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OCR
Oxford Cambridge and RSA

GCSE (9–1)

Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/05 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 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 our secure Teach Cambridge site.

Paper 5 series overview

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. There was a large spread of marks, with most candidates able to access at least parts of the paper.

Presentation of work was generally good, but a small number of candidates are still using random approaches in their working to some of the unstructured problem-solving questions (for example, Question 7 and Question 11(b) where a more structured approach would have benefitted particularly in obtaining method marks). With a random approach often multiple methods are seen and when no single correct method is selected or implied by the answer, examiners are unable to give method marks.

The questions that were generally well-answered tended to be in the first half of the paper and included Question 1 prime factors, Question 2 estimation, Question 3 basic algebra, Question 4(a) reasoning from a time series graph, Question 9(a) percentage, Question 10 sequences and Question 14(a) sampling.

The questions that candidates found most challenging included Question 4(b) recognising limitations of data presentation, Question 11(a) division by a decimal, Question 12 equation of a parallel line, Question 13(c) reasoning from a graph, Question 15(a) constructing a perpendicular to a line, Question 21 transformations and graphs and then the last 4 questions on the paper, which were intended to stretch candidates at the Higher grades.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• had a good breadth of knowledge across the curriculum • had 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 compass and ruler drawing constructions • drew ruled lines or curves as appropriate to the nature of the function when drawing graphs.	• had a more limited breadth of knowledge across the curriculum • used random, unstructured working on multi-mark questions, where often multiple methods were seen with no selection • were less secure with their arithmetic when performing calculations involving ratio, fractions, decimals and percentages.

Question 1

1 Write 60 as a product of its prime factors.

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

This was answered well by almost all candidates. Most used a factor tree to obtain the prime factors. Few candidates did not give their responses as a product or made an error with one pair of factors.

Question 2

2 By writing each number correct to **1** significant figure, find an estimate for this calculation.

$$\frac{486}{\sqrt{101.2}}$$

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

Most candidates rounded the values given in the question to 1 significant figure and went on to give the correct answer. Few candidates rounded just one of the figures (usually rounding 101.2 to 100), for which they were given partial marks. Some gave the answer 48.6 from $486 \div \sqrt{100}$ and then rounded to 50, which was given only partial marks as the working did not follow the instructions given in the question.

Assessment for learning

For estimation questions, always round the figures in the calculation before attempting the actual calculation. Here, the demand specifies the degree of accuracy to round the values to complete the estimation.

Question 3 (a)

3 (a) Simplify.

$3a^2 \times 4a^5$

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

Almost all candidates answered this correctly.

Question 3 (b)

(b) Factorise fully.

$4x^2 - 12x$

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

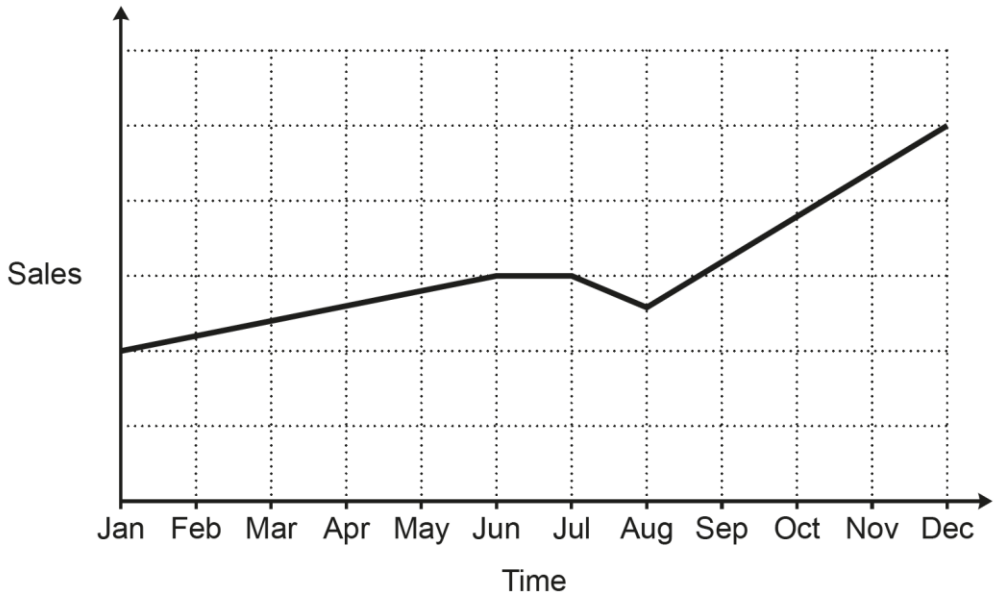
Most candidates gave a correct fully factorised expression. Some gave a partial factorisation such as $2x(2x - 6)$ and were given partial marks.

Misconception

Where expressions can be factorised by removing common factors, always remove the highest common factor from the terms to make sure the expression is factorised 'fully'.

Question 4 (a)

4 A sales representative and a manager discuss this graph of sales over the last year.



(a) The sales representative says

I can tell from the graph that, over the last year, sales have risen every month.

Is the sales representative correct?
Give a reason for your answer.

..... because .....

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

Almost all candidates were able to give a correct response by referring the shape of the graph in the period between June and August.

Question 4 (b)

(b) The manager says

I can tell from the graph that sales are now more than double what they were at the start of the year.

