

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE MATHEMATICS

H

Higher Tier

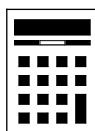
Paper 2 Calculator

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- a calculator
- mathematical instruments
- the Formulae Sheet (enclosed).



Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top 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.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

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.

Advice

In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24	
TOTAL	



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

Do not write
outside the
box

- 1 Circle the fraction that is equal to 1.25%

[1 mark]

$$\frac{1}{8}$$

$$\frac{1}{25}$$

$$\frac{1}{80}$$

$$\frac{1}{125}$$

- 2 Circle the expression that means the probability of A and **not** B.

[1 mark]

$$P(A' \cup B)$$

$$P(A \cup B')$$

$$P(A' \cap B)$$

$$P(A \cap B')$$

- 3 Circle the triangular number.

[1 mark]

$$9$$

$$12$$

$$15$$

$$18$$



- 4 Circle the inequality represented by the diagram.



[1 mark]

$-5 < x < 1$

$-5 < x \leq 1$

$-5 \leq x < 1$

$5 \leq x \leq 1$

- 5 Solve $5(2x - 1) = 6x + 9$

[3 marks]

$x = \underline{\hspace{4cm}}$



6

Show that 2125 can be written as
a cube number **multiplied** by a prime number between 10 and 20

[2 marks]

7

Sam types a constant number of words per minute.
He takes 8 minutes to type a report of 416 words.
How long does it take him to type an essay of 1534 words?
Give your answer in minutes and seconds.

[3 marks]

Answer _____ minutes _____ seconds



8

A school play takes place each day from Monday to Friday.

Here are the attendances on four of the days.

Monday	Tuesday	Wednesday	Thursday
72	83	88	97

For all **five** days, the mean attendance is 90

Work out the attendance on Friday.

[3 marks]

Answer _____

Turn over for the next question

Turn over ►



- 9** Rosie makes phone calls to try to sell broadband.
Today, she made 120 calls.
The table shows the results.

Result of call	Frequency
Not answered	33
Answered but sale not made	81
Answered and sale made	6

- 9 (a)** Write down the relative frequency that a call was **not answered**.

[1 mark]

Answer _____

- 9 (b)** During the **rest of the week**, Rosie will make 500 calls.

Using the results in the table, how many sales does she expect to make during the **rest of the week**?

[2 marks]

Answer _____



10

Harry and Ellie each bought a printer and a hard drive.
Here is some information about how much they paid.

	Printer	Hard drive
Harry	£80	£25
Ellie	10% less than Harry	20% more than Harry

Ellie says,

“In total, I paid more than Harry because 20% is greater than 10%”

Is she correct?

Tick a box.

Yes

☐

No

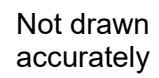
☐

Show calculations to support your answer.

[2 marks]



A shape is made by joining a right-angled triangle to a rectangle.



[5 marks]

[illegible]

Answer _____ cm^2



12

$$4y = 5x$$

Which statement is correct?

Tick **one** box.

[1 mark]

☐

y is 80% of x

☐

y is 125% of x

☐

x is 20% of y

☐

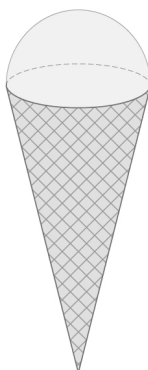
x is 400% of y

Turn over for the next question

Turn over ►



- 13** Outside a cafe there is a large plastic ice cream cornet.
The cornet is a hemisphere on top of a cone.



The cone and the hemisphere each have radius 24 cm

The cone has perpendicular height 117 cm

$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$

r is the radius

h is the perpendicular height

$$\text{Volume of a hemisphere} = \frac{2}{3} \pi r^3$$

r is the radius

- 13 (a)** Work out the total volume of the cornet.

[4 marks]

Answer _____ cm^3



- 13 (b)** The actual cornets that the cafe sells are **similar** to the plastic one.
For the actual cornets, the cone and the hemisphere each have radius 2 cm
How many times greater is the volume of the plastic cornet than an actual cornet?

[3 marks]

Answer _____

Turn over for the next question

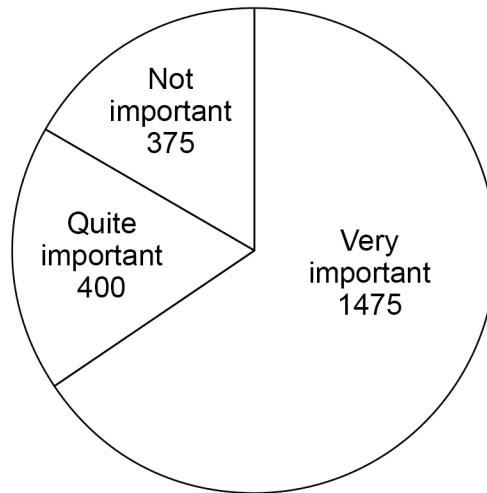


14

A survey was held in a football stadium.

A sample of the crowd was asked about the importance of a family area.

The pie chart represents the answers.



14 (a) The total number of people in the crowd was 29 250

Estimate how many people in the crowd think that a family area is **very important**.

Assume that the sample is representative of the crowd.

