

Take a look at our GCSE Maths: Exemplar student responses

- Understand our approach
- See how students responded
- Gain an insight into how marks are awarded

Got any questions?

Call us on 0161 957 3852 and get straight
through to the Maths team, or email us at
maths@aqa.org.uk

In April 2015, we asked a number of schools to participate in a student trial of our first set of practice papers. We wanted to understand more about how individual questions perform and provide some exemplar student responses.

The research:

There were limitations with the research – schools were focusing on preparing their Year 11 students for the real examination, there wasn't the same motivation from students and it would be impossible for all schools to reproduce the conditions of a live exam. We also accepted that it would also be unreasonable to expect all students to sit a full set of papers, and that teachers would want to select

the students who took part. Additionally, the new GCSE contains some content not covered in the current specification, and it was recognised that students might not be familiar with these topics.

Despite all of this, we collected over 1,000 scripts from 10 schools and they have told us a great deal about how students approach this new GCSE.

The scripts:

In this document, we've chosen to look at two papers – 1F and 2H – to see how students responded and similar analysis of other papers will follow.

The exemplar answers in this document are transcribed from student scripts. Sometimes they are fully correct answers and sometimes they highlight common errors or misconceptions. Alongside each question is a summary of how students performed and many of the questions are accompanied by brief comments on:

- how more successful students approached the question

- common errors, misconceptions and misunderstandings
- changes we would consider in improving our papers as a result of the evidence here.

These exemplars show how students are reacting to these questions. We see them as an important tool in helping us all understand how real students perform on these new style questions. In doing so, we hope they are of value when thinking about how to deliver the new specification in a way that prepares students for the new Assessment Objectives.

The papers:

The students in this trial sat our first set of practice papers for the new GCSE Mathematics qualification (8300), which we released in December 2014. These were written before Ofqual's research and review, published in June 2015. As a result, they haven't been reviewed and approved by Ofqual and may not reflect in full the standard of AQA GCSE

Mathematics for 2017 and beyond. However, the purpose of this work was to focus on how individual questions might perform and we remain confident that these questions give a good indication of what you and your students can expect in 2017.

GCSE Mathematics Specification (8300/1F)

Paper 1 Foundation tier

F

Date

Morning

1 hour 30 minutes

Materials

For this paper you must have:

- mathematical instruments.

You must **not** use a calculator.



Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the bottom of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book.
- In all calculations, show clearly how you work out your answer.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number

Candidate number

Surname

Forename(s)

Candidate signature

The performance data for each question shows the percentage of students in the trial who scored each available mark on that question. The x row gives the percentage who made no attempt at the question. In this trial, the no attempt figures were very much higher than we would see in a live exam.

Answer **all** questions in the spaces provided.

- 1 Circle the number that is **not** a multiple of 6

[1 mark]

24

76

108

144

1

Performance

1 70.3%

0 28.7%

X 1.0%

- 2 Which symbol makes this statement correct?

0.062 _____ 0.52

Circle your answer.

[1 mark]

=

<

>

>

2

Performance

1 63.1%

0 35.9%

X 1.0%

- 3 Solve $x - 7 = 56$

Circle your answer.

[1 mark]

$x = 8$

$x = 49$

$x = 56$

$x = 63$

3

Performance

1 87.2%

0 12.3%

X 0.5%

4

Circle the expression that can be written as $2y^2$

[1 mark]

$(2y)^2$

$2 \times 2 \times y$

$2 \times y \times y$

$2 \times 2 \times y \times y$

4

Performance

1 66.2%

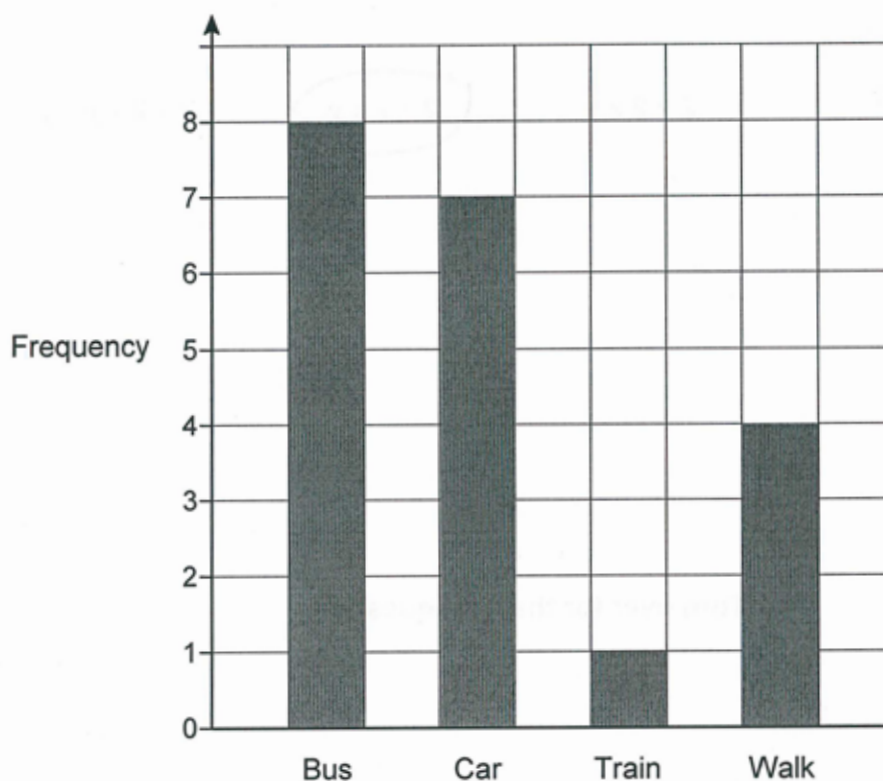
0 32.3%

X 1.5%

Turn over for the next question

5

The bar chart shows information about how 20 students travel to school.



Show the information in a pictogram.

Use the key given.

[3 marks]

Key : ○ represents 2 students

Bus	○ ○ ○ ○
Car	○ ○ ○ ◐
Train	◐
Walk	○ ○

5

Almost all candidates gained full marks. While this area of content remains part of the specification and will be tested, candidate performance indicates that while the question appears suitable for this stage of the paper, it did not differentiate effectively

Performance
 3 95.9%
 2 1.5%
 1 2.1%
 0 0%
 X 0.5%

6 (a) Work out $\frac{3}{5}$ of 200

[2 marks]

$$200 \div 5 = 40 \times 3 = 120$$

6a

Performance

2 56.9%

1 13.3%

0 11.8%

X 18.0%

Answer

120

2

6 (b) Work out $25.8 + 12.6 \div 2$

[2 marks]

$$\begin{array}{r} 25.8 \\ + 12.6 \\ \hline 38.4 \end{array} \div 2 = 19.2$$

1

Answer

19.2

6b

This early, low-demand question proved more difficult than expected with a facility score of 38%. Many students did not recognise the order of operations, leading to answers of 19.2 (as in the exemplar response) and a single mark given. Those who were aware the division had to be carried out first usually went on to get both available marks. Lots of students scored nothing as they got the operations in the wrong order and made errors in the arithmetic.

Performance

2 11.8%

1 52.3%

0 32.3%

X 3.6%

7

Simplify

$$7a - 2b + 3a + 5b$$

[2 marks]

$$10a - 7b$$

7

Performance

2 41.0%

1 24.6%

0 28.7%

X 5.6%

Answer

$$10a - 7b$$

8

A bag contains red counters and blue counters in the ratio 3 : 5

What fraction of the counters is red?

Circle your answer.

[1 mark]

$$\frac{1}{3}$$

$$\frac{3}{5}$$

$$\frac{3}{8}$$

$$\frac{5}{8}$$

8

Performance

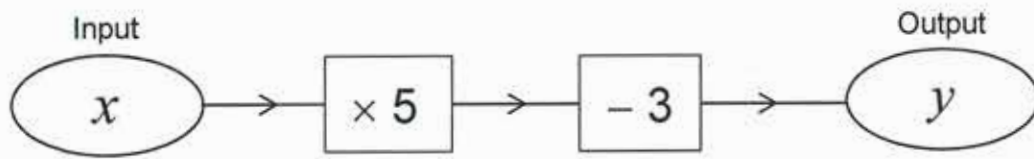
1 50.3%

0 47.2%

X 2.6%

9

Here is a number machine.