Is the manager correct?
Give a reason for your answer.

..... because .....

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

Few candidates were able to give an acceptable response by referring to the fact that the vertical axis had no values or that the actual sales figures were not given. Most said that the statement was true and then commented on the number of squares that the graph had risen during the year compared to the number of squares at the start of the year.

Question 5 (a)

5 Work out.

(a) $\begin{pmatrix} 3 \\ -1 \end{pmatrix} + \begin{pmatrix} -2 \\ 4 \end{pmatrix}$

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

This was well answered; most candidates gave the correct vector in the required form.

Question 5 (b)

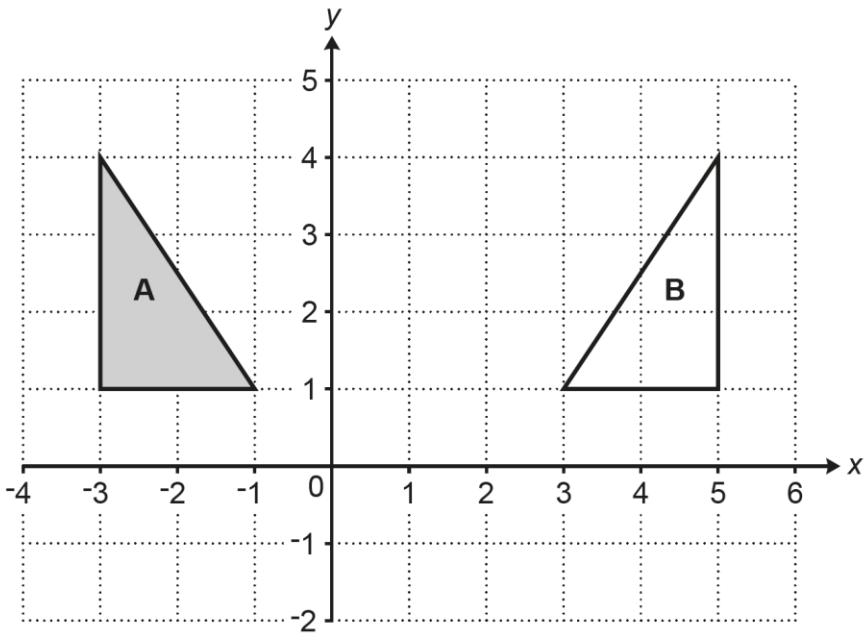
(b) $\begin{pmatrix}5\\3\end{pmatrix}-2\begin{pmatrix}1\\-4\end{pmatrix}$

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

This was well answered by many candidates. Others found it more challenging. For some, there was more success with the horizontal component of the vector than the vertical one where the double negative was involved.

Question 6

6 Triangle **A** and triangle **B** are drawn on the coordinate grid.



Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.

.....

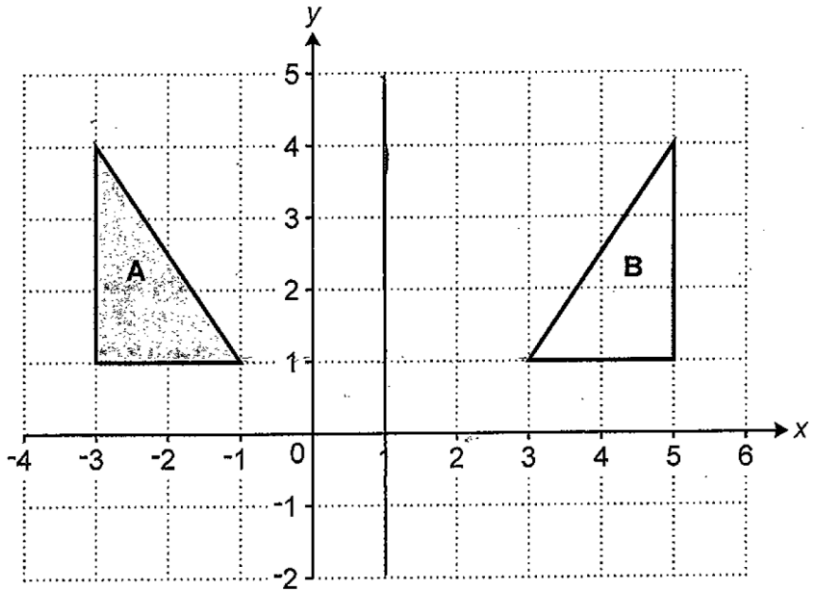
..... **[2]**

Although many candidates were successful, many did not use the correct terminology for either the term 'reflection' or to describe the mirror line. Some gave extra incorrect properties in addition to the mirror line, e.g. Reflection in $x = 1$ centre (0, 0). Others gave more than one transformation, e.g. reflect and then move 2 squares. In those cases, where more than one transformation is given, then examiners will give no marks.

Assessment for learning

Candidates need to use the correct language when describing transformations. The mark allocation for the question reveals the number of properties that are needed with the transformation. In this case, 2 marks means that one property, the equation of the mirror line, is needed in addition to the correct term, reflection.