[3 marks]

Answer _____



14 (b)

In fact,

50% of the **sample** were sitting in the family area10% of the **crowd** were sitting in the family area.

What is this likely to mean about the actual number of people in the crowd who think that a family area is very important?

Tick **one** box.

[1 mark]

☐

It is larger than the answer to part (a)

☐

It is the same as the answer to part (a)

☐

It is lower than the answer to part (a)

15

In the grid, the **product** of each row, column and diagonal is 1

	$\frac{1}{4}$	
	4	$\frac{1}{8}$

Complete the grid.

[2 marks]

Turn over ►



- 16** Amol owns a sandwich shop.
The shop is open from Monday to Saturday.
In June, Amol sold 3000 sandwiches.

- 16 (a)** Amol wants to work out the mean number of sandwiches he sold per day in June.
His method is $3000 \div 30 = 100$
Make **one** criticism of Amol's method.

[1 mark]

- 16 (b)** Amol received £6660 from selling the 3000 sandwiches in June.
The numbers of sandwiches sold were in the ratio
 $\text{meat} : \text{cheese} : \text{vegan} = 9 : 4 : 7$

The price of a meat sandwich is £2.39

The price of a cheese sandwich is £1.89

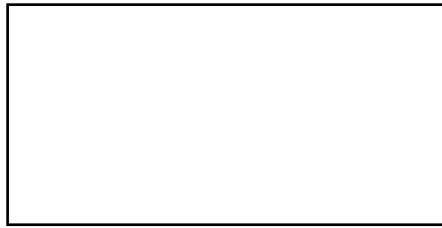
Work out the price of a vegan sandwich.

[4 marks]

Answer £ _____



- 17** Here is the plan of a solid.



Circle the solid that it could be.

[1 mark]

sphere

cone

hemisphere

cylinder

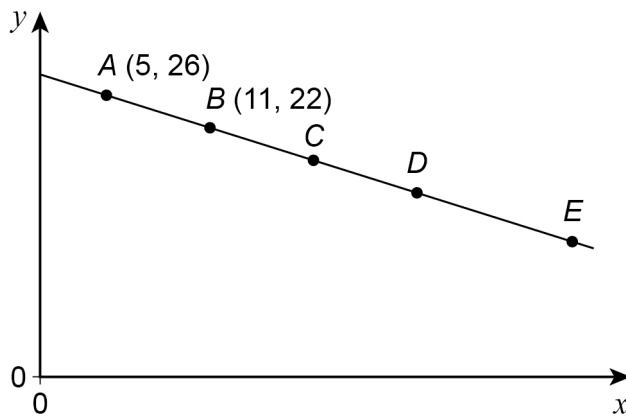
- 18** Solve $x^2 + 7x - 11 = 0$
Give your solutions as decimals.

[2 marks]

Answer _____



- 19 A, B, C, D and E are points on a straight line.



Not drawn
accurately

A, B, C and D are equally spaced.

$$AD : DE = 2 : 1$$

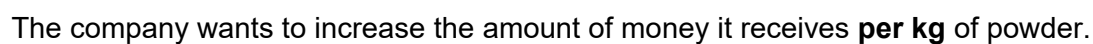
Work out the coordinates of E .

[3 marks]

Answer (_____ , _____)



A company makes and sells boxes of washing powder.



To get the required increase it can

increase the price to £5.88

or

reduce the mass of powder in the box by $x\%$

Work out the value of x to 2 decimal places.

[4 marks]

[illegible]

$x =$ _____

7

Turn over ►



- 21** Which of these is the equation of a circle?
Circle your answer.

[1 mark]

$x^2 - y^2 = 6$

$x^2 + y^2 = 6$

$y = x^2 - 6$

$y = x^2 + 6$

- 22** Circle the reciprocal of 8^5

[1 mark]

8^{-5}

5^{-8}

-8^5

5^8

- 23** Factorise $3x^2 - 16x - 12$

[2 marks]

Answer _____



A straight line

and

Work out the value of x .

[4 marks]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

$x =$ _____

3

Turn over ►



[4 marks]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

26

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

For J, the force is 18.9 newtons and the area is 0.45 m^2

pressure for J : pressure for K = 7 : 8

$$\text{area for J} : \text{area for K} = 9 : 5$$

Work out the force for K.

[4 marks]

[illegible]

Answer _____ newtons

27

To be rented, a bedroom must have a floor area of at least 6.51 m^2

A bedroom has a rectangular floor.

The floor measures 2.4 m by 2.9 m, each correct to 2 significant figures.

Show that the bedroom can be rented.

[3 marks]



29 The equation of a curve is $y = x^2 - 18x + 70$

By completing the square, work out the coordinates of the turning point.

You **must** show your working.

[3 marks]

Answer (_____ , _____)

END OF QUESTIONS



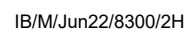
There are no questions printed on this page

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**



[illegible]



GCSE MATHEMATICS 8300/2H

Higher Tier Paper 2 Calculator

Mark scheme

June 2022

Version: 1.0 Final



Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

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Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
oe	Or equivalent. Accept answers that are equivalent. eg accept 0.5 as well as $\frac{1}{2}$
[a, b]	Accept values between a and b inclusive.
[a, b)	Accept values $a \leq \text{value} < b$
3.14...	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles.

