

# GCSE

# Mathematics

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**8300/3F: Paper 3F (calculator) Foundation**

Report on the exam

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## Contents

The below table is interactive. You can press the control button click on the title of the question to go directly to that page.

Contents	Page
<a href="#">Summary</a>	3
<a href="#">Individual questions</a>	4
<a href="#">Further support</a>	12

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## Summary

### Overall performance compared to last year

There was no evidence of time pressure with most students able to complete the whole paper. Some of the questions that were common with the Higher tier proved very challenging for students on this tier.

Students were not always able to access some of the questions, but they were rewarded for good use of mathematics shown at different levels of ability. Students did not always show working when instructed to do so and some students did not use their calculator effectively.

### Topics where students excelled

- Calculating percentages of an amount or a percentage change to an amount
- Working out factors of a number
- Substituting and evaluating expressions in a formula
- Working with proportions of an amount to calculate costs
- Identifying errors on a pictogram
- Calculating with unit costs in the context of an AO3 problem solving question
- Simplifying a three-term algebraic expression
- Calculating the number of students out of a total from a given probability condition
- Evaluating outputs with an unknown value in two number machines using AO3 multi step process problem solving
- Working with an arithmetic progression in the context of an AO3 problem solving question

### Topics where students struggled

- Naming properties of a circle
- Rearranging a simple formula
- Calculating the area of a triangle
- Working out the area of a cuboid and rounding their answer to one decimal place
- Systematic listing in the context of timetabled subjects AO2 question involving reasoning
- Explanation using given probabilities of events problem with AO2 'show that' reasoning
- Cost calculation using proportion in the context of an AO2 question involving map scales
- Working with fractions to compare mixed numbers in their relative position to a decimal
- Transposing values from a frequency tree and placing them in a Venn diagram
- Using bounds of accuracy to complete an error interval
- Calculating a percentage change from an original to a final amount
- Working with prime and cube numbers in the context of an AO2 question involving reasoning
- Using trigonometry to work out the size of an angle
- Working out probabilities from word descriptions and completion of a tree diagram
- Calculating a combined two stage probability
- Solving simultaneous equations with one equal coefficient in both equations
- Calculating the surface area of a cylinder in an AO3 problem solving question
- Reasoning decisions on the effect of area and perimeter from a change in the cylinders net
- AO3 multi step reasoning and problem solving question with angles in parallel lines and a triangle

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## Individual questions

### Question 1a

This simple percentage of an amount calculation was answered very well by a large majority of students.

### Question 2

This simple place value of a digit in a number was answered very well by a large majority of students.

### Question 3a

This identification of an equilateral triangle was answered well by the majority of students however spelling was extremely varied. Common incorrect responses were right-angled, isosceles and scalene.

### Question 3b

The correct identification of a chord was poorly answered by the large majority of students. Common incorrect responses were segment, sector and tangent. There were a significant number of non-attempts.

### Question 4

Many students correctly identified all of the factors of 45, however some missed a value in the listing process, with the most common omissions being 1 and 45.

### Question 5a

The question was answered very well by many students correctly substituting into the given formula and evaluating the correct answer of 99.

There were a number of students who were unsure how to correctly evaluate after substituting and it appears did not use a calculator.

Common misconceptions were:

- $15^2$  incorrectly evaluated by doubling 15 to 30
- $2 \times 63$  incorrectly written as 263.

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## Question 5b

This rearrange a formula question was not answered well by the majority of students. Common incorrect answers were  $m + k$  and  $\frac{m}{k}$ .

## Question 6a

Many students correctly identified the midpoint of the longest side as (5, 3). The most common error was to use the horizontal length as the longest length and give an answer (5, 1) with others incorrectly transposing coordinates with an answer (3, 5) or giving the vertex of the two longest sides (9, 1).

## Question 6b

This calculation of the area of a triangle question on a centimetre grid was answered poorly by many of the students.

A significant number of students did not divide by two and instead showed  $8 \times 4 = 32 \text{ cm}^2$  indicating no check by counting the number of squares on the centimetre grid.

## Question 7

The large majority of students worked well with proportions of an amount to calculate the costs for two years given the costs for five months.

The very large majority correctly identified £19.84 as the cost of one month's broadband but then made errors in further calculations. Some students decided to use a build-up method with varying degrees of success. Others incorrectly used ten months in a year, or made errors in their repeated addition, with some giving an answer for only one year.

## Question 8

In this question students had to correctly calculate the volume of a cuboid and then round their value to one decimal place. It was not answered well with some gaining a mark for a correct method to calculate the volume but then incorrectly rounding or by rounding their incorrect volume value correctly to one decimal place.