Exemplar 1

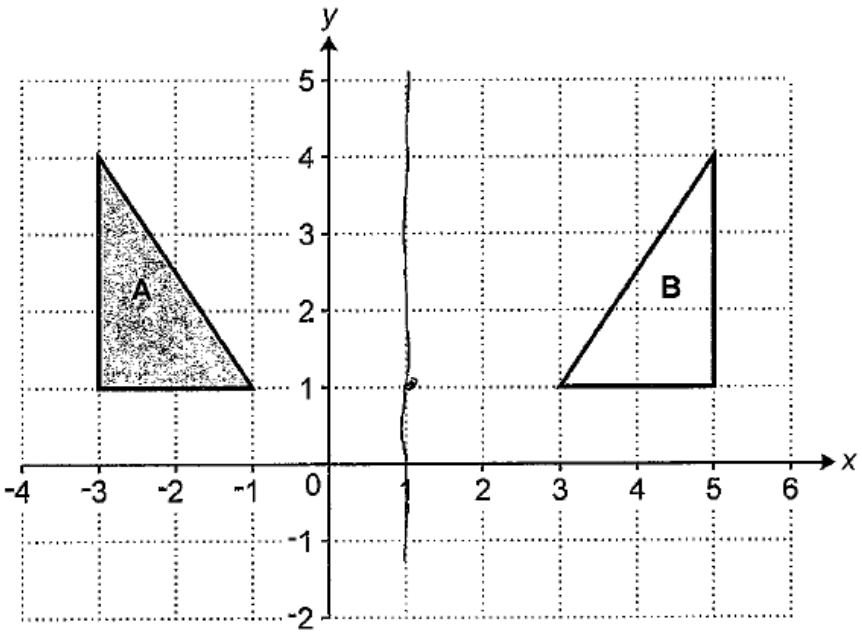


Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.

Reflection in the line $x = 1$

The candidate gives a clear concise answer using the correct terminology reflection and the equation of the mirror line to be given 2 marks.

Exemplar 2



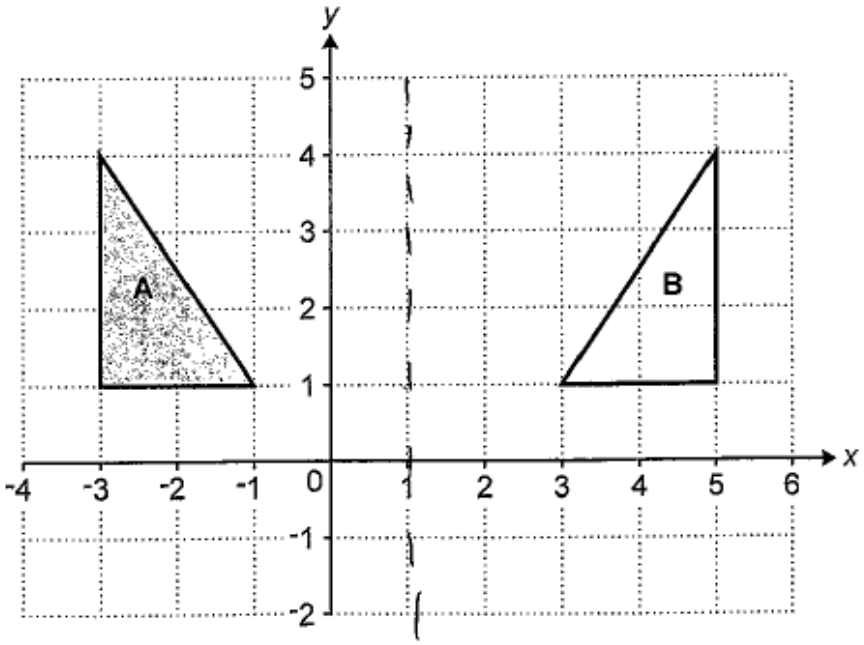
Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.

A is flipped on the (x = 1)

A is mirrored on the line x = 1 **[2]**

The candidate does not used the correct terminology for reflection but gives the equation of the mirror line and so is given 1 mark.

Exemplar 3



Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.

Reflection at $x=1$ and enlargement of 1.

[2]

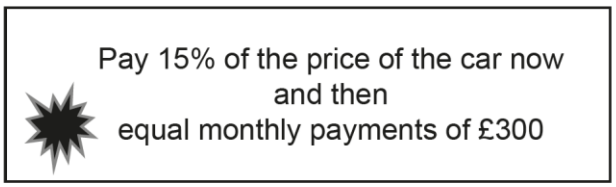
The candidate initially gives a correct response, but then spoils the answer by adding a second transformation. The question requires a single transformation so in cases like this, adding a second transformation will result in no marks given.

Question 7

7 A motorist wants to buy a new car but does not have enough money.

The price of the car is £16 000.

The motorist sees this notice for a deal on the car they want to buy.
The number of equal monthly payments is hidden.



Work out the number of monthly payments if the total cost of the car to the motorist is £17 400.
You must show your working.

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

Many candidates were able to understand the process that 15 percent of a value was required to be paid and then the remaining balance was to be paid in instalments of £300. There was some confusion between using £16 000 or £17 400 as the price of the car to calculate the deposit of 15 percent. Those that used £16 000 usually went on to give the correct answer. Those that started with £17 600 were usually able to calculate 15 percent of this value and then subtract it from £17 400 before dividing by 300, although the arithmetic for the division was more difficult. Partial marks were given for this initial misunderstanding if the subsequent method was then shown correctly.

Question 8

8 The density of some concrete is 2.4 g/cm^3.
A lump of this concrete has a volume of 400 cm^3.

Work out the mass of the lump of concrete.