Diagrams

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

Responses which appear to come from incorrect methods

Whenever there is doubt as to whether a student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

Questions which ask students to show working

Instructions on marking will be given but usually marks are not awarded to students who show no working.

Questions which do not ask students to show working

As a general principle, a correct response is awarded full marks.

Misread or miscopy

Students often copy values from a question incorrectly. If the examiner thinks that the student has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

Further work

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

Choice

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

Work not replaced

Erased or crossed out work that is still legible should be marked.

Work replaced

Erased or crossed out work that has been replaced is not awarded marks.

Premature approximation

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Continental notation

Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that it is clear to the examiner that the student intended it to be a decimal point.

Q	Answer	Mark	Comment
1	$\frac{1}{80}$	B1	

Q	Answer	Mark	Comment
2	$P(A \cap B')$	B1	

Q	Answer	Mark	Comment
3	15	B1	

Q	Answer	Mark	Comment
4	$-5 < x \leq 1$	B1	

Q	Answer	Mark	Comments
5	Alternative method 1		
	$10x - 5$	M1	may be seen in a grid
	their $10x - 6x = 9 +$ their 5 or $4x = 14$ or $14 \div 4$ or $7 \div 2$	M1	oe eg their $-5 - 9 = 6x -$ their $10x$ or $4x - 14 = 0$ collecting two terms in x and two constant terms correctly
	$\frac{14}{4}$ or $3\frac{2}{4}$ or $\frac{7}{2}$ or $3\frac{1}{2}$ or 3.5	A1ft	oe ft M1M0 or M0M1 with exactly one error
	Alternative method 2		
	$\frac{6x}{5} + \frac{9}{5}$	M1	oe two terms eg $1.2x + 1.8$
	$2x -$ their $\frac{6x}{5} =$ their $\frac{9}{5} + 1$ or $\frac{4x}{5} = \frac{14}{5}$	M1	oe eg $-1 -$ their $\frac{9}{5} =$ their $\frac{6x}{5} - 2x$ or $\frac{4x}{5} - \frac{14}{5} = 0$ collecting two terms in x and two constant terms correctly
	$\frac{14}{4}$ or $3\frac{2}{4}$ or $\frac{7}{2}$ or $3\frac{1}{2}$ or 3.5	A1ft	oe ft M1M0 or M0M1 with exactly one error

Additional Guidance is on the next page

5 cont	Additional Guidance	
	Ignore simplification or conversion if correct answer seen	
	Correct answer from trial and improvement	M1M1A1
	Correct equation with terms collected or division with no or incorrect answer	M1M1A0
	Embedded 3.5 with no or incorrect answer	M1M1A0
	$10x - 5 = 6x + 9$ $10x - 6x = 9 - 5$ $x = 1$ (exactly one error in line 2)	M1 M0 A1ft
	$7x - 5 = 6x + 9$ $7x - 6x = 9 + 5$ $x = 14$ (exactly one error in line 1)	M0 M1 A1ft
	$10x - 5 = 6x + 9$ $10x + 6x = 9 - 5$ $x = \frac{4}{16}$ (two errors in line 2)	M1 M0 A0ft
	$10x - 1 = 6x + 9$ $10x - 6x = 9 + 1$ $x = 3$ (exactly one error in line 1 but answer does not ft)	M0 M1 A0ft
	$7x - 6 = 6x + 9$ $7x - 6x = 9 + 6$ $x = 15$ (two errors in line 1)	M0 M1 A0ft
	$10x + 4 = 6x + 9$ $10x - 6x = 9 + 4$ $x = 3.25$ (neither M mark scored)	M0 M0 A0ft
	$10x - 5 = 30x + 45$	M1M0A0ft
	Any ft answer must be rounded or truncated to 1 dp or better	
	The last two marks can be implied without the collection of terms seen eg $10x - 1 = 6x + 9$ and $x = 2.5$	M0M1A1ft
	Collecting terms before the bracket has been expanded	M0M0A0ft

Q	Answer	Mark	Comments
6	125 and 17 or 5^3 and 17 or 5 and 5 and 5 and 17	B2	together in any order eg 125×17 or 17×5^3 or 5, 5, 5, 17 or $2125 \div 17 = 125$ or $2125 \div 125 = 17$ B1 at least three of 8, 27, 64, 125, 216, 343, 512, 729, 1000, 1331, 1728, 2197 etc (allow 2^3 , 3^3 , 4^3 etc) or all four of 11, 13, 17, 19 (ignore any numbers not between 10 and 20) or (cube number > 1) \times (prime number between 10 and 20) or $2125 \div$ (cube number > 1) or $2125 \div$ (prime number between 10 and 20)
	Additional Guidance		
	B1 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts		
	B2 responses may be seen on a factor tree		
	B1 for three cube numbers given in index form – evaluations can be ignored eg 4^3 5^3 6^3 scores B1 with no evaluations or with incorrect evaluations		
	B1 for multiplications or divisions – evaluation can be ignored eg1 $2^3 \times 13$ scores B1 with no evaluation or evaluated incorrectly eg2 $2125 \div 27$ scores B1 with no evaluation or evaluated incorrectly eg3 $2125 \div 11$ scores B1 with no evaluation or evaluated incorrectly		
	125 and 17 seen in multiple attempts is B2 if 2125 included eg $125 \times 17 = 2125$ or $2125 \div 17 = 125$ or $2125 \div 125 = 17$ seen amongst multiple attempts	B2	
	125 and 17 seen in multiple attempts is B1 if 2125 not included eg 125×17 seen amongst multiple attempts	B1	
	11 13 15 17 19 does not score B1 unless 11 13 17 19 selected		
	Incomplete list eg 11 13 19 does not score B1		

