

The table shows information about these times.

Time (t seconds)	$20 < t \leqslant 30$	$30 < t \leqslant 40$	$40 < t \leqslant 50$	$50 < t \leqslant 70$	$70 < t \leqslant 90$
Frequency	8	0	12	30	10

(a) Two students are picked at random.
Reece works out the probability that they both took longer than 50 seconds to complete the puzzle.
Reece's working is shown below.

The number of students who took longer than 50 seconds is 30 + 10 = 40

The probability that one student took longer than 50 seconds is $\frac{40}{60} = \frac{2}{3}$

The probability they both took longer than 50 seconds is $\frac{2}{3} \times \frac{2}{3} = \frac{4}{9}$

Explain the error in their method and write the correct calculation that Reece needs to do.
You do not need to work out the answer to the calculation.

The error is .....

.....

The correct calculation is ..... **[2]**

This question was omitted by a significant number of candidates. A few referred to the second probability being incorrect which was the minimal answer to the first part. Some gave the second probability correctly as $\frac{39}{59}$.

Many went to the values in the table and gave answers such as $\frac{30}{60} \times \frac{10}{60}$ or similar.

Question 12 (b)

(b) Two students are picked at random from those who took 50 seconds or less.

Find the probability that one of them took 30 seconds or less and the other took more than 40 seconds.
You must show your working.

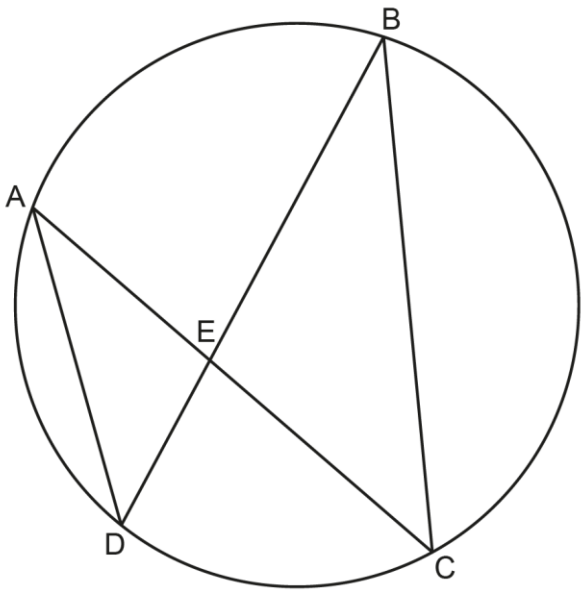
(b) ..... **[5]**

This part proved very challenging for all candidates. The few that attempted to multiply probabilities did not regard the two events as dependent and missed the fact that the choice was from those who took 50 seconds or less, not all 60 students. Calculations typically had only the numerators correct, such as $\frac{12}{60} \times \frac{8}{60}$.

The majority did not attempt a product of probabilities, but partial credit was earned by some for stating $\frac{12}{20}$ or $\frac{8}{20}$.

Question 13

13 Points A, B, C and D lie on the circumference of a circle.
Line AC intersects line BD at point E.



Not to scale

Prove that triangle AED is similar to triangle BEC.

.....

.....

.....

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

This question proved challenging for all candidates and was omitted by a number of candidates.

A few realised that finding equal pairs of angles was the strategy.

More able candidates attempted to work systematically, line by line, giving a pair of angles with a reason.

Angle AED = angle BEC with the reason, [vertically] opposite, earned partial credit for some candidates, but the majority were unable to give correct geometric reasons for the other equal pairs of angles.

A number gave incorrect angle pairs, such as angle A = angle C, perhaps thinking they were alternate angles. Some also referred to lengths and gave reasons of congruency, such as SAS.

Question 14

14 The number of bees, P, in a colony is given by the formula

$P = ab^x$

where x is the number of months after the start of July.

At the start of July, there were 25 000 bees in the colony.
After one month, there were 23 500 bees in the colony.

Find the value of a and the value of b.
Give the value of b as a decimal.

$a =$ .....

$b =$ ..... **[4]**

This question on exponential decay was found to be challenging for all except the most able candidates.

Question 15 (a)

15 (a) Simplify.

$\sqrt{3} \times \sqrt{15}$

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

There was some good work seen here and many scored 2 marks or a partial mark for showing either $\sqrt{45}$ or $\sqrt{15} = \sqrt{3}\sqrt{5}$ in working.

Question 15 (b)

(b) Rationalise the denominator and simplify.

$$\frac{40}{\sqrt{15}}$$

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

This was not as well answered as the previous part but those that realised that multiplication by $\frac{\sqrt{15}}{\sqrt{15}}$ was the first step were usually successful in this part. A few did not then simplify the answer.