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

Most candidates recognised that to work out the mass in grams, 2.4 should be multiplied by 400. Many were unable to complete the calculation correctly and responses involving the figures 96, but not 960, were frequent.

Question 9 (a)

9 A box contains only red, green and black pens.
The ratio of red pens to green pens to black pens is 1 : 4 : 11.

(a) Work out the percentage of the pens that are green.

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

This was well answered. Almost all candidates that realised the green pens were $\frac{4}{16}$ of the pens in the box went on to give the correct answer. A few candidates struggled to link the proportion of green pens to a fraction and did not make progress.

Question 9 (b)

(b) There are 24 more green pens than red pens.

Work out the total number of pens in the box.

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

There were many correct answers supported by clear concise working and candidates' work with ratio problems has improved. The most common error was to use the number of green pens and not the difference between the green and red pens in the first step, so many divided 24 by 4 and then went on to give an answer of 96.

Question 10 (a)

10 (a) Find the next term of this sequence.

1 3 9 27 81 ..... **[1]**

Those that recognised the term-to-term relationship of multiply by 3 gave the correct response. A few candidates tried to look for differences between the terms using difference trees and gave incorrect responses.

Question 10 (b)

(b) In the Fibonacci sequence below, the next term is found by adding the two previous terms. The third term is 0.83 and the fourth term is 1.29.

Complete the first, second and fifth terms of the sequence.

.... 0.83 1.29 ..... **[3]**

This was very well answered. Any of the few errors made in finding the terms were in the arithmetic and not in the understanding of the pattern of the sequence.

Question 11 (a)

11 (a) Work out.

$0.8 \div 0.004$

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

Many candidates continue to find division by a decimal value difficult and answers such as 0.2, 0.02 or 0.002 were frequent. Those that made the adjustment to both figures in the calculation and divided 800 by 4 were usually successful.

Question 11 (b)

(b) A carpenter has a plank of wood of length w metres.

The carpenter cuts $\frac{3}{5}$ of the plank of wood into 20 equal pieces.

Each piece has length 0.06 metres.

Work out the value of w, the original length of the plank of wood.
You must show your working.

(b) $w =$ ..... **[4]**

There were many methods that candidates used here. The most common and most successful was to multiply 0.06 by 20 to reach 1.2 m and then to divide 1.2 m by $\frac{3}{5}$. Some candidates sensibly chose to work in centimetres and then convert back to metres for the answer. The most common error was to attempt to find $\frac{3}{5}$ of 1.2 in the final step. Some were unable to process the information given in the question, for example attempting to find $\frac{3}{5}$ of 20 as a first step.

Question 12

12 Write down an equation for the line that is parallel to $y = 3x - 5$ and passes through the point (0, 1).

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

Few candidates were successful here. Many did not demonstrate an understanding that the equation should have a gradient of 3. Answers of $y = -3x \pm c$ or $y = mx - 5$ where m was 1 were among incorrect responses given. Some candidates showed understanding of one of the properties and were given partial marks for an equation with the correct gradient or the correct y-intercept.

Question 13 (a)

13 **(a)** Complete the table for $y = x^3 + 4x^2$.

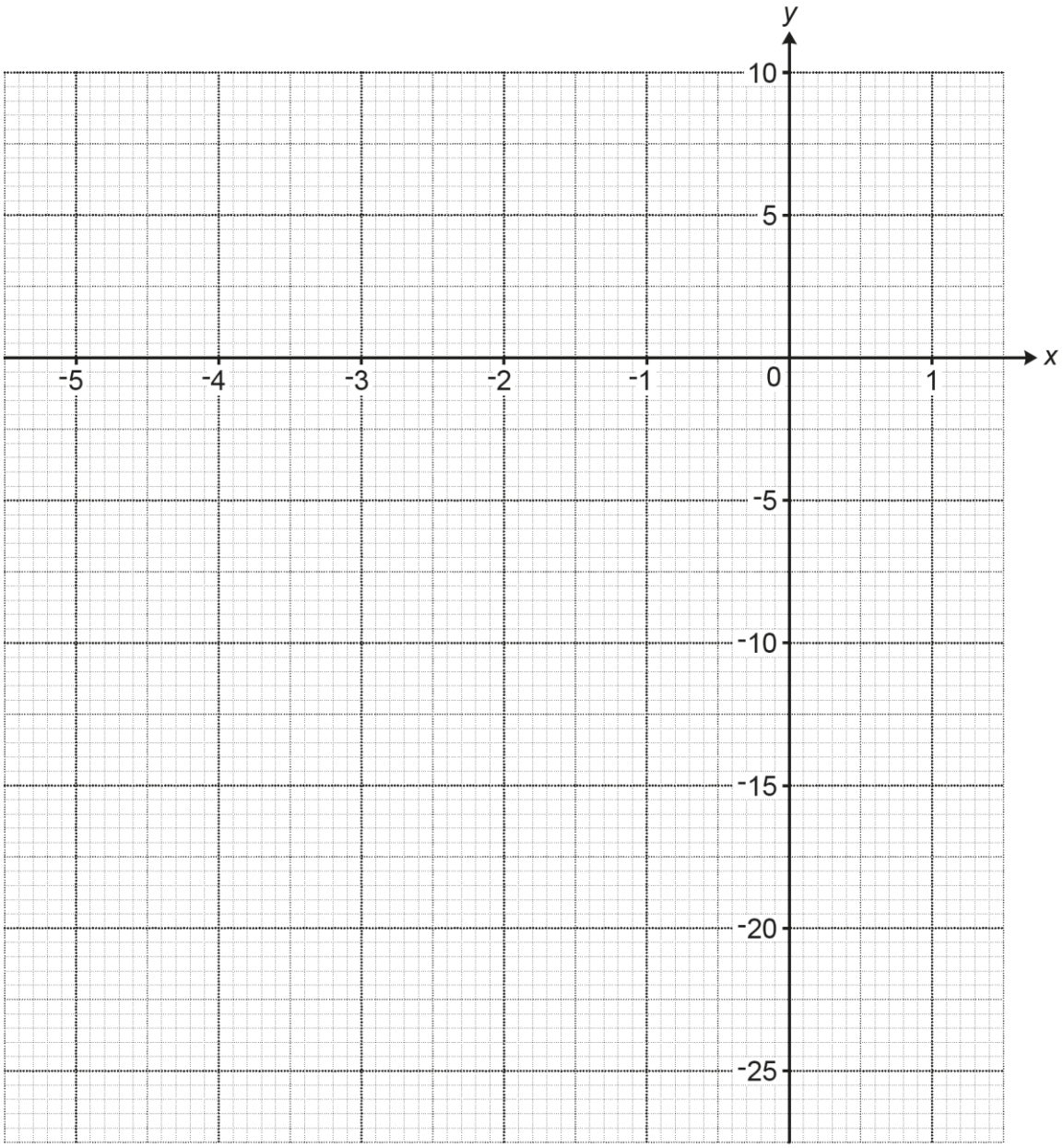
x	-5	-4.5	-4	-3	-2	-1	0	1
y	-25	-10.1	0	9	8		0	5