Q	Answer	Mark	Comments
7	Alternative method 1 Words per minute or words per second		
	$416 \div 8$ or 52	M1	oe eg $416 \div (8 \times 60)$ or $416 \div 480$ or $\frac{13}{15}$ or [0.86, 0.87] or 0.9
	1534 \div their 52 or $(1534 - 416) \div$ their 52 + 8 or 29.5	M1dep	oe eg $1534 \div$ their [0.86, 0.87] or $(1534 - 416) \div$ their [0.86, 0.87] + 8×60 or 1770
	29 minutes 30 seconds	A1	SC2 29 minutes 50 seconds or 29 minutes 5 seconds
	Alternative method 2 Minutes per word or seconds per word		
	$8 \div 416$ or $\frac{1}{52}$ or [0.019, 0.019231] or 0.02	M1	oe eg $8 \times 60 \div 416$ or $480 \div 416$ or $\frac{15}{13}$ or [1.15, 1.154] or 1.2
	1534 \times their [0.019, 0.019231] or $(1534 - 416) \times$ their [0.019, 0.019231] + 8 or 29.5	M1dep	oe eg $1534 \times$ their [1.15, 1.154] or $(1534 - 416) \times$ their [1.15, 1.154] + 8×60 or 1770
	29 minutes 30 seconds	A1	SC2 29 minutes 50 seconds or 29 minutes 5 seconds

Mark scheme and Additional Guidance continue on the next page

7 cont	Alternative method 3 Essay words ÷ report words		
	1534 ÷ 416 or $\frac{59}{16}$ or [3.68, 3.69] or 3.7 or (1534 – 416) ÷ 416 or [2.68, 2.69] or 2.7	M1	oe
	8 × their [3.68, 3.69] or 8 × their [2.68, 2.69] + 8 or 29.5	M1dep	oe eg 8 × 60 × their [3.68, 3.69] or 8 × 60 × their [2.68, 2.69] + 8 × 60 or 1770
	29 minutes 30 seconds	A1	SC2 29 minutes 50 seconds or 29 minutes 5 seconds
	Additional Guidance		
	M1 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts		
	Answer 29.5 minutes 1770 seconds	M1M1A0	
	Build-up method must be a fully correct method that would lead to 29.5		
	If working with report words ÷ essay words apply the principles of Alt 3		

Q	Answer	Mark	Comments
8	Alternative method 1		
	90×5 or 450 or $\frac{72+83+88+97+x}{5}$ or $\frac{340+x}{5}$	M1	oe any letter or symbol
	$90 \times 5 - 72 - 83 - 88 - 97$ or $90 \times 5 - 340$ or $72 + 83 + 88 + 97 + x = 90 \times 5$ or $340 + x = 90 \times 5$	M1dep	oe any letter or symbol equations must have fraction eliminated
	110	A1	
	Alternative method 2		
	Trial of any value with mean correctly evaluated	M1	also allow if given to the next or previous integer eg1 trial of 100 $\frac{72+83+88+97+100}{5} = 88$ eg2 trial of 78 $\frac{340+78}{5} = 83$ (or 84 or 83.6) ignore trials with mean not evaluated or incorrectly evaluated
	Trial of 110 with mean evaluated to 90	M1dep	eg $\frac{72+83+88+97+110}{5} = 90$ this mark implies M1M1
	110	A1	

Mark scheme and Additional Guidance continue on the next page

8 cont	Alternative method 3		
	$\frac{72+83+88+97}{4}$ or $\frac{340}{4}$ or 85	M1	oe
	their 85 + 5 × (90 – their 85) or their 85 + 5 × 5 or their 85 + 25	M1dep	oe 90 + 4 × (90 – their 85)
	110	A1	
	Alternative method 4		
	$\frac{72+83+88+97}{5}$ or $\frac{340}{5}$ or 68	M1	oe
	5 × (90 – their 68) or 5 × 22	M1dep	oe
	110	A1	
	Alternative method 5		
	(90 – 72) + (90 – 83) + (90 – 88) + (90 – 97) or 18 + 7 + 2 – 7 or 20	M1	oe eg (72 – 90) + (83 – 90) + (88 – 90) + (97 – 90) or 90 × 4 – 72 – 83 – 88 – 97 or –18 – 7 – 2 + 7 or –20
	90 + their 20	M1dep	oe eg 90 – their –20
	110	A1	
	Additional Guidance		
	M1 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts		
	Embedded 110 scores M1M1A0 using Alt 2 (even if a different answer is given)		
	Condone eg Alt 3 $72 + 83 + 88 + 97 \div 4$ No further marks unless recovered		M1
	Alt 5 1st M1 Subtractions must be consistent		
	Condone 110% for 110		