9 (a) Work out the **output** when the input is 12

[1 mark]

$$12 \times 5 = 60 - 3 = 57$$

9a

Performance

1	84.1%
0	11.8%
X	4.1%

Answer

57

9 (b) Work out the **input** when the output is 7.5

[2 marks]

$$7.5 + 3 = 10.5 \times 5 = 52.5$$

$$52.5 \div 5 = 10.5 - 3 = 7.5$$

9b

Performance

2	31.8%
1	31.3%
0	26.7%
X	10.3%

Answer

52.5

9 (c) Write y as an expression in terms of x .

[1 mark]

$$y = 5x - 3$$

$$y \leq 5x - 3$$

9c

Performance

1	19.0%
0	46.7%
X	34.4%

Answer

$$\cancel{y = 5x - 3} \quad y \leq 5x - 3$$

9

The first part of this question was done well by most students. In part (b), many students understood the idea of inverse operations but lost marks through errors in arithmetic or getting their operations confused (as in the exemplar). Even though x and y featured in the number machine, the change of representation to an expression is clearly difficult for Foundation students and many did not attempt the final part. The exemplar response shown suggests confusion in understanding the vocabulary of expression and inequality. In this example, even if the student had not crossed out the correct answer, no mark would be awarded as a choice of answers was offered. It is important to remind students to always cross out work they do not want marked.

- 10 In a quiz, teams are asked 20 questions.

Teams score

3 points for a correct answer

0 points for questions not attempted

-2 points for an incorrect answer.

- 10 (a) Team A has these results.

	Correct	Not attempted	Incorrect
Number of questions	12	5	3

$\times 3$

0

-2

Work out the total number of points Team A scores.

[2 marks]

$36 - 6$

10a

Performance

2 69.2%

1 5.6%

0 22.6%

X 2.6%

Answer

30

- 10 (b) Team B answers 16 out of 20 questions correctly.

Work out the percentage of questions Team B answers correctly.

[2 marks]

10b

Performance

2 50.3%

1 10.3%

0 28.2%

X 11.3%

Answer

4/5

%

10 (c) After 17 questions, Team C has 35 points.

After 20 questions, Team C has 34 points.

How many of the last three questions are answered correctly, not attempted or answered incorrectly?

[2 marks]

$$35 + 3 = 38 \quad 38 - 2 = 36 \quad 36 - 2 = 34$$

10c

Performance
2 53.9%
1 0%
0 29.2%
X 16.9%

Correct

1

Not attempted

0

Incorrect

2

Turn over for the next question

10

In part (b) of this question, the exemplar response serves as a reminder to students to read the question carefully and give answers in the form requested. Part (c) proved accessible for many students and those who progressed managed to get both marks.

- 11 A sequence of patterns uses black squares and white squares.

Here are the first three patterns.



Pattern 1



Pattern 2



Pattern 3

- 11 (a) Circle the expression for the number of black squares in Pattern n .

[1 mark]

$4n$

$n + 2$

$6n - 2$

$2n + 2$

11a

Performance	
1	25.6%
0	71.8%
X	2.6%

11

In part (a), the incorrect choice shown in this exemplar was the most common. This is, perhaps, no surprise as students are often more comfortable with term to term rather than position to term descriptions of sequences. In part (b), the mark was most often given for realising the sequence starts even and goes up in twos so will always be even (as in the exemplar). Explanations using the correct n th term formula from the previous part were rare.

- 11 (b) Will the number of black squares always be even?

Tick a box.

Yes



No



Give a reason for your answer.

[1 mark]

because its going up in 2s so which is an even number so it wont be odd and the sequence starts on an even number there is no odd number in the 2 times tables

11b

Performance	
1	22.1%
0	73.9%
X	4.1%

- 12 82 children visit a sports centre.

50 of the children swim. *4*

At least one adult is needed for every 12 children who swim.

The other 32 children dance. *2*

At least one adult is needed for every 15 children who dance.

Work out the **minimum** number of adults needed for the 82 children.

[4 marks]

$$12 \times 5 = 60 \text{ swimmers}$$

$$15 \times 3 = 45 \text{ dance}$$

12 Performance

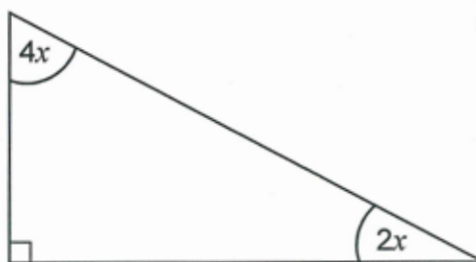
4	44.1%
3	5.1%
2	29.2%
1	8.7%
0	7.7%
X	5.1%

Answer

6

- 13 Work out the value of x .

Not drawn accurately



[3 marks]

13

Performance

3	34.9%
2	4.6%
1	1.0%
0	41.0%
X	18.5%

$$6x + 90 = 180$$

$$6x = 90$$

$$x = 15$$

Answer

15

degrees

14 (a) The sum of two square numbers is 180

What are the **two** square numbers?

[2 marks]

$$\begin{array}{r} 12^2 = 144 \\ 6^2 = 36 \\ \hline 180 \end{array}$$

Answer 12 and 6

14a

Performance

2	16.4%
1	24.1%
0	41%
X	18.5%

14 (b) Kim says,

"The sum of any two **different** square numbers is **always** even."

Is she correct?

Write down a calculation to support your answer.

[1 mark]

$$\begin{array}{l} \text{No} \quad 1^2 = 1 \quad 1 + 4 = 5 \\ \quad \quad 2^2 = 4 \quad 5 \text{ isn't even} \end{array}$$

14b

Performance

1	33.3%
0	32.3%
X	34.4%

14

The exemplar response to part (a) shows the importance of reading the question carefully. Here, the student knew what to do, but lost a mark by not giving the requested answer.

- 15 A piano competition takes place every 3 years.
A violin competition takes place every 4 years.
Both competitions took place in 2009

2009
2005
2001
1997
1993

15a	Performance
1	68.7%
0	28.7%
X	2.6%

- 15 (a) In which of these years did the **violin** competition take place?
Circle your answer.

[1 mark]

1992

1993

1994

1995

- 15 (b) When is the next year after 2009 that **both** competitions will take place?

[1 mark]

2009 2012 2015 2018 2021

2009 2013 2017 2021

15b	Performance
1	53.9%
0	38.5%
X	7.7%

Answer 2021

- 15 (c) In any leap year, the number made by the last two digits is divisible by 4
For example, 1996 and 2004 were leap years because 96 and 04 are divisible by 4
Give a reason why the violin competition will **never** take place in a leap year.

[1 mark]

None of it's last two didgits are
ever divisible by 4

15c The exemplar response to part (c) here was not sufficient to gain the mark as it did little more than re-state the condition.

Performance	
1	18.5%
0	50.8%
X	30.8%

- 16 Work out the value of $4(2x + 3y)$ when $x = 5$ and $y = -\frac{1}{2}$

[2 marks]

$$4 \times 2 \times 5 = 4 \times 10$$

$$4 \times 3 \times -\frac{1}{2} = 4 \times$$

16

Performance

2 12.8%

1 10.8%

0 54.9%

X 21.5%

Answer _____

- 17 Factorise $15x + 35y - 40z$

[1 mark]

$$5xyz(3+7-8)$$

17

Performance

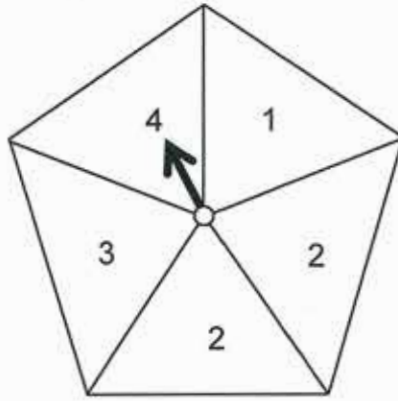
1 25.6%

0 37.4%

X 36.9%

Answer $5xy(3+7-8z)$

- 18 Joanne has a fair five-sided spinner.



18 Part (a) was done well. While we take care to ramp demand through a paper, it is sometimes appropriate to ask a straightforward lead-in question before a more challenging second part. In this case, the shift in demand was significant and few students made progress with part (b). Those who did, as in the exemplar, listed all outcomes systematically and extracted those with a total of four. In the exemplar, the final mark was lost as the required **probability** was not given.

- 18 (a) Write down the probability of scoring a 4 with one spin.