Question 15 (c)

(c) Work out.

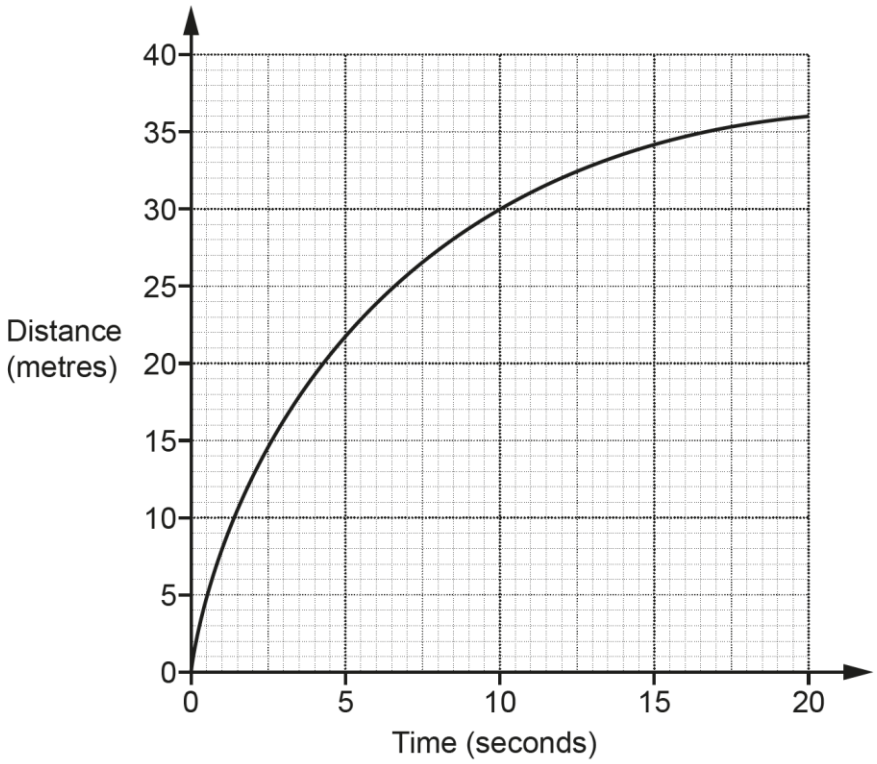
$$27^{\frac{4}{3}}$$

(c) ..... **[2]**

Answers varied in this part. Those that were able to interpret the index correctly were able to process correctly and get the answer. Many were not able to interpret the fractional index and instead, incorrectly divided by 3 and multiplied by 4.

Question 16 (a)

16 The graph shows the distance travelled by a particle over the first 20 seconds of its motion.



(a) Show that the average speed of the particle over the first 20 seconds of its motion is 1.8 m/s. **[1]**

This was well answered by most. Some misread the scale and worked out 35 ÷ 20 before rounding to 1.8 and a few chose unrelated calculations to get to the given answer, such as 18 ÷ 10.

Question 16 (b)

(b) Estimate the speed of the particle at 10 seconds.
You must show working to support your estimate.

(b) ..... m/s **[3]**

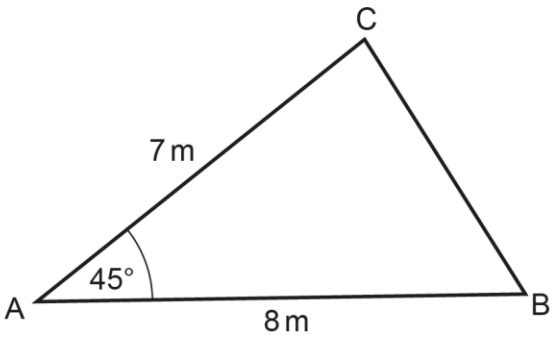
The key to answering this question was to realise that a tangent to the curve was needed to estimate the change in distance over time at time = 10 seconds. Only a few attempted to draw a tangent. The majority of those attempting this part divided 30 by 10.

Misconception

? On a distance-time graph, a straight line indicates constant speed, and a curve indicates non-constant speed. To estimate the speed at a particular point on a curve, a tangent must be drawn to the curve at that point. The tangent is then used to estimate the change in distance over time (speed) at that point.

Question 17

17 The diagram shows triangle ABC.



Not to scale

Find the area of the triangle.
Give your answer in the form $a\sqrt{b}$ where a and b are integers.

..... m^2 **[3]**

This was a challenging question and very few responses were seen.