Q	Answer	Mark	Comments
9(a)	$\frac{33}{120}$ or $\frac{11}{40}$ or 0.275 or 27.5%	B1	oe fraction, decimal or percentage
	Additional Guidance		
	Correct answer seen with an answer of 33		B0
	Ignore simplification or conversion if correct answer seen		
	eg1 $\frac{33}{120}$ seen Answer $\frac{3}{10}$		B1
	eg2 0.275 seen Answer 0.28		B1
	eg3 $\frac{11}{40}$ seen Answer 27.5		B1
	Ignore words if correct answer seen		
	eg1 $\frac{33}{120}$ seen Answer 11 out of 40		B1
	eg2 $\frac{33}{120}$, unlikely		B1
	Answer given as ratio (even if correct answer also seen)		
	eg 33 : 120		B0
	Answer only in words eg 33 out of 120		B0
	Only 27.5 (without %)		B0
	Only 27% or 28%		B0
	Only 0.27 or 0.28		B0
	Only $\frac{1.1}{4}$		B0

Q	Answer	Mark	Comments
9(b)	$\frac{6}{120} \times 500$ or $[4.16, 4.17] \times 6$ or $[24.96, 25.02]$ or 4.2×6 or 25.2 or $25 : 500$ or $\frac{25}{500}$	M1	oe eg 0.05×500 or $500 \div 20$
	25	A1	
	Additional Guidance		
	Working and value may be seen by table		
	24 + 1, Answer 25		M1A1
	480 = 24, Answer 25		M1A1
	Embedded but not selected as answer eg $137.5 + 337.5 + 25 = 500$		M1A0
	Working for Not answered or Answered but sale not made is not choice eg ignore 137.5 and 337.5 seen		
	25 followed by answer 19		M1A0
	If rounded or truncated values are used, the final answer must be exactly 25 eg1 $500 \div 120 = 4.16$, 4.16×6 Answer 25 (may have kept full value on calculator) eg2 $500 \div 120 = 4.16$, $4.16 \times 6 = 24.96$ Answer 25 (comes from further rounding)		M1 A1 M1 A0

Q	Answer	Mark	Comments
10	80×0.9 or 72 or 25×1.2 or 30 or 80×0.1 and 25×0.2 or 8 and 5 or –8 and 5	M1	oe eg $80 \times (1 - 0.1)$ or $25 + 25 \times 0.2$ or $25 + 5$ implied by 102 or 3 or –3
	No and correct valid amount(s)	A1	eg no and 105 and 102 or no and 3 or no and –3 or no and 8 and 5 or no and –8 and 5
	Additional Guidance		
	If neither box is ticked, No may be implied eg neither box is ticked and Ellie paid 3 less		M1A1
	Working and values may be seen by the table		
	No and 105 with M1 not seen		M0A0
	No and 8 with M1 not seen		M0A0
	No and 5 with M1 not seen		M0A0
	Condone No and 8 and 5 with arithmetic error(s) seen eg 72 so 8 less 30 so 5 more 105 and 103 No (arithmetic error in calculating Ellie's total)		M1A1
	Do not condone No and 8 and 5 with process error(s) seen eg $80 - 8 = 72$ $25 - 5 = 20$ (process error, should be $25 + 5$) 105 and 92 No		M1A0

Q	Answer	Mark	Comments
11	Alternative method 1		
	16^2 or 256 and 30^2 or 900	M1	oe implied by 1156
	$\sqrt{16^2 + 30^2}$ or $\sqrt{256 + 900}$ or $\sqrt{1156}$ or 34	M1dep	oe eg $\sqrt{16^2 + 30^2 - 2 \times 16 \times 30 \times \cos 90}$
	52 × their 34 or 1768	M1dep	oe if M1M0 their 34 can be any value other than 16, 30 or 52 dep on 1st M
	$0.5 \times 30 \times 16$ or 240	M1	oe eg $0.5 \times 30 \times 16 \times \sin 90$
	2008	A1	SC3 2248
	Alternative method 2		
	$\tan^{-1} \frac{16}{30}$ or [28, 28.1] or $\tan^{-1} \frac{30}{16}$ or [61.9, 62]	M1	oe may be on diagram
	$\frac{30}{\cos(\text{their } [28, 28.1])}$ or $\frac{16}{\cos(\text{their } [61.9, 62])}$ or 34	M1dep	oe eg $\frac{16}{\sin(\text{their } [28, 28.1])}$ or $30 \cos(\text{their } [28, 28.1]) + 16 \cos(\text{their } [61.9, 62])$
	52 × their 34 or 1768	M1dep	oe if M1M0 their 34 can be any value other than 16, 30 or 52 dep on 1st M
	$0.5 \times 30 \times 16$ or 240	M1	oe eg $0.5 \times 30 \times 16 \times \sin 90$
	2008	A1	SC3 2248

Additional Guidance is on the next page

11 cont	Additional Guidance	
	Up to M4 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts	
	The 4th mark in Alts 1 and 2 is not dependent on any other marks	
	34 or 1768 or 240 may be on the diagram	
	SC3 is for using 30×16 for the area of the triangle	
	Ignore units	