[1 mark]

18a Performance
1 75.4%
0 21.5%
X 3.1%

Answer

$$\frac{1}{5}$$

- 18 (b) Work out the probability of scoring a **total** of 4 with two spins.

[3 marks]

x	1	2	2	3	4
1	2	3	3	(4)	5
2	3	(4)	(4)	5	6
2	3	(4)	(4)	5	6
3	(4)	5	5	6	7
4	5	6	6	7	8

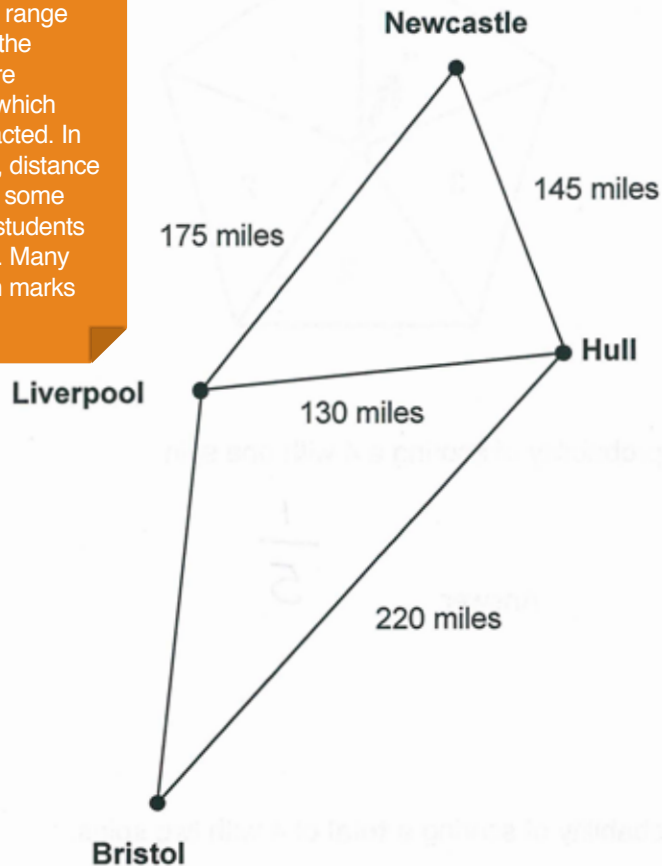
18b Performance
3 0.5%
2 1.0%
1 0.5%
0 81.0%
X 16.9%

Answer

$$\frac{6}{25}$$

19

The diagram shows distances by road between four cities.

Not drawn
accurately

- 19 (a) Sam drives from Newcastle to Hull, and then from Hull to Bristol.
Tim drives from Newcastle to Liverpool, and then from Liverpool to Bristol.
Sam drives 10 **more** miles than Tim.

Work out the distance by road from Liverpool to Bristol.

[3 marks]

$$\begin{array}{r}
 \text{Newcastle to hull} = 145 \text{ miles} \\
 \text{Hull to Bristol} = 220 \text{ miles} \\
 \text{Newcastle to Liverpool} = 175 \text{ miles} \\
 \text{Liverpool to Bristol} = 190 \text{ miles} \\
 \begin{array}{r}
 175 \quad 220 \\
 -145 \quad 30 \\
 \hline
 30 \quad 190
 \end{array}
 \end{array}$$

Answer 190 miles miles

19a

Performance

3	42.6%
2	19.5%
1	19.0%
0	10.8%
X	8.2%

- 19 (b) Rob is going to drive from Hull to Liverpool.
There are road works for 25 miles of the journey.
He assumes his average speed will be

50 mph where there are road works
70 mph for the rest of the journey.

$$\begin{array}{r} 10.5 \\ \times 7 \\ \hline 73.5 \end{array}$$

Using his assumptions, work out his journey time.

[4 marks]



Hull to Liverpool = 130 miles

$130 - 25 = 105$ miles

105 miles

$\times 70$ mph

7.35 minutes

25 miles

$\times 50$ mph

1.25 minutes

8 hours 6 minutes

19b

Performance

4	11.8%
3	3.1%
2	7.7%
1	29.2%
0	21.5%
X	26.7%

Answer

9

- 19 (c) Rob's assumptions about the average speeds are too high.
How does this affect his journey time?

[1 mark]

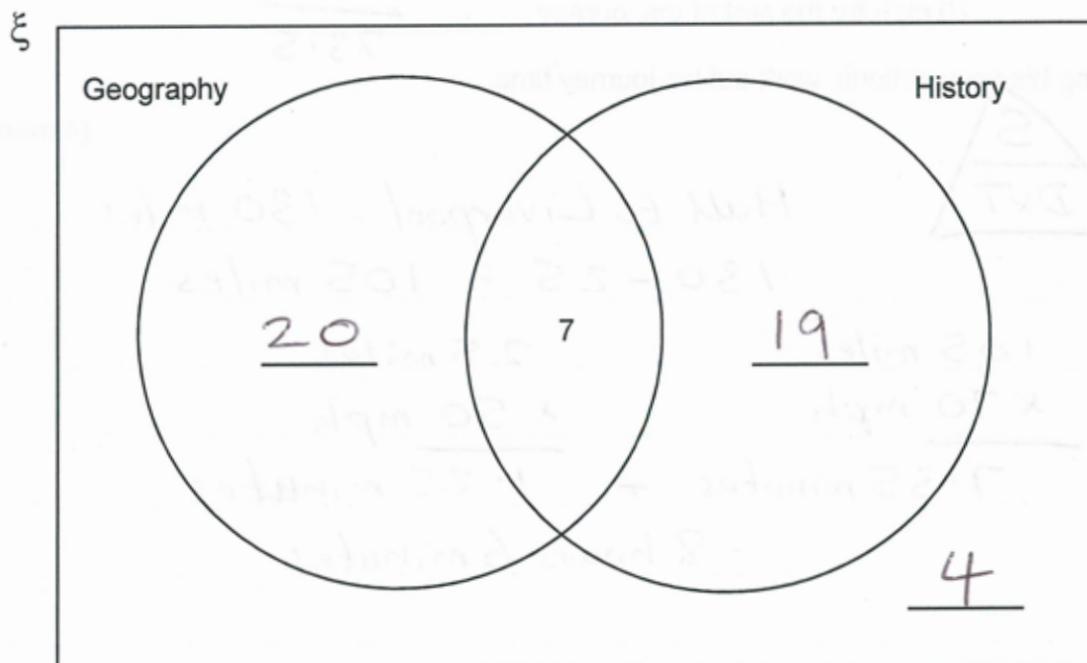
He will take longer than he expected

19c

Performance

1	35.9%
0	22.6%
X	41.5%

- 20 50 students are asked if they study Geography or History.
The Venn diagram shows some information about their answers.



- 20 (a) What does the number 7 on the diagram represent?

[1 mark]

that 7 people take both history
and geography

- 20 (b) 20 students study Geography but **not** History.
19 students study History.

Complete the Venn diagram.

20 Although this topic is not covered in the current GCSE, the question was well answered. A common mistake in part (b) was not to realise the difference in the two given statements leading to the response in the exemplar and only 2 out of 3 marks awarded.

20a	Performance
1	83.6%
0	5.1%
X	11.3%

[3 marks]

20b	Performance
3	8.7%
2	42.6%
1	32.3%
0	5.1%
X	11.3%

21

Here are the instructions on a bottle of fruit squash.

To make fizzy juice
mix 2 parts fruit squash
with 7 parts lemonade



21 (a) How much fruit squash is needed to make 450 ml of fizzy juice?

[2 marks]

$$450 \div 9 = 50$$

21a

Performance

2 20.5%

1 8.2%

0 30.3%

X 41.0%

Answer 100 ml

21 (b) Tom has 80 ml of fruit squash.

He also has 210 ml of lemonade.

What is the **maximum** amount of fizzy juice he can make?

[3 marks]

$$210 \div 7 = 30$$

21b

Performance

3 6.7%

2 0%

1 13.9%

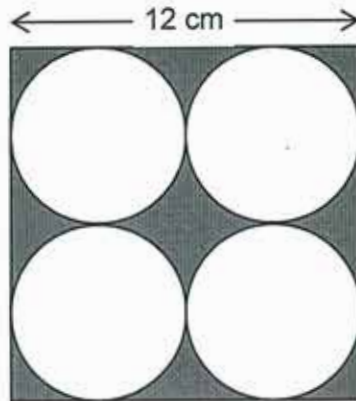
0 31.8%

X 47.7%

Answer ml

22

Four identical circles just fit inside a square as shown.