OCR support

A student guide to exact trigonometric ratios, detailing conceptual and pattern spotting techniques, is available here: Teaching activity: 10.05c Exact trigonometric ratios

Question 18 (a)

18 (a) By factorising, find the roots of $y = x^2 + 18x + 77$.

(a) $x =$ ..... and $x =$ ..... **[3]**

This was a well answered question. Most were able to either give the correct factors or attempt to find them. Those that did give correct factors usually gave the correct solutions.

Question 18 (b) (i)

(b) (i) Write $y = x^2 + 18x + 77$ in the form $y = (x + a)^2 - b$.

(b)(i) $y =$ ..... **[3]**

This was slightly less well answered than the previous part, but a significant number understood the strategy of completing the square; executed it correctly and gave the answer.

Errors included $(x + 9)^2 + 77$ and $(x + 9) - 4$ but in each of these cases partial marks were given.

Question 18 (b) (ii)

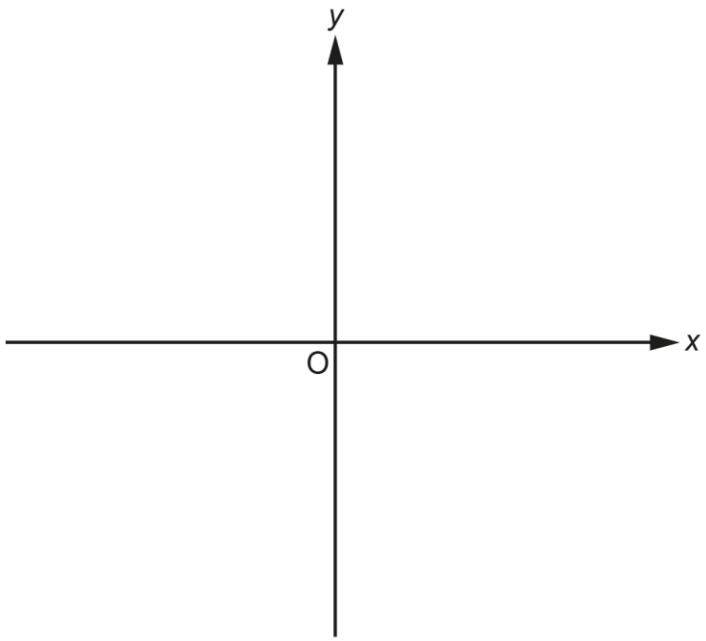
(ii) Write down the coordinates of the turning point of the graph of $y = x^2 + 18x + 77$.

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

Fewer were able to connect their answer to part (b) (i) to this part, but a significant minority were successful.

Question 19 (a)

19 (a) Sketch the graph of $y = 5^x$ indicating any values where the graph crosses the axes.



[2]

Two of the last three questions assessed content from some higher tier topics (graphs of exponential and trigonometric functions and Pythagoras' in 3-D figures). These questions were found to be challenging for all candidates and very few responses were seen.

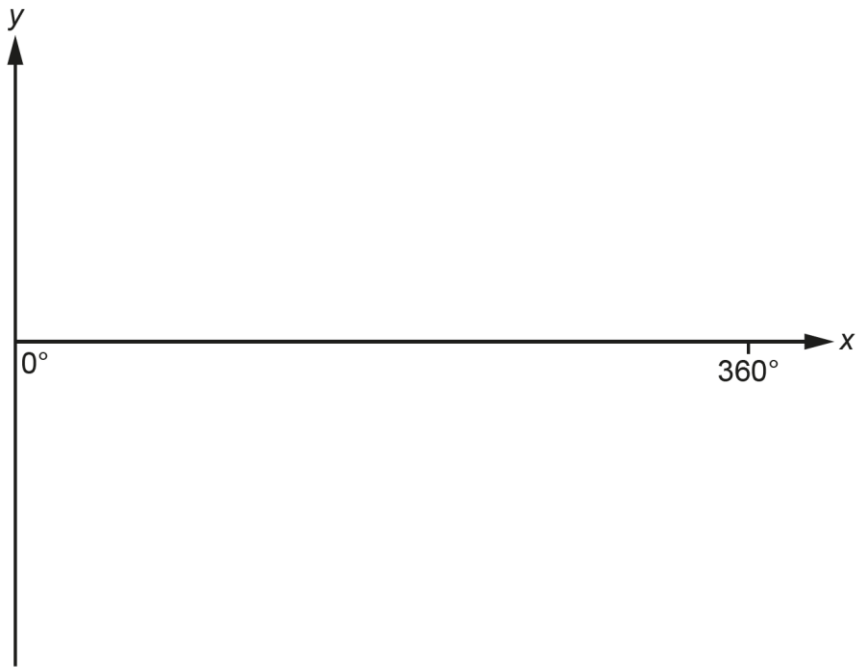
OCR support

Check in tests and Section check in tests covering all higher tier topics are available here:

Check-in tests

Question 19 (b)

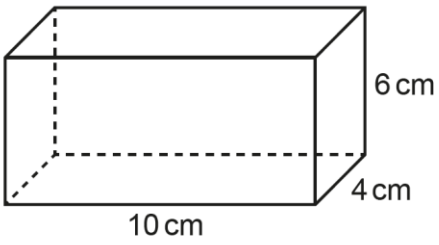
(b) Sketch the graph of $y = \tan x$ for $0° \leqslant x \leqslant 360°$ indicating any values where the graph crosses the axes.