Q	Answer	Mark	Comments
12	y is 125% of x	B1	

Q	Answer	Mark	Comments
13(a)	$\frac{1}{3} \times \pi \times 24^2 \times 117$ or $\frac{2}{3} \times \pi \times 24^3$	M1	oe eg $\frac{1}{3} \pi \times 576 \times 117$ or $\frac{2}{3} \pi \times 13824$
	22 464 π or [70 536, 70 582] or 9216 π or [28 938, 28 957]	A1	may be seen in a sum implied by final A1
	$\frac{1}{3} \times \pi \times 24^2 \times 117 + \frac{2}{3} \times \pi \times 24^3$ or 22 464 π + 9216 π or [70 536, 70 582] + [28 938, 28 957]	M1dep	oe
	31 680 π or [99 474, 99 539]	A1	
	Additional Guidance		
	π may be seen as any value in the interval [3.14, 3.142]		
	Do not allow any misreads of formulae unless recovered eg $\pi \times 24^2 \times 117$ and $\frac{2}{3} \times \pi \times 24^2$		M0
	Allow dots for multiplication		
	For A marks allow eg 22 464 $\times \pi$ or $\pi \times 31\,680$		
	31 680 π followed by incorrect evaluation attempt		M1A1M1A1
	31 680 π followed by further work		M1A1M1A0
	31 680 only		M0A0M0A0
	$\frac{1}{3} \times \pi \times 24^2 \times 117 = 4725$ $\frac{2}{3} \times \pi \times 24^3 = 28\,952$ 4725 + 28 952 (even though 4725 is wrong the method for $\frac{1}{3} \times \pi \times 24^2 \times 117$ is seen)		M1A1 M1

Q	Answer	Mark	Comments
13(b)	Alternative method 1 Uses volume scale factor		
	$24 \div 2$ or 12	M1	oe eg $12 \times 2 = 24$
	(their 12) ³	M1dep	oe eg $24^3 \div 2^3$ or $13824 \div 8$
	1728	A1	condone 1 : 1728 or 1728 : 1 SC2 $\frac{1}{1728}$
	Alternative method 2 Compares volumes of cornets (ie compares total volumes)		
	$24 \div 2$ or 12	M1	oe eg $12 \times 2 = 24$ may be implied eg (height of cone) 9.75 or (volume of cone) 13π or (volume of cone) [40.8, 40.85] or (total volume) $\frac{55}{3}\pi$ or [57.4, 57.7]
	their (a) \div $(\frac{1}{3}\pi \times 2^2 \times \frac{117}{\text{their } 12} + \frac{2}{3}\pi \times 2^3)$	M1dep	oe eg their (a) \div [57.4, 57.7]
	1728	A1	condone 1 : 1728 or 1728 : 1 SC2 $\frac{1}{1728}$

Mark scheme and Additional Guidance continue on the next two pages

13(b) cont	Alternative method 3 Compares volumes of cones		
	$24 \div 2$ or 12	M1	oe eg $12 \times 2 = 24$ may be implied eg (height of cone) 9.75 or (volume of cone) 13π or (volume of cone) [40.8, 40.85] or (total volume) $\frac{55}{3}\pi$ or [57.4, 57.7]
	their volume of cone from (a) $\div (\frac{1}{3}\pi \times 2^2 \times \frac{117}{\text{their } 12})$	M1dep	oe eg their volume of cone from (a) $\div [40.8, 40.85]$
	1728	A1	condone 1 : 1728 or 1728 : 1 SC2 $\frac{1}{1728}$
	Alternative method 4 Compares volumes of hemispheres		
	their volume of hemisphere from (a) $\div (\frac{2}{3}\pi \times 2^3)$	M2	oe eg their volume of hemisphere from (a) $\div [16.7, 16.8]$
	1728	A1	condone 1 : 1728 or 1728 : 1 SC2 $\frac{1}{1728}$

Additional Guidance is on the next page

13(b) cont	Additional Guidance	
	π may be seen as any value in the interval [3.14, 3.142]	
	Answer $\times 1728$ or $1728 \times$	M1M1A1
	Answer 12	M1M0A0
	Answer 12^3 with 1728 seen	M1M1A1
	Answer 12^3 without 1728 seen	M1M1A0
	Alts 2, 3 and 4 Allow if an incorrect volume formula from (a) is used in (b) eg Alt 4 (a) $\frac{1}{2} \times \frac{2}{3} \times \pi \times 24^3 = 4608\pi$ (b) $\frac{1}{2} \times \frac{2}{3} \times \pi \times 2^3 = \frac{8}{3}\pi$ $4608\pi \div \frac{8}{3}\pi$ 1728	M2 A1
	Alts 2 and 3 Allow $\frac{55}{3}$ rounded to 1dp or better eg allow 18.3	
	Alt 4 Allow $\frac{16}{3}$ rounded to 1dp or better eg allow 5.3	
	Alts 2 and 3 2nd M1 – allow consistent omission of π	
	Alt 4 M2 – allow consistent omission of π	
	Alts 2, 3 and 4 Answer 1728 is M1M1A1 unless it comes from rounding or truncating eg1 Alt 2 $99\,525.655 \div 57.595 = 1728$ eg2 Alt 2 $99\,525.655 \div 57.595 = 1728.03$ Answer 1728	M1M1A1 M1M1A0