Not drawn
accurately

Work out the area of the shaded section.

Give your answer in terms of π .

[4 marks]

$$12 \times 12 = 144$$

$$12 \div 2 = 6 \div 2 = 3$$

$$\pi \times 3 = 3\pi = 3 \times 3.14$$

$$3.14$$

$$\times 3$$

$$\hline .42$$

Answer _____ cm^2

22

Current Foundation tier students are unfamiliar with working and expressing answers in terms of π and there were many attempts to assign a value to it, often leading to arithmetic error. As in this exemplar, many students only got a single mark for the area of the square.

Performance

4	2.6%
3	13.9%
2	4.6%
1	20.5%
0	21.5%
X	36.9%

23

Bag A contains 10 blue balls and 20 red balls.

Bag B contains 8 blue balls and 12 red balls.



A ball is chosen at random from each bag.

Jo says,

"It is more likely that a blue ball is chosen from Bag A than Bag B because there are more blue balls in Bag A."

Is she correct?

You **must** show your working.

[3 marks]

	blue	red
Bag A	10	20
Bag B	8	12

Yes ~~no~~ because its $\frac{10}{30}$ chance of picking out a blue ball whereas its $\frac{8}{20}$ in bag B

Turn over for the next question

23

As this was a question about the likelihood of an event, it was important for students to work with probabilities rather than proportions. For full marks, students had to state both probabilities, put them into a form to allow a direct comparison and state the answer is No.

Performance

3	14.4%
2	2.6%
1	30.8%
0	31.8%
X	20.5%

- 24 Which of these has the greatest value?
Circle your answer.

[1 mark]

6.15×10^4

61 499

6.2×10^3

61.6×10^3

24

Performance

1 42.1%

0 41.0%

X 16.9%

- 25 There are between 25 and 35 students in a class.
The ratio of boys to girls is 4 : 7
How many students are in the class?

[2 marks]

$$\begin{array}{r} 7 \times 2 = 14 \\ 4 \times 2 = 8 \\ \hline 22 \\ 7 \times 3 = 21 \\ 4 \times 3 = 12 \\ \hline 33 \end{array}$$

25

Most students who used a 'scaling up' strategy for this question were successful, working in multiples of 11 or, as here, combining multiples of 7 and 4. Unfortunately, the student in this exemplar was confused by their arithmetic slip and lost a mark.

25

Performance

2 28.2%

1 3.1%

0 33.9%

X 34.9%

Answer

28

- 26 A ball is dropped from a height of 50 metres.
After each bounce, the ball reaches 20% of its previous height.
How high does it reach after the second bounce?

[2 marks]

$$\begin{array}{r} \text{1st} - 50\text{m} \quad 20\% = 10\text{m} \\ \text{2nd} - 40\text{m} \quad 20\% = 8\text{m} \\ \hline 32\text{m} \end{array}$$

26

Performance

2 10.3%

1 38.0%

0 24.1%

X 27.7%

Answer

32

metres

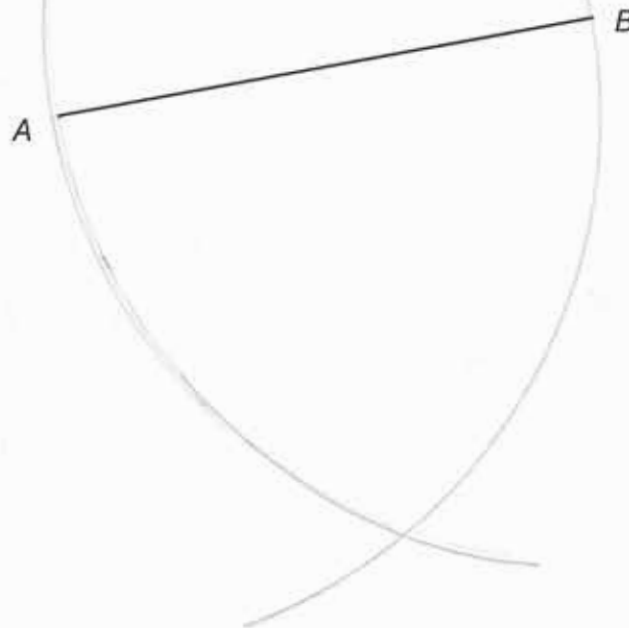
26

A common error, as shown here, was to make the question more complex by misreading it as losing rather than reaching 20% of its height with each bounce. Working out 20% of 50m and doubling was common.

27

Use a ruler and a pair of compasses in this question.
Construct the perpendicular bisector of AB .

[2 marks]



Turn over for the next question

27 Performance in this question among those who attempted it was better than in some earlier questions and, in future, we may look at putting these construction questions earlier in the paper. This exemplar response was a rare one gaining only a single mark for an incomplete construction.

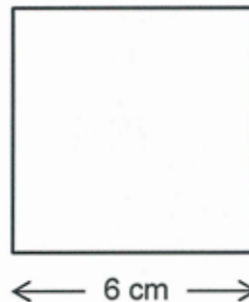
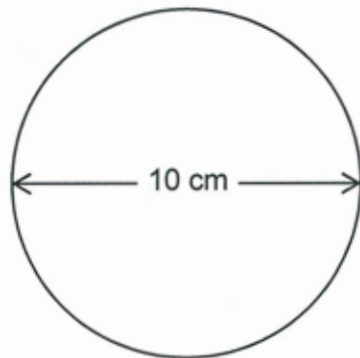
Performance

2	25.1%
1	2.6%
0	24.1%
X	48.2%

28

A circle has diameter 10 cm

A square has side length 6 cm

Not drawn
accurately

Use calculations to show that the square will fit inside the circle without touching the edge of the circle.

[3 marks]

$$10 \div 2 = 5$$

$$5^2 = 25$$

$$3.14 \times 25 = 78.5$$

$$\text{Circle} = 78.5 \text{ cm}^2$$

$$\text{Square} = 6 \times 6 = 36 \text{ cm}^2$$

Yes it will fit in

END OF QUESTIONS

28 Only one student in the Foundation and very few in the Higher tier trial were successful in this question. Most who attempted it compared areas, which gained no credit.

Performance

3	0.5%
2	0%
1	0%
0	61%
X	38.5%

GCSE Mathematics Specification (8300/2H)

H

Paper 2 Higher tier

Date

Morning

1 hour 30 minutes

Materials

For this paper you must have:

- a calculator
- mathematical instruments.



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Answer **all** questions in the spaces provided.

- 1 Here is a linear sequence.

5 13 21 29

Circle the expression for the n th term of the sequence.

[1 mark]

$n + 8$

$5n + 8$

$8n$

$8n - 3$

1	Performance
1	77.4%
0	22.2%
X	0.4%

- 2 Circle the fraction that is equivalent to 0.05%

[1 mark]

$\frac{1}{2000}$

$\frac{1}{500}$

$\frac{1}{200}$

$\frac{1}{50}$

2	Performance
1	37.5%
0	61.3%
X	1.2%

- 3 A straight line has equation $y = 6 - 2x$

Circle the gradient of the line.

[1 mark]

-2

2

$2x$

6

3	Performance
1	52.0%
0	45.2%
X	2.8%

1-4 These first four multiple choice questions showed clearly that questions of this type are not always easy for students but are almost always attempted. In Q2, all the wrong options were commonly seen. In Q3, the incorrect choice of $2x$ as the gradient was surprisingly common and in Q4, $y = x + k$ was often seen.

- 4 y is directly proportional to x and k is a constant.

Circle the correct equation.

[1 mark]

$$y = x + k$$

$$y = kx$$

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

$$y = x - k$$

4

Performance

1 51.6%

0 44.0%

X 4.4%

- 5 Jack and Kylie are asked to work out this calculation to 2 decimal places.

$$\frac{\sqrt{9.8 \times 12.1}}{19.4 + 30.2}$$

Jack's answer is 0.22

Kylie's answer is 30.76

How have they obtained these answers?

Is either answer correct?

5

While this was not a question on new content, it addressed a new skill from AO3 - evaluating methods and solutions - so it was a novel question for this group of students. Some were able to identify the correct answer and show how Jack got to that correct answer. Very few students were able to identify and explain where Kylie went wrong.