Other misconceptions were:

- not attempting to round a correct volume of 69.255
- truncating a correct volume of 69.255 to 69.2
- adding the three given lengths
- calculating the cross-sectional area from  $6.75 \times 3.8 = 25.65$  and then incorrectly adding the third length of 2.7 or dividing by 2.7

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## Question 9

Identifying errors on a pictogram was answered well by the large majority of students who correctly stated that the key was missing and that the symbol for prawn cocktail was incorrect. The most common error was to comment on both the prawn cocktail and the total as two separate mistakes and not make a reference to the missing key.

## Question 10

This calculating with unit costs problem solving question was answered reasonably well by the majority of students. The most common error was in calculating  $84p \times 1.75$  and many used an incorrect value of £1.68 for the cost of 1.75 kg of potatoes.

The very large majority of students then went onto subtract the correct value of £1.47, or an incorrect value, from £9.03 and then divided it by four.

## Question 11a

Simplifying by collecting like terms was answered well by the majority of students.

The large majority of students correctly identified the  $x$  term as  $10x$ . The most common incorrect answer involved students not retaining the original sign with the term with  $-5y$  becoming  $5y$  and  $-7$  becoming  $7$  in subsequent rearrangement of terms.

Common errors were:

- $9y + 5y = 14y$  for the  $y$  term
- $-4y$  for the  $y$  term
- $1 + 7 = 8$  for the number term
- $1 - 7 = -6$  for the number term but showing an incorrect answer  $10x - 14y + -6$
- $10x - 14y - 6$  with further incorrect work in an answer  $8xy$ .

## Question 11b

Identification of an equivalent expression for an algebraic term was answered reasonably well by the majority of students.

## Question 12

A poorly answered question where the majority of students misinterpreted the given conditions in the systematic listing question in the context of timetabled subjects.

A significant number of students did not include Maths as chosen in Subject 1 and included History and French. Others incorrectly included Geography, Chemistry, Physics and ICT in their lists.

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### Question 13a

This calculation for the number of students from a given probability condition was answered reasonably well. Common errors were giving the answer in the form of a fraction over 1400, or in a subtraction of 126 from 1400 with an answer 1274.

### Question 13b

This 'show that' explanation question with the probabilities of events given was answered poorly by the majority of students. The most common answer was  $0.67 + 0.48 = 1.15$  but with no or an incorrect explanation of how this indicated that students took both subjects.

An alternative method in calculating the number of students from the given probabilities resulted in both 672 and 938 being shown but these were often not added to indicate a total greater than 1400 with an explanation that students took both subjects. There were a significant number of non-attempts.

### Question 14

A poorly answered AO2 problem solving question requiring a cost calculation using proportions from map scales.

There were many different approaches to this question with the most successful approach to add together the distances in cm and then scale these into a total in miles.

Common misconceptions were to omit one length. Others who attempted to scale each individual distance into miles encountered difficulties and some misinterpreted '40p for each mile he drives' as 40p for each fully completed mile. Another common error was using  $1.35 \times 4 = \text{£}5.40$  for the house delivery element with delivery to four houses including A twice in the return journey to A.

### Question 15

A very well answered question by the large majority on this AO3 problem solving question evaluating outputs with an unknown value in two number machines.

The large majority of students used the first number machine correctly to achieve 23 in the first output box. A common misconception was to achieve 67 in working using the second number machine but to give an answer of  $-67$  following the  $-a$  shown in the machine. Some were unable to process  $90 - a = 23$  giving an incorrect answer of 113.

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## Question 16

This question was not answered well by the majority. Those students using a decimal approach generally had more success than those using a fractions approach who generally made no further progress after  $\frac{21}{5}$  and  $\frac{5}{2}$ .

A common misconception involved the incorrect use of a calculator in evaluating  $4\frac{1}{5}$  as 0.8 by first inputting 4 and then  $\frac{1}{5}$  thus achieving  $4 \times \frac{1}{5} = 0.8$ , this led to 1.7 from an incorrect method.

## Question 17

This AO3 problem solving question involving an arithmetic progression was answered reasonably well by students. There were a significant number of non-attempts.

Correct evaluations of the last two terms in the arithmetic progression were mostly seen. The most common misconception was using the level 5 score of 1800 rather than the total score as a misinterpretation of 'the highest possible score' and achieve an answer of 550.

## Question 18

A poorly answered question with many students unable to transpose the values from the frequency tree onto the Venn diagram.

The most common misconception was a misunderstanding that the overlapping region on the Venn diagram for Wednesday and Saturday correctly represented Wednesday Yes and Saturday Yes from the frequency tree. A significant number of students transposed the values in the same order of 53, 25, 68, 64 onto the Venn diagram.

## Question 19

This question was very poorly answered by the large majority of students and there were a very large number of non-attempts. The most common misconception was a misunderstanding in calculating the lower and upper bounds of a measurement to the nearest centimetre.

Common incorrect answers were 7.5 with 8 or 8.4, 7.9 and 8.1, 7 and 8 or 8 and 9.

## Question 20

A poorly answered question in determining which of the statistical measures was an estimate.