[1]

Few gave the correct value of 3. An answer of 5 was common and -17 was also seen.

Question 13 (b)

(b) Draw the graph of $y = x^3 + 4x^2$ for $-5 \leqslant x \leqslant 1$.



[3]

Few candidates gave a fully correct curve. Many were given partial marks for correctly plotting their points. The plots at (-4.5, -10.1), (-3, -9) and (-2, -8) were those most commonly plotted incorrectly, where candidates were not able to correctly interpret the vertical scale of the graph.

Question 13 (c)

(c) The equation $x^3 + 4x^2 = k$, where k is an integer, has exactly one solution for $-5 \leqslant x \leqslant 1$.

Find the greatest possible value of k.

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

This part proved challenging and there were a range of incorrect values given. To be successful, candidates needed to look for the 'highest' horizontal line through an integer on the y-axis that crossed the curve once only.

Question 14 (a)

14 A teacher is planning a theme day for the 500 pupils at their school.
The teacher asks a sample of 20 pupils from year 8 which theme they would prefer.

The results are shown in the table.

Theme	Number of pupils
Sport	7
Art and design	3
Recipes	2
Music and movies	8

(a) Describe **two** disadvantages of the teacher's sampling method.

1. .....

.....

2. .....

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

This was very well answered by most candidates. Most were able to give at least one reason, usually referring to a small sample or that it was restricted to one age group.

Question 14 (b)

(b) Using the results from the table the teacher estimates that 175 pupils in the school would prefer a sport theme.

Here is the teacher's method.

$\frac{7}{20} \times 500 = 175$

Write down **one** assumption the teacher has made when making their estimate.

.....

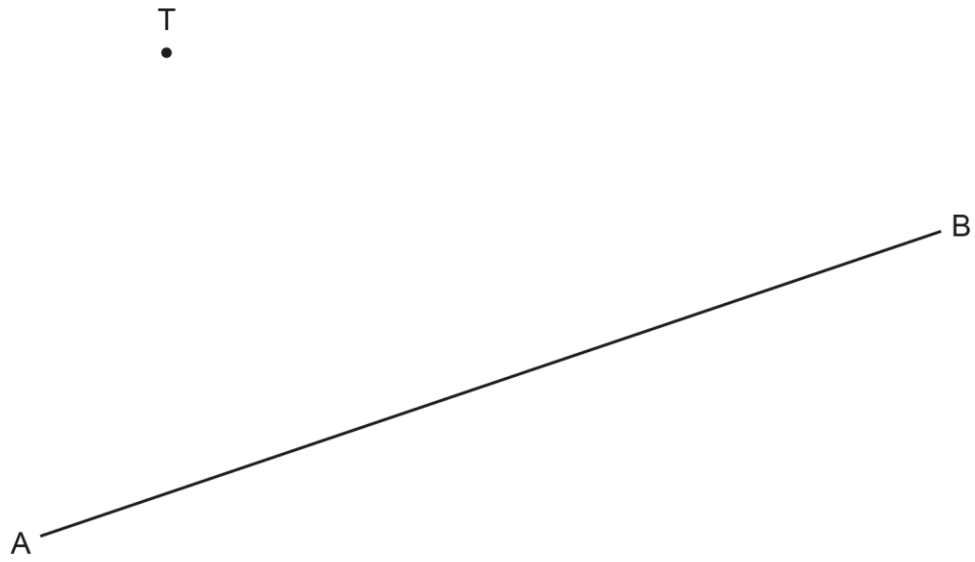
..... **[1]**

Fewer candidates were successful in this part than in part (a). Most who were successful referred to the assumption that the rest of the school made choices in the same proportions as those in the sample in some way. Others who were not successful made comments such as 'it depends if they all attend', or 'they may not do sports', with a few candidates stating the assumption was that 175 of the school chose sports without relating back to the sample.