Performance

3 1.2%

2 20.2%

1 30.2%

0 45.2%

X 3.2%

[3 marks]

Jack did $\frac{\sqrt{118.58}}{49.6} = \frac{10.8894...}{49.6} = 0.219$ or 0.22

He is right

Kylie did $\frac{\sqrt{9.8 \times 12.1}}{19.4 + 30.2} = \frac{10.8894...}{49.6} = 30.76$ and she is wrong

- 6 (a) Solve the inequality $3x \leq 18$

[1 mark]

$$3x \leq 18 = x \leq 6$$

6a

Performance

1 60.1%

0 33.5%

X 6.5%

Answer $x \leq 6$

- 6 (b) Solve the inequality $4(x + 2) > 12$

[2 marks]

$$4x + 8 > 12 \quad 4x > 4 \quad x > 1$$

6b

Performance

2 46.4%

1 31.1%

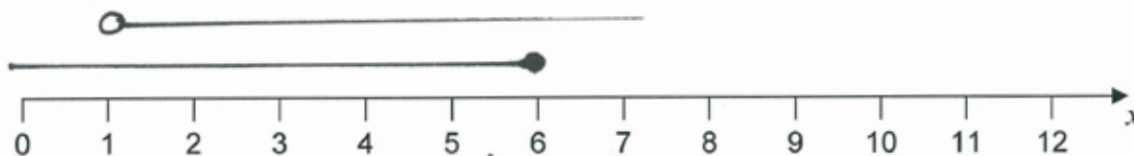
0 17.7%

X 4.8%

Answer $x > 1$

- 6 (c) Represent the solution set that satisfies **both** answers to parts (a) and (b) on the number line.

[1 mark]



6c

Performance

1 25.8%

0 58.1%

X 16.1%

6

Parts (a) and (b) were reasonably well done but many students struggled to summarise their findings correctly on the number line as shown in this exemplar.

- 7 This formula works out the tax you pay.

$$T = 0.2(E - 10\,600)$$

T is the tax you pay in pounds.

E is the amount you earn in pounds.

7

Performance	
3	57.3%
2	9.7%
1	12.5%
0	16.9%
X	3.6%

Alison pays £5200 tax.

Work out the amount she earns.

[3 marks]

$$5200 \div 0.2 = 26000$$

$$26000 + 10600 = 36600$$

$$(36600 - 10600) \times 0.2 = 5200$$

Answer £ 36600

- 8 Solve $x^2 = 30.25$

[2 marks]

$$\sqrt{30.25} = 5.5$$

Answer 5.5

8 As the performance data and the exemplar here show, 1 mark out of 2 was common. Most students could easily find the square root but few gave both positive and negative roots.

Performance	
2	8.9%
1	85.5%
0	3.2%
X	2.4%

9 Here are two piles of the same type of paper.

Each sheet of paper is $\frac{7}{1000}$ cm thick.

The taller pile is $10\frac{1}{2}$ cm high.



height of taller pile : height of shorter pile = 3 : 2

Work out the number of sheets of paper in the shorter pile.

[3 marks]

$$10.5 \div \frac{7}{1000} = 1500$$

$$1500 \div 5 = 300$$

$$300 \times 2 = 600$$

9

Performance

3 40.7%

2 4.0%

1 28.6%

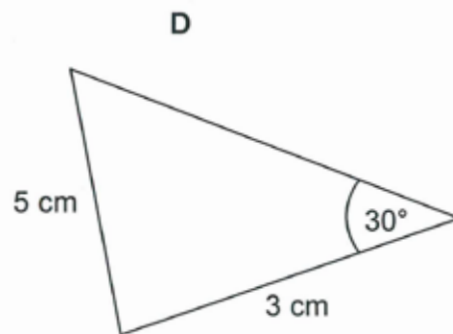
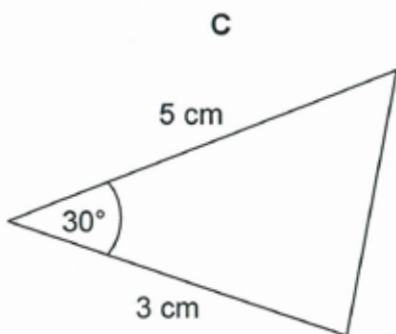
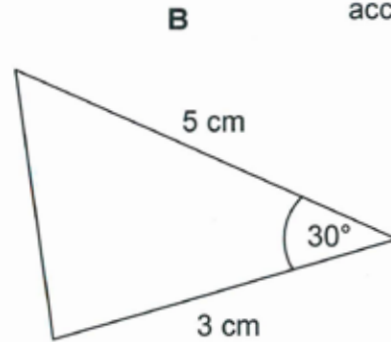
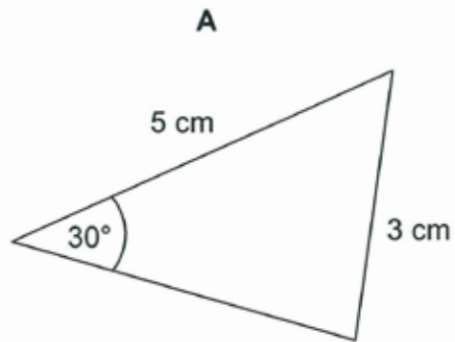
0 16.5%

X 10.1%

Answer

10

Here are four triangles.

Not drawn
accurately

- 10 (a) Which **two** triangles are congruent?
Circle your answers.

[1 mark]

A

B**C**

D

10a	Performance
1	77.0%
0	20.6%
X	2.4%

- 10 (b) Circle the reason for your answer to part (a).

[1 mark]

SSS

ASA

SAS

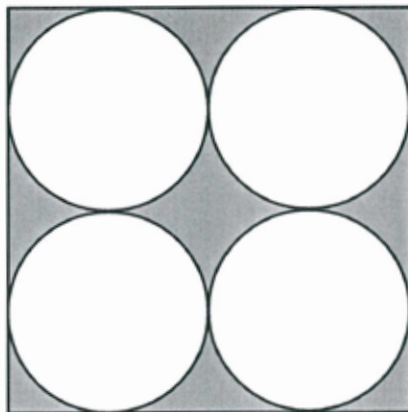
RHS

10b	Performance
1	62.5%
0	31.5%
X	6.1%

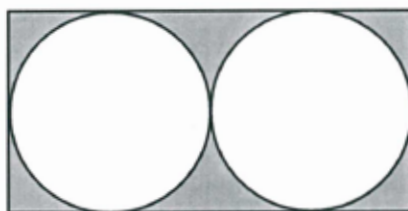
- 11 Volume of a sphere = $\frac{4}{3} \pi r^3$ where r is the radius.

Identical spheres of radius 9.5 cm are packed tightly into a cuboid.

Plan view



Front view



- 11 (a) Work out the total volume of the spheres in the cuboid.

[3 marks]

$$\frac{4}{3} \times \pi \times 9.5^3 = 3591.364002$$

$$14365.45601 \text{ cm}^3$$

11a

Performance

3	58.5%
2	3.6%
1	25.0%
0	4.4%
X	8.5%

Answer

14365.5

cm³

11 (b) Work out the volume of the cuboid.

[4 marks]

$$(9.5 \times 4) \times (9.5 \times 4) \times (9.5 \times 2) = 38 \times 38 \times 19$$

$$= 27436$$

11b

Performance

4	48.0%
3	2.4%
2	10.1%
1	12.1%
0	7.7%
X	19.8%

Answer

27436

cm³

11 (c) Work out the total volume of the spheres as a percentage of the volume of the cuboid.

[2 marks]

$$\frac{14365}{27436} = 0.523489 \dots$$

$$\times 100 = 52.3489$$

11c

Performance

2	49.6%
1	6.1%
0	11.7%
X	32.7%

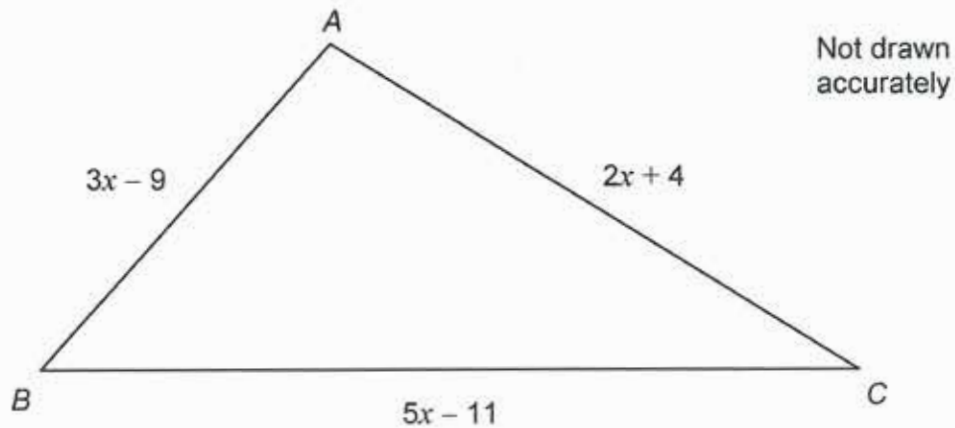
Answer

52.3

%

12

In this question all lengths are in centimetres.