Q	Answer	Mark	Comments
14(a)	Alternative method 1		
	$375 + 400 + 1475$ or 2250 or 13 seen or $\frac{59}{90}$ seen or [0.65, 0.66] seen	M1	oe for 375 allow 350 or 370 or 380 or 400 for 1475 allow 1450 or 1470 or 1480 or 1500 eg $400 + 400 + 1500$ any estimated values must be seen eg only seeing 2300 is M0
	$\frac{1475}{375 + 400 + 1475} \times 29\,250$ or 1475×13 or $[0.65, 0.66] \times 29\,250$ or [19012.5, 19305]	M1dep	oe for 375 allow 350 or 370 or 380 or 400 for 1475 allow 1450 or 1470 or 1480 or 1500 for 29 250 allow 29 000 or 29 200 or 29 300 or 29 500 or 30 000
	19 175	A1	
	Alternative method 2		
	[234, 238]	M1	may be on the diagram
	$\frac{\text{their } [234, 238]}{360} \times 29\,250$ or their [234, 238] $\times 81.25$	M1dep	oe for 29 250 allow 29 000 or 29 200 or 29 300 or 29 500 or 30 000
	19 175	A1	
	Additional Guidance		
	$375 + 400 + 1475 = 2250$ If they subsequently estimate 2250 no further marks can be scored	M1	
	Answer 19 175 is M1M1A1 unless it comes from rounding or truncating eg1 Alt 1 $0.65555 \times 29\,250 = 19\,175$ eg2 Alt 1 $0.65555 \times 29\,250 = 19\,174.8$ Answer 19 175	M1M1A1 M1M1A0	
	Alt 2 if their angle is outside the range [234, 238]	M0M0A0	

Q	Answer	Mark	Comment
14(b)	It is lower than the answer to part (a)	B1	

Q	Answer	Mark	Comment									
15	<table><tr><td>8</td><td>$\frac{1}{4}$</td><td>$\frac{1}{2}$</td></tr><tr><td>$\frac{1}{16}$</td><td>1</td><td>16</td></tr><tr><td>2</td><td>4</td><td>$\frac{1}{8}$</td></tr></table>	8	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{16}$	1	16	2	4	$\frac{1}{8}$	B2	oe values eg 0.0625 for $\frac{1}{16}$ condone unprocessed values eg for 8 allow $\frac{16}{2}$ or $\frac{8}{1}$ B1 at least three of the eight rows, columns and diagonals have a product of 1 do not count rows, columns or diagonals that only have ones do not count incomplete rows, columns or diagonals
	8	$\frac{1}{4}$	$\frac{1}{2}$									
	$\frac{1}{16}$	1	16									
	2	4	$\frac{1}{8}$									
	Additional Guidance											
If decimal values are used they must be exact												
The given values in the grid cannot be changed												
B1 can be awarded with an incomplete grid eg <table><tr><td>8</td><td>$\frac{1}{4}$</td><td></td></tr><tr><td>$\frac{1}{16}$</td><td>1</td><td></td></tr><tr><td>2</td><td>4</td><td>$\frac{1}{8}$</td></tr></table>		8	$\frac{1}{4}$		$\frac{1}{16}$	1		2	4	$\frac{1}{8}$	B1	
8	$\frac{1}{4}$											
$\frac{1}{16}$	1											
2	4	$\frac{1}{8}$										
<table><tr><td>1</td><td>$\frac{1}{4}$</td><td>1</td></tr><tr><td>1</td><td>1</td><td>$\frac{1}{2}$</td></tr><tr><td>1</td><td>4</td><td>$\frac{1}{8}$</td></tr></table>	1	$\frac{1}{4}$	1	1	1	$\frac{1}{2}$	1	4	$\frac{1}{8}$	Three products of 1 but two are not counted as they only have ones	B0	
1	$\frac{1}{4}$	1										
1	1	$\frac{1}{2}$										
1	4	$\frac{1}{8}$										

Q	Answer	Mark	Comments
16(a)	Valid criticism of method indicating or implying that 30 is incorrect	B1	eg the shop was open for fewer than 30 days
	Additional Guidance		
	Valid criticism with non-contradictory statements		B1
	Contradictory statements		B0
	30 should be 26		B1
	The answer is 115 (allow 116 or 115.4 or 115.38...)		B1
	30 should be 25		B1
	The answer is 120		B1
	30 should be 24 (condone)		B1
	The answer is 125 (condone)		B1
	The answer is more than 100		B1
	The shop wasn't open for 30 days		B1
	He didn't work every day in June		B1
	The shop was shut on Sundays		B1
	He is open 6 days a week		B1
	The shop isn't open every day		B1
	He should divide by 31		B0
	He doesn't work weekends		B0
	There aren't 30 days in June		B0
	Not every month has 30 days		B0
	30 should be 27		B0
	The answer is less than 100		B0

Q	Answer	Mark	Comments
16(b)	Alternative method 1		
	$3000 \div (9 + 4 + 7)$ or $3000 \div 20$ or 150	M1	oe implied by 1350 or 600 or 1050 or 358.5(0) or 283.5(0)
	9×2.39 or 21.51 or 4×1.89 or 7.56 or 29.07	M1	oe may be embedded or implied eg $9 \times 2.39 \times \text{their } 150$ or $4 \times 1.89 \times \text{their } 150$ their 150 can be any number 3226.5(0) or 1134 or 4360.5(0) score M1M1
	$(6660 - 9 \times 2.39 \times \text{their } 150 - 4 \times 1.89 \times \text{their } 150) \div (7 \times \text{their } 150)$ or $(6660 - 3226.5(0) - 1134) \div 1050$ or $(6660 - 4360.5(0)) \div 1050$ or $2299.5(0) \div 1050$	M1dep	oe eg $(6660 - 9 \times 2.39 \times \text{their } 150 - 4 \times 1.89 \times \text{their } 150) \div (3000 - 9 \times \text{their } 150 - 4 \times \text{their } 150)$ or $\frac{219}{100}$ dep on M1M1 their 150 must be from 1st M1
	2.19	A1	