Question 15 (a)

15 The diagram shows a town T and a straight road AB.

Scale: 2 cm represents 1 km



A new straight road is built from town T to the road AB.
The road is the shortest possible distance from town T to the road AB.

(a) Using ruler and compasses only, construct the road from town T to the road AB. **[2]**

Some candidates gave a correct construction. Others were able to draw the perpendicular from T to AB, but without construction arcs. Some responses didn't demonstrate an understanding of the terminology used in the question, for example candidates drawing a line from T to A or B, or sometimes to the midpoint of AB.

Question 15 (b)

(b) The new road costs £200 000 per kilometre to build.
The road constructor says

The new road will cost over £600 000 to build.

Show that the road constructor is incorrect.

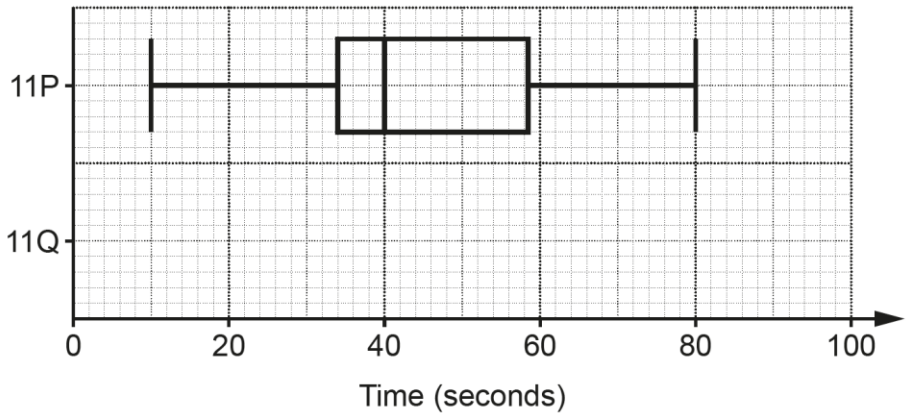
.....

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

There were some very good answers that measured their perpendicular in cm before correctly converting this distance to km using the scale and then correctly multiplied this by £200 000. Some used a concise technique and divided £600 000 by £200 000 to get 3 km as the length of road that was possible and then compared this with their perpendicular converted to km. Most candidates were given at least partial marks here.

Question 16 (a)

16 The box plot shows the distribution of the times, in seconds, taken by class 11P to complete a problem.



(a) The times, in seconds, taken by class 11Q to complete the same problem are summarised below.

- median = 52
- lower quartile = 42
- interquartile range = 18
- range = 70
- highest score = 86

Show the distribution of 11Q's times as a box plot on the diagram above. **[3]**

This was generally well answered. Many candidates were able to calculate that the lowest value is 16 and the upper quartile is 60 from the given information. Errors included misinterpreting the scale when drawing the diagram, or in some cases not having a '5 point' box plot.

Question 16 (b)

(b) Which class has the more **consistent** times?
Give a reason for your answer.

..... because .....

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

Few candidates were successful here. Many said 11P and referred to it as having a greater range or interquartile range. Those that chose 11Q often gave an incorrect reason and referred to median or range and not the interquartile range being smaller.

Question 17

17 y is directly proportional to the cube of x.

Complete the table.

x	1	2	
y	7		875

[4]

There were a few good answers scoring all 4 marks. Others were able to give a correct equation for the proportional relationship but only find one correct value. Many were unable to interpret the proportional relationship; having $y = 7x$ leading to 14 and 125 was a common error. Many candidates omitted this question.

Question 18

18 Work out.

$0.\dot{2}\dot{8} + \frac{4}{9}$

Give your answer as a fraction in its simplest form.