Given $AB : BC = 1 : 2$ show that $AC : BC = 3 : 4$

[5 marks]

$$5x - 11 = 2(3x - 9)$$

$$5x - 11 = 6x - 18$$

$$-11 = x - 18$$

$$x = \underline{7}$$

$$2 \times 7 + 4 = 18 = AC$$

$$5 \times 7 - 11 = 24 = BC$$

$$18 \div 6 = 3$$

$$24 \div 6 = 4 = 3 : 4$$

12 This 5 mark question required students to be organised in setting out their working. It was common to see the translation of the relationship between AB and BC into an equation done incorrectly, leading to a fractional value of x and, usually, no more than 1 mark gained. Students who had the ratio the right way round and worked methodically often went on to get full marks here.

Performance

5	11.7%
4	1.6%
3	4.0%
2	5.2%
1	13.3%
0	35.5%
X	28.6%

- 13** A menu has a choice of 3 starters, 5 main courses and 4 desserts.
- How many different choices of a 3-course meal are possible?
- Circle your answer.

[1 mark]

12

23

60

972

13	Performance
1	80.2%
0	14.9%
X	4.8%

- 14** A triangle has vertices at $A(2, 1)$, $B(3, 4)$ and $C(6, 1)$
- The triangle is reflected.
- Points A and C do not move.
- Circle the equation of the line of reflection.

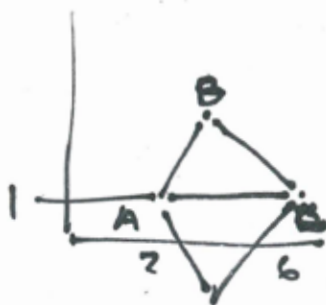
[1 mark]

$y = x$

$x = 2$

$y = 1$

$x = 4$



- 14** As in this exemplar, successful students were often those who drew a rough sketch of the situation. This is a useful insight for us and we will try and ensure some working space is available around multiple choice questions, as it was here. In answering such questions, students should be encouraged to do some rough working if needed to arrive at the correct choice.

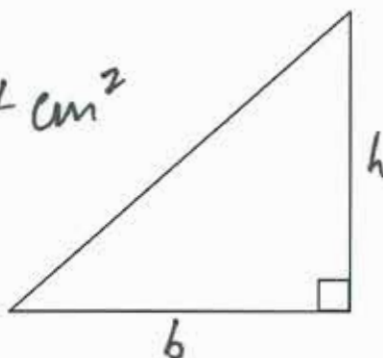
Performance	
1	48.8%
0	41.1%
X	10.1%

Turn over for the next question

15

The area of a right-angled, isosceles triangle is 4 cm^2 Not drawn
accurately

$$\frac{b \times h}{2} = 4 \text{ cm}^2$$



Work out the perimeter of the triangle in centimetres.

Give your answer in the form $a + b\sqrt{c}$, where a , b and c are integers.

[4 marks]

$$\frac{b \times h}{2} = 4 \quad b \times h = 8$$

$$2\sqrt{2} \times 2\sqrt{2} = 8$$

$$4\sqrt{4} + 8$$

Answer

cm

15

This proved to be a challenging question, with many students not attempting it. For Higher tier students, the knowledge required to work through this problem should be familiar, but connecting the steps and working with surds in an organised way was only managed by a few. This question shows the increased structural demand of papers for this new GCSE in that, although it is at the halfway point in the paper, it is designed to discriminate at grades 6 and 7 (B and A currently). In reviewing performance, this question had a much lower success rate than, for example, Q17 and should, perhaps, have appeared later in the paper.

Performance

4	6.9%
3	4.0%
2	7.3%
1	10.1%
0	37.5%
X	34.3%

16

On 1st January 2012 Beth invested some money in a bank account.

The account pays 2.5% compound interest per year.

On 1st January 2013 Beth withdrew £1000 from the account.

On 1st January 2014 she had £17 466 in the account.

Work out how much money Beth originally invested in the account.

[4 marks]

Money x multiplier - 1000

$$17466 \div 1.025 = 17040 + 1000 = 18040$$

$$18040 \div 1.025 = 17600$$

16

Performance

4	14.1%
3	0.0%
2	2.4%
1	2.4%
0	60.5%
X	20.6%

Answer £ 17600

Turn over for the next question

- 17 The probability that Gina goes to the gym on Saturday is 0.9
The probability that Dave goes to the gym on Saturday is 0.6
These probabilities are **independent**.

- 17 (a) Calculate the probability that **both** Gina and Dave do **not** go to the gym on Saturday.

[2 marks]

$$1 - 0.9 = 0.1 \text{ Gina not going on Saturday}$$

$$1 - 0.6 = 0.4 \text{ Dave not going on Saturday}$$

$$0.1 \times 0.4 = 0.04$$

17a

Performance

2	35.5%
1	28.6%
0	20.6%
X	15.3%

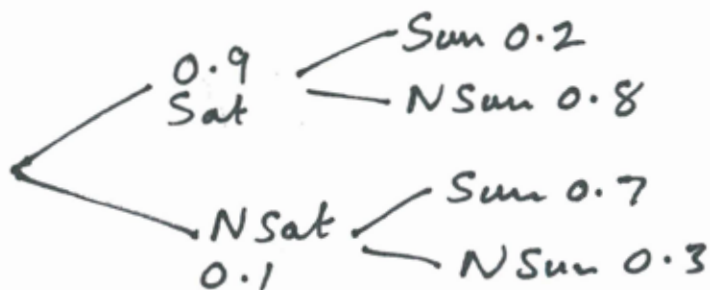
Answer

0.04

- 17 (b) If Gina goes to the gym on Saturday the probability that she goes on Sunday is 0.2
If Gina does **not** go to the gym on Saturday the probability that she goes on Sunday is 0.7

Calculate the probability that Gina goes to the gym on exactly **one** of the two days.

[4 marks]



17b

Performance

4	25.4 %
3	0.8%
2	6.5%
1	6.1%
0	37.5%
X	23.8%

$$\text{Sat and Not Sun} = 0.9 \times 0.8 = 0.72$$

$$\text{Not Sat and Sun} = 0.1 \times 0.7 = 0.07$$

$$0.72 + 0.07 = 0.79$$

17

As shown here, there were a lot of well structured, correct answers to this probability problem, many using the space provided to sketch a tree diagram.

Answer

0.79

- 18 The height, h metres, of a particle at time, t seconds, is given by the function