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## Question 21

This percentage increase and decrease question was not answered well.

The majority of students successfully calculated the 6% percentage increase on £27 000 to achieve £27 560 or the 9% decrease on £4000 to achieve £3640. Common misconceptions in the first stage of the question involved the use of an incorrect multiplier such as 0.6 or 0.9 or to use a build up method with errors rather than an efficient method of  $1 + 0.06 = 1.06$  as a multiplier.

After correctly achieving £31 200 or £1200, the very large majority of students were then unable to calculate a percentage change using the final and original values for the total annual pay.

## Question 22

A poorly answered question with many students unable to choose three different prime numbers that added to the same value as the third cube number. There were a significant number of non-attempts.

The most common misconceptions were:

- not identifying 27 as the third cube number, often 64 was identified incorrectly
- not using three different prime numbers eg.  $27 = 11 + 11 + 5$
- incorrectly including 1 as a prime number eg.  $27 = 19 + 7 + 1$
- incorrectly including 9 as a prime number eg.  $27 = 11 + 9 + 7$
- misinterpreting square numbers as prime numbers eg.  $27 = 4 + 9 + 16$ .

## Question 23

This trigonometry question involving the use of the cosine function was answered very poorly with a significant number of non-attempts. Those students who correctly labelled the three sides of the right-angled triangle as Hypotenuse(H), Opposite(O) and Adjacent(A), then selected A and H as the two sides with given information and selected cosine were generally successful.

The most common misconceptions were:

- students writing down a calculation involving any trigonometric function with the given values of 8.3 and 6.7 eg.  $\cos(8.3) \times 6.7 = 6.62$
- $\cos^{-1}\left(\frac{8.3}{6.7}\right)$
- $\cos = \frac{6.7}{8.3}$
- $\cos\left(\frac{6.7}{8.3}\right)$
- using the sine function to work out 56.8 as the complement to  $90^\circ$  of the correct answer
- using Pythagoras to work out the third side without further correct working.

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## Question 24a

This tree diagram question was answered very poorly.

The most common misconception involved students not working out probabilities and simply marking integer values on the branches of the tree diagram, typically placing 1 and 4 on the branches for Bag A.

Some students correctly worked out the probabilities  $\frac{3}{10}$  and  $\frac{7}{10}$  but did not write on both pairs of branches for Bag B.

## Question 24b

The very large majority of students answered this question part on calculating a combined probability from the tree diagram very poorly and there were a significant number of non-attempts.

A significant number of students added fractions instead of multiplying along the tree diagram branches with the most common error being  $\frac{1}{5} + \frac{3}{10} = \frac{4}{15}$ .

## Question 25

This simultaneous equations question was answered very poorly and there were a large number of non-attempts. Many students knew that they needed to eliminate one variable but the very large majority of students were unable to do so correctly.

Common errors included:

- subtracting  $2y$  from both equations leaving  $7x = 100$  and  $3x = 48$
- subtracting  $2y$  from both equations leaving  $7x = 98$  and  $3x = 46$
- correctly calculating  $100 - 48 = 52$  but not equating this to  $7x - 3x$  or  $4x$
- adding both equations  $10x + 4y = 148$ , then  $10x = 100$  and  $4y = 48$
- correctly achieving  $x = 13$  but then unable to proceed to work out the value of  $y$ .

## Question 26a

A very small minority of students achieved a fully correct solution for this AO3 problem solving question to calculate the surface area of a cylinder. There were a large number of non-attempts.

The majority of students were unable to equate the length of the rectangle with the circumference of the top of the cylinder.

The most common misconceptions were:

- not using  $\pi$  in calculations and using the radius or diameter of the circle as the width of rectangle with  $1.9 \times 10.2$  or  $3.8 \times 10.2$
- calculating the area of the circle and then multiplying by the height of the rectangle.

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### Question 26b

This reasoning decision on the effect of the area of the cylinder's net being a parallelogram instead of a rectangle was poorly answered.

### Question 26c

This reasoning decision on the effect of the perimeter of the cylinder's net being a parallelogram instead of a rectangle was also very poorly answered.

### Question 27

A very small minority of students correctly answered this multi step reasoning and problem solving question with angles in parallel lines and a triangle. There were a large number of non-attempts.

Many students got the first mark for correctly labelling an interior or exterior angle of the triangle but most were then not able to proceed further than  $108^\circ$  being the sum of  $p$  and  $r$ .

The most common misconceptions were:

- the sum of  $p$  and  $r$  being 3 parts and working out  $108 \div 3 = 36$  and  $36 \times 2 = 72$
- using 360 for the sum of angles in a triangle with  $360 - 72 = 288$  for the sum of  $p$  and  $r$
- giving an incorrect final answer of  $27^\circ$  after correctly calculating  $108 \div 4 = 27$  but not multiplying by three for the value of  $p$ .

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## Contact us

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