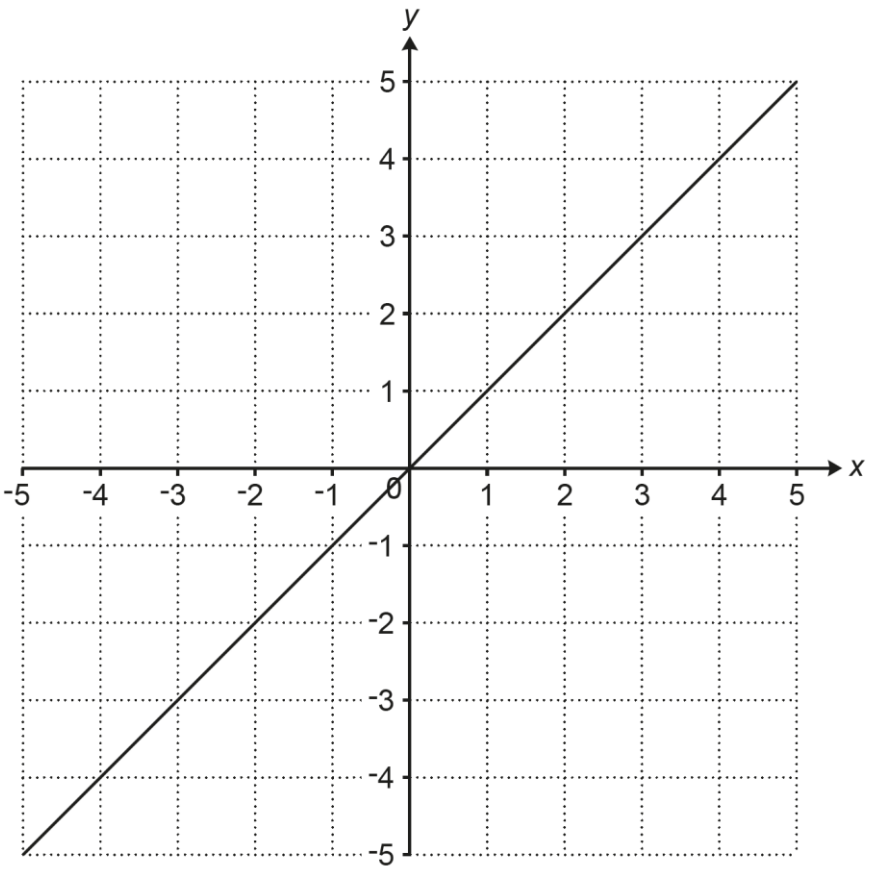
..... **[4]**

Some very good responses were seen here that were given full marks or 3 marks where candidates had given a correct equivalent fraction, but not simplified to $\frac{8}{11}$. Many others were able to convert $0.\dot{2}\dot{8}$ to a fraction correctly to be given method marks.

A common error was to convert $0.\dot{2}\dot{8}$ to $\frac{28}{100}$ or $\frac{28}{90}$.

Question 19

19 The graph of $y = x$ is drawn on the grid.



The region **R** satisfies the following inequalities.

$y \geqslant x$ $y \leqslant 2$ $y < -2x - 3$

By drawing two more straight lines on the grid, find and label the region **R**. **[6]**

Few candidates gave a fully correct response for the region. Others were able to draw two correct lines and identify the correct region, but did not draw $y = -2x - 3$ as a broken line. Most candidates struggled to draw $y = -2x - 3$, but were able to draw $y = 2$. Many were given partial marks for identifying a region that satisfied at least one of the lines. Examiners allowed a follow-through mark for the region if the line $y = -2x - 3$ had been drawn incorrectly, provided it was a ruled line with a negative gradient.

Assessment for learning

Before drawing a boundary line, candidates should consider whether it is included in the required region or not. Lines should always be ruled and where the line is not included in the region, it should be drawn as a ruled broken line.

Question 20

20 Work out.

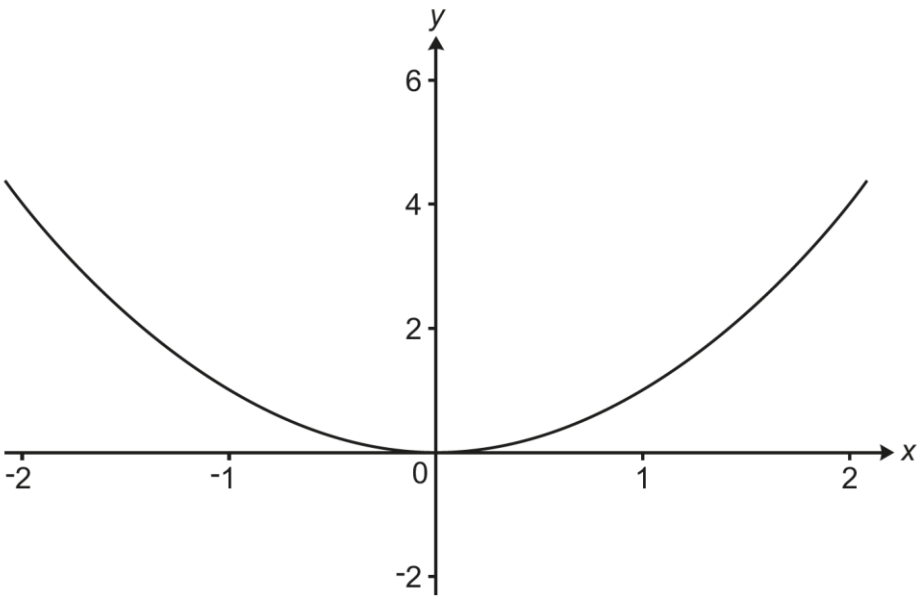
$36^{-\frac{1}{2}}$

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

There were few correct responses for this question and there were a range of incorrect values given. Partial marks were given for those that were able to interpret either the negative part of the index or the root of 36 in their answer.

Question 21 (a)

21 The graph of $y = x^2$ is shown below for $-2 \leqslant x \leqslant 2$.



(a) Find the equation of the image when $y = x^2$ is reflected in the line $y = 2$.

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

Some candidates gave a correct equation. Others recognised that the equation must be in the form $y = k - x^2$ and they were given partial marks for answer such as $y = -x^2$. Many omitted this part.

Question 21 (b)

(b) Describe the **single** transformation that maps the graph of $y = x^2$ onto the graph of $y = x^2 + 6x - 5$.

.....