$$h = 0$$

$$0 \leq t < 2$$

$$h = (14 - t)(t - 2)$$

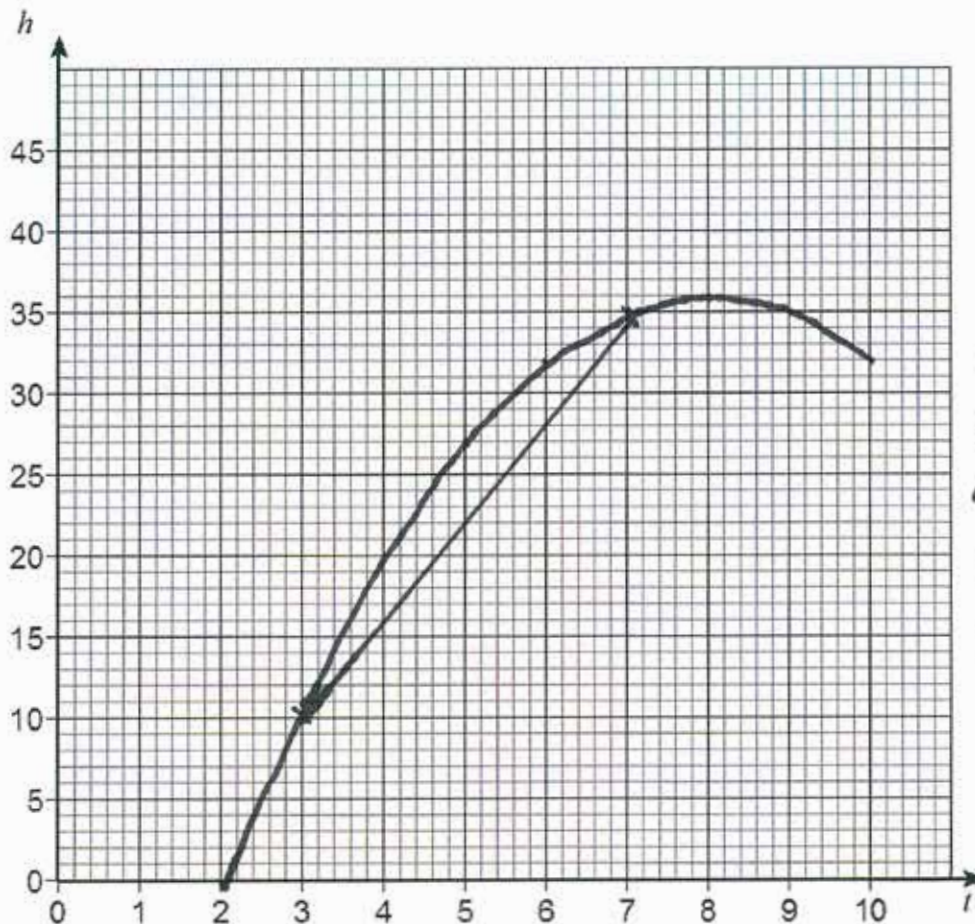
$$2 \leq t \leq 10$$

18a	Performance
3	9.3%
2	8.1%
1	2.4%
0	37.9%
X	42.3%

- 18 (a) Draw a graph to show the height of the particle in the first 10 seconds.

[3 marks]

2



10 : 32
9 : 35
8 : 36
7 : 35
6 : 32
5 : 27
4 : 20
3 : 11
2 : 0

18 It was pleasing to see some good responses to this question testing new GCSE content. Students were maybe familiar with the topic from either the linked pair pilot or further maths certificate. In laying out this question, we had to decide whether to keep it all on one page or allow more space for students to draw out a table of coordinates. With hindsight, and in live papers, we would probably choose to go on to a facing page to give room for calculation.

- 18 (b) By joining the points on the curve where $t = 3$ and $t = 7$ with a straight line, work out the average rate of change of height between 3 and 7 seconds.

[2 marks]

2

$$35 - 11 = 24$$

$$24 / 4 = 6$$

18b	Performance
2	11.7%
1	0.0%
0	24.2%
X	64.1%

Answer

6

m/s

19

In this question use

1 pound = 0.4536 kilograms

1 inch = 0.0254 metres

The pressure of a basketball is 7.5 pounds per square inch.

Work out this pressure in grams per square centimetre.

[4 marks]

$$0.4536 \times 7.5 = 3.402$$

$$0.0254^2 = 6.4516 \times 10^{-4}$$

$$= 0.00064516$$

$$3.402 \times 0.00064516$$

$$= 0.0219483432$$

19

Performance

4	3.2%
3	0.0%
2	1.2%
1	50.8%
0	13.7%
X	31.1%

Answer

0.0219

g/cm²

20

The speed of 50 vehicles was measured travelling along a road.

Speed, s (mph)	Number of cars
$0 < s \leq 40$	2
$40 < s \leq 60$	11
$60 < s \leq 75$	24
$75 < s \leq 90$	9
$90 < s$	4

20 In this question, many students understood how to estimate the number of cars in the sample exceeding the speed limit, but struggled to get the correct likely income from fines. Part (b) was well answered by many, with sensible comments about the limitations of the small sample.

- 20 (a) Every driver travelling at more than 70 mph is fined £60
On average, 8400 drivers use the road each day.

Estimate the total amount of money raised from fines on the road each day.

[3 marks]

$$8 + 9 + 4 = 21$$

$$21 \times 8400 = 176400$$

20a	Performance
3	16.9%
2	1.6%
1	19.0%
0	37.5%
X	25.0%

Answer £ 176,400

- 20 (b) Mia says,

"4% of vehicles on the road travel at 40 mph or less."

Explain why she might be wrong.

20b	Performance
1	34.3%
0	33.1%
X	32.7%

[1 mark]

At different times of the day, traffic will be at different speeds so she would need to measure all day.

21 (a) Write $x^2 - 10x + 29$ in the form $(x - a)^2 + b$

[2 marks]

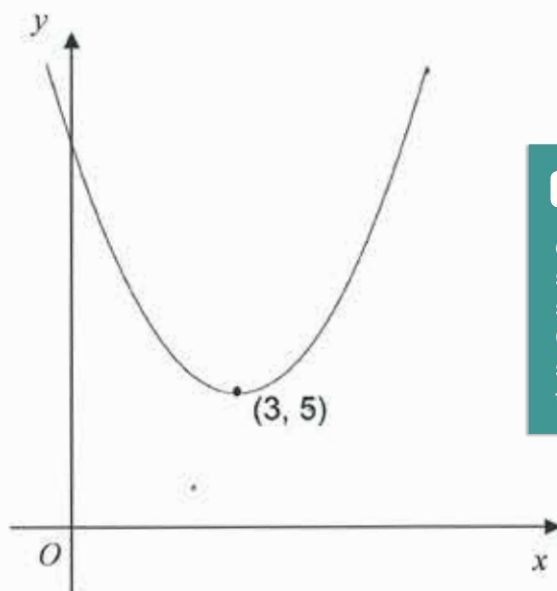
$$(x-5)^2 - 5^2 + 29$$

21a

Performance	
2	25.0%
1	7.7%
0	35.9%
X	31.5%

Answer $(x-5)^2 + 54$

21 (b) A sketch of $y = x^2 + cx + d$ is shown.
The turning point is (3, 5)



Not drawn accurately

21

Most students who recognised the need to complete the square did so successfully, though a few made slips like the one shown here. Only one student in the trial was successful with part (b), a new topic in this new GCSE.

Work out the values of c and d .

[3 marks]

$$y - 5 = (x - 3)^2$$

$$y - 5 = x^2 - 6x + 9$$

$$y = x^2 - 6x + 14$$

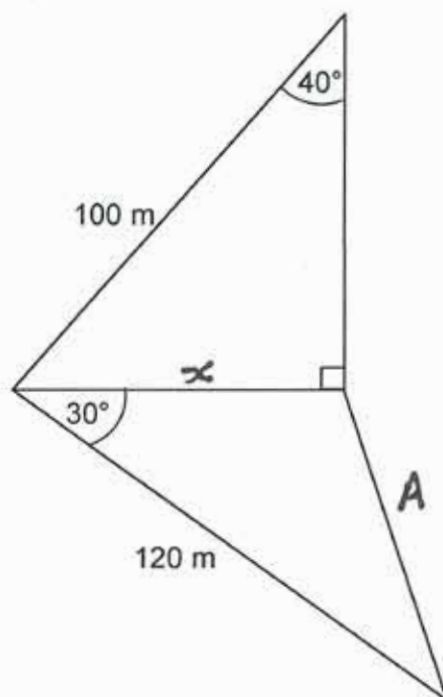
21b

Performance	
3	0.4%
2	0.0%
1	0.4%
0	44.0%
X	55.2%

$c = -6$ $d = 14$

22

Two triangular lawns are surrounded by fences as shown.
The lawns are also separated by a fence.



Not drawn
accurately

22 Where creditworthy attempts were seen in this question, they tended to stop at 2 marks for successfully finding the missing sides of the right angled triangle. In the trial, as in the new specification, students were expected to know the cosine rule and, as in this exemplar, they often and unsurprisingly did not.

Performance

5	4.9%
4	1.6%
3	1.2%
2	16.9%
1	7.3%
0	37.5%
X	30.7%

Work out the **total** length of the **five** fences.