[2]

Question 20

20 Kai has a box in the shape of a cuboid.
The internal dimensions of the box are 10 cm by 4 cm by 6 cm.

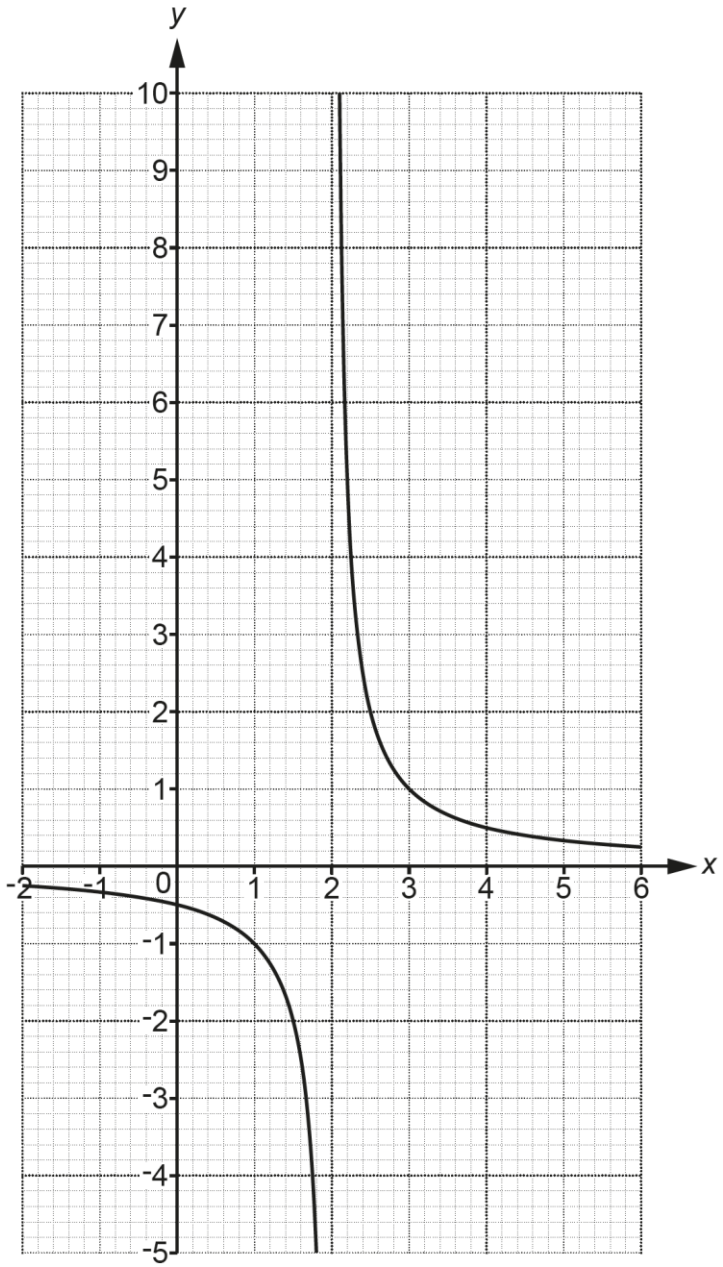


Kai is given a pencil of length 13 cm.

Show that the pencil does not fit completely inside the box. **[4]**

Question 21 (a)

21 The graph of $y = \frac{1}{x-2}$ is drawn on the grid for $-2 \leqslant x \leqslant 6$.



(a) There are no values of x for which $\frac{1}{x-2} = k$.

Find the value of k.

(a) $k =$ ..... **[1]**

Question 21 (b) (i)

(b) (i) **Use the graph** to find approximate solutions to the equation $\frac{1}{x-2} = 3x - 1$.
Give your answers to **1** decimal place.
Show your working on the graph.

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

Question 21 (b) (ii)

(ii) Show algebraically that $\frac{1}{x-2} = 3x - 1$ has the same solutions as $3x^2 - 7x + 1 = 0$. **[4]**

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