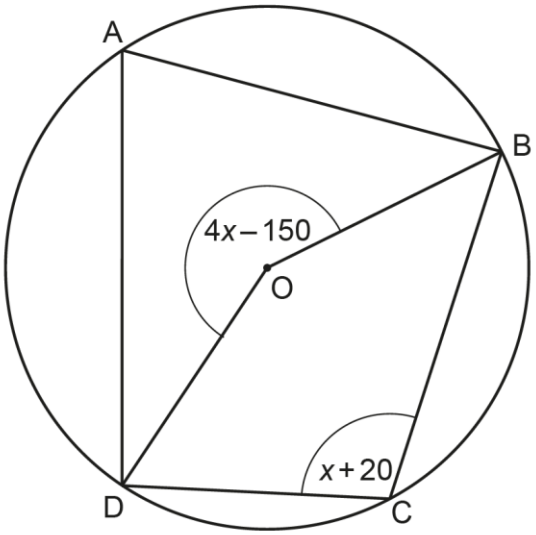
..... **[4]**

This proved to be challenging for almost all candidates. Many omitted this part. Some candidates completed the square and then linked it to the coordinates of the turning point of $y = x^2 + 6x - 5$ before giving a correct transformation. Some others recognised the transformation and gave the answer translation, but without any algebraic work to establish the vector required.

Question 22 (a)

22 In this question all angles are given in degrees.

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



Not to scale

(a) Find the size of angle BCD.

(a) ..... ° **[4]**

A few candidates were able to set up a correct equation, solve it to find the value of x and then use this to find the size of angle BCD. Many set up an incorrect equation, for example $x + 20 = 4x - 150$ or $x + 20 + 4x - 150 = 360$. A follow-through mark was available for solving an incorrect equation of equivalent difficulty to the correct equation. This mark was given to a small number of candidates.

Question 22 (b)

(b) Find the size of angle DAB.
Give a reason for your answer.

..... ° because .....

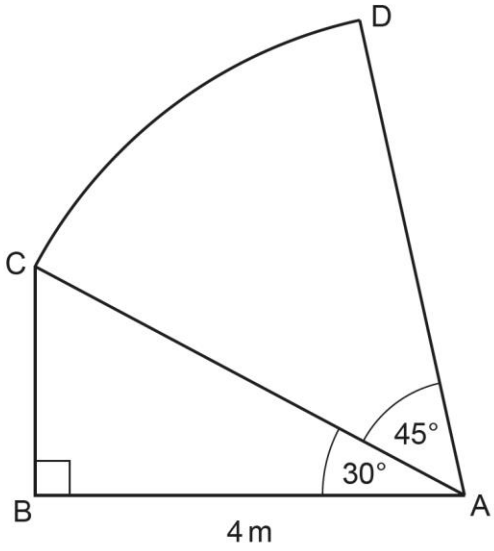
..... **[2]**

There were some good responses that gave a correct angle and used the correct geometrical language involving a cyclic quadrilateral. A few candidates were given a partial mark for the correct angle with an incorrect reason or not using the correct language to describe the geometrical property.

Question 23 (a)

23 In the diagram,

- ABC is a right-angled triangle
- ACD is the sector of a circle with centre A.



Not to scale

(a) Show that the area of the sector ACD is $\frac{8}{3}\pi$ m^2. **[6]**

This proved challenging for all but some of the higher performing candidates. There were some successful responses that showed each step of reasoning towards the required area. Some were able to set up a correct trigonometric equation to find AC, but then could not recall the exact value of cos 30 that was needed to complete the solution. There were follow-through marks available for the method using their AC to find the area of the sector, provided candidates had considered a correct trig equation to find AC previously.

Question 23 (b)

(b) Work out the total area of the shape ABCD.

Give your answer in the form $\left(\frac{a\sqrt{k}}{b}+\frac{8}{3}\pi\right)\text{m}^2$.

(b) ..... m^2 **[3]**

Fewer candidates were successful here than in part (a) and there were many that omitted this part. Those that were successful used either trigonometry or Pythagoras' theorem with their AC to find BC, before attempting to find the area of the triangle. The concise method using $\frac{1}{2}\times$ their AC $\times 4\sin 30$ to find the area was seldom seen.

Question 24

24 The x-coordinates of the intersections of the graphs of $y = x^2 + ax + 7$ and $y = 3x + b$ are the solutions to the equation $x^2 + 8x + 13 = 0$.

Find the value of a and the value of b.

a = ...

b = ... **[3]**

Only the highest performing candidates had success on this question. Some were given partial marks for stating that $x^2 + ax + 7 = 3x + b$ would lead to the given equation. Most others that attempted the question tried to find the solutions of the equation $x^2 + 8x + 13 = 0$.

Question 25

25 Riley has a set of cards.
Each card has a triangle or circle drawn on it and is coloured red or blue.

The table gives some information about the number of each type of card.

	Number of cards with a triangle	**Number of cards with a circle**
Number of blue cards	3	8
Number of red cards	9	2

Riley chooses three of these cards at random without replacement.
All three of these cards have a circle drawn on them.

Riley says

The probability that two of these three cards are blue and one is red is less than $\frac{1}{2}$.

Is Riley correct?
You must show your working.

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

There were a small number of fully correct solutions to this challenging question, although, many candidates were given a mark for writing a single relevant probability that could be used as a starting point. Most did not consider the condition that Riley's cards all have a circle and incorrect probabilities out of 11 and 22 were often seen. Very few considered a product of three probabilities within their working.

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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.

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