[5 marks]

$$\sin 40^\circ = \frac{x}{100}$$

$$x = 100 \times \sin 40$$

$$= 64.28$$

$$100^2 - 64.28^2 = 5868.08$$

$$\sqrt{5868.08} = 76.6 \text{ cm}$$

$$\frac{120 + 64.28 + \cos 30}{2} = A = 92.6$$

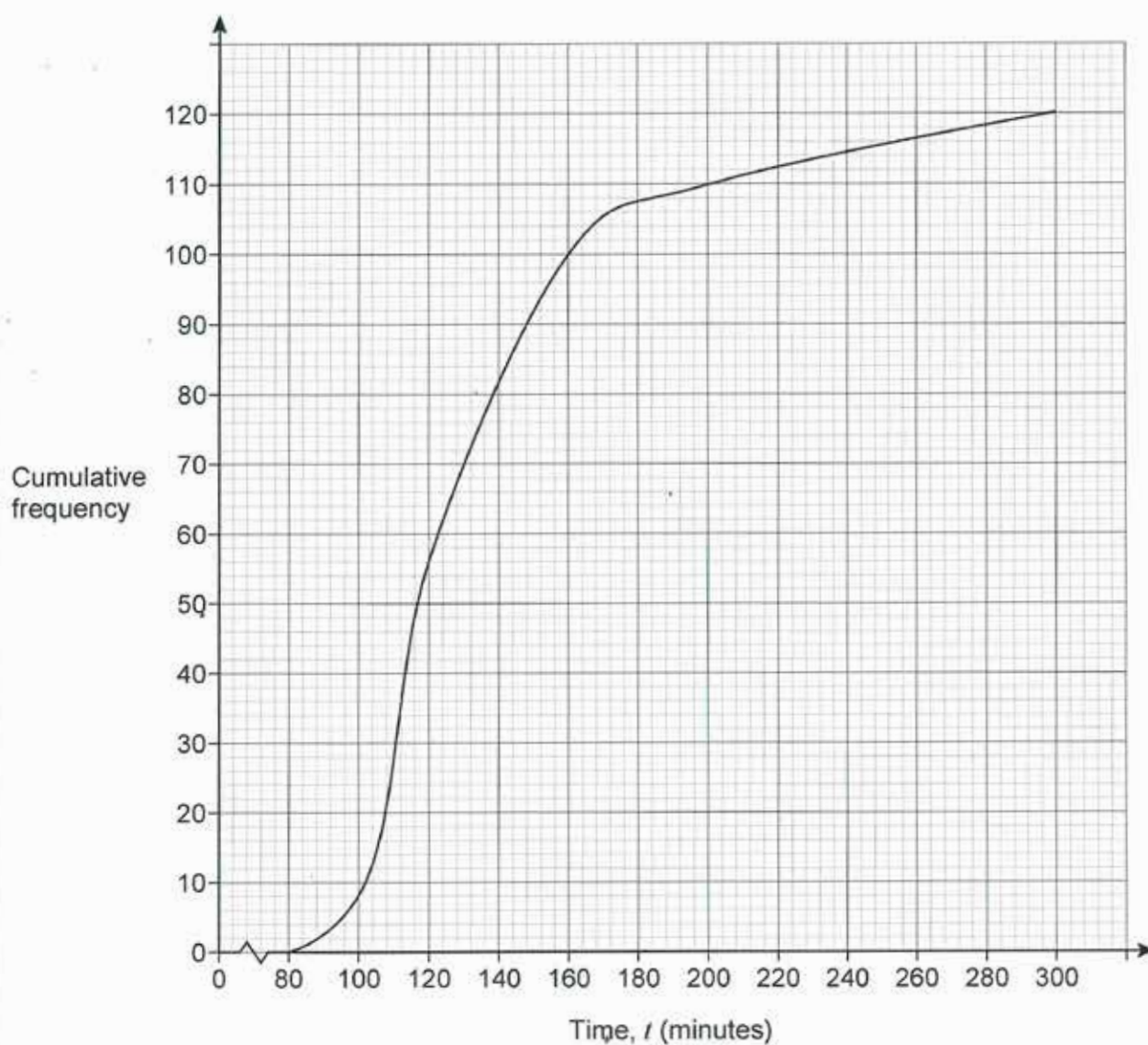
$$120 + 92.6 + 100 + 76.6 + 64.28 = 453.48$$

Answer **453.48**

m

23

The cumulative frequency diagram shows the times taken by runners to complete a half-marathon.

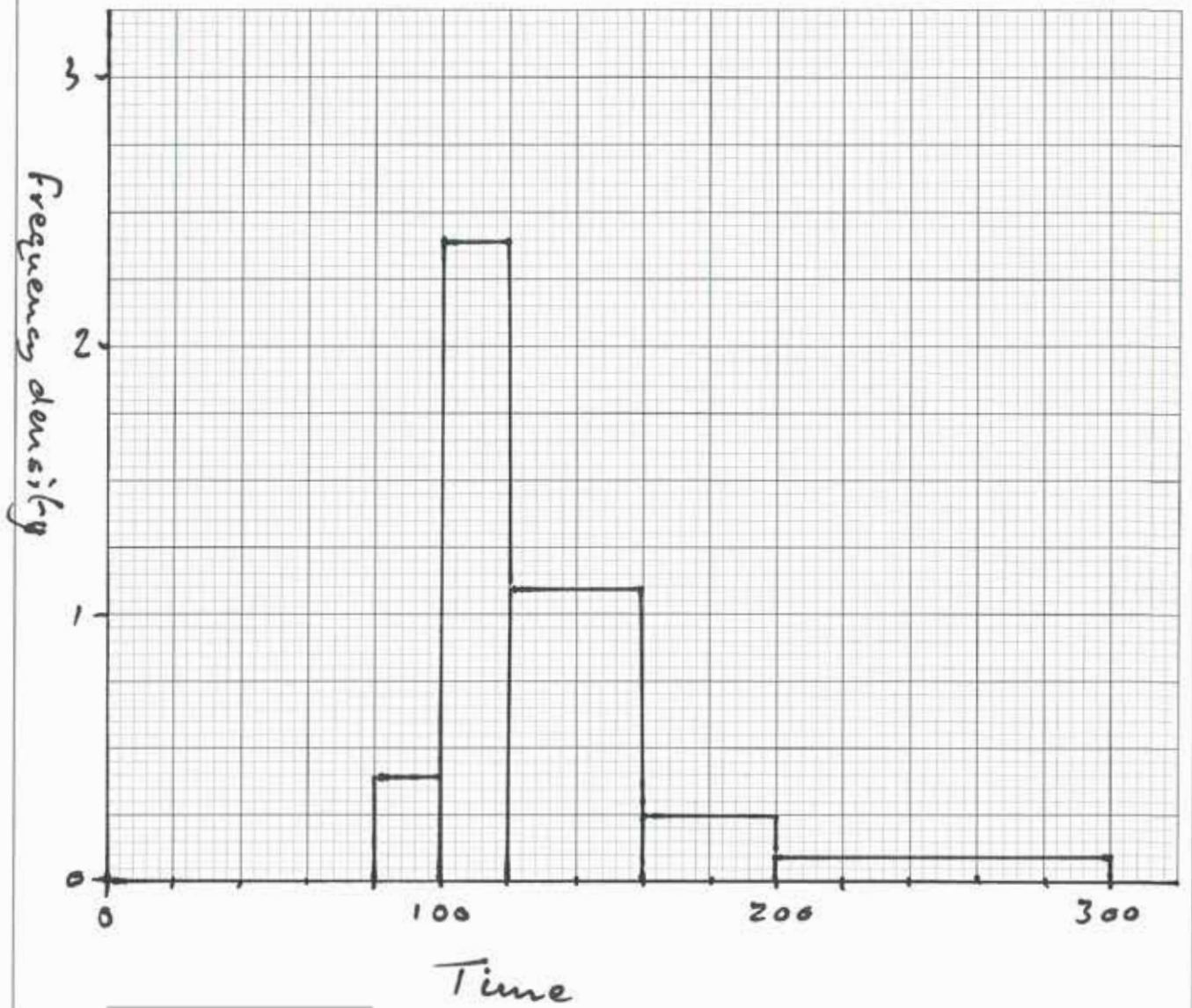


On the grid opposite, draw a histogram to represent the data.

[6 marks]

Use this table to help you.

Time, t (minutes)	cF	F	width	f.density
$80 \leq t < 100$	8	8	20	0.4
$100 \leq t < 120$	56	48	20	2.4
$120 \leq t < 160$	100	44	40	1.1
$160 \leq t < 200$	110	10	40	0.25
$200 \leq t < 300$	120	10	100	0.1



23 Performance

6	3.6%
5	2.4%
4	1.6%
3	3.6%
2	13.7%
1	10.9%
0	23.4%
X	40.7%

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