Mark scheme and Additional Guidance continue on the next page

16(b) cont	Alternative method 2		
	3000 ÷ (9 + 4 + 7) or 3000 ÷ 20 or 150	M1	oe implied by 1350 or 600 or 1050 or 358.5(0) or 283.5(0)
	9 × 2.39 or 21.51 or 4 × 1.89 or 7.56 or 29.07	M1	oe may be embedded or implied eg 9 × 2.39 × their 150 or 4 × 1.89 × their 150 their 150 can be any number 3226.5(0) or 1134 or 4360.5(0) score M1M1
	$\left(\frac{6660}{\text{their 150}} - 9 \times 2.39 - 4 \times 1.89 \right) \div 7$ or (44.4(0) – 21.51 – 7.56) ÷ 7 or 15.33 ÷ 7	M1dep	oe eg (44.4(0) – 29.07) ÷ 7 or $\frac{219}{100}$ dep on M1M1 their 150 must be from 1st M1
	2.19	A1	
	Additional Guidance		
	Up to M1M1 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts		

Q	Answer	Mark	Comment
17	cylinder	B1	

Q	Answer	Mark	Comments
18	$\frac{-7 \pm \sqrt{7^2 - 4 \times 1 \times -11}}{2 \times 1}$ or $-\frac{7}{2} \pm \sqrt{\left(\frac{7}{2}\right)^2 + 11}$	M1	oe eg $\frac{-7 \pm \sqrt{49 + 44}}{2}$ or $\frac{-7 \pm \sqrt{93}}{2}$ or $-\frac{7}{2} \pm \sqrt{\frac{49}{4} + 11}$ or $-\frac{7}{2} \pm \sqrt{\frac{93}{4}}$
	1.3(2...) and -8.3(2...)	A1	
	Additional Guidance		
	$-3.5 \pm \sqrt{12.25 + 11}$ or $-3.5 \pm \sqrt{23.25}$		M1
	For M1 allow solutions given separately eg $\frac{-7 + \sqrt{93}}{2}$ and $\frac{-7 - \sqrt{93}}{2}$		M1
	Both solutions correct		M1A1
	One solution correct does not imply M1		
	Not using \pm is M0 unless recovered eg1 $\frac{-7 + \sqrt{7^2 - 4 \times 1 \times -11}}{2 \times 1}$ followed by 1.32 eg2 $\frac{-7 + \sqrt{7^2 - 4 \times 1 \times -11}}{2 \times 1}$ followed by 1.3 and -8.3		M0A0 M1A1
	A short dividing line or a short square root symbol is M0 unless recovered eg by a correct solution		
	Condone if their square root symbol is above any part of -11		
	$\sqrt{7^2 - 4 \times 1 \times -11}$ is correct for $\sqrt{7^2 - 4 \times 1 \times -11}$		
	Both decimal solutions seen in working but only one on answer line		M1A0

Q	Answer	Mark	Comments
19	(32, 8)	B3	B2 $E(32, \dots)$ or $E(\dots, 8)$ B1 $C(17, 18)$ or $D(23, 14)$ SC1 $C(a, b)$ and $D(a + 6, b - 4)$
	Additional Guidance		
	Mark the answer line for B3 and B2 (if blank check working lines and diagram)		
	B1 or SC1 is likely to be seen in working lines or on the diagram		
	Condone missing brackets eg $C\ 17, 18$		B1
	Coordinates can be implied eg $D\ x = 23\ y = 14$		B1
	Condone answers given as vectors for B2, B1 or SC1 eg $C \begin{pmatrix} 17 \\ 18 \end{pmatrix}$		B1
	SC1 C cannot be (5, 26) or (11, 22) and coordinates of D must be evaluated eg $C(15, 17)$ and $D(21, 13)$		SC1

Q	Answer	Mark	Comments
20	Alternative method 1		
	$5.88 \div 1.68$ or 3.5 or $1.68 \div 5.88$ or [0.285, 0.29] or $5.88 \div 5.60$ or 1.05	M1	oe eg $\frac{7}{2}$ or $\frac{2}{7}$ or $\frac{21}{20}$ or $5.6 \times 1.05 = 5.88$
	$5.6(0) \div (5.88 \div 1.68)$ or $5.6(0) \times (1.68 \div 5.88)$ or $1.68 \div (5.88 \div 5.60)$ or 1.6	M1dep	oe eg $5.6(0) \div 3.5$ or $5.6(0) \times [0.285, 0.29]$ or $1.68 \div 1.05$
	their $1.6 \div 1.68$ or [0.952, 0.9524] or $1 - \text{their } 1.6 \div 1.68$ or $1 - [0.952, 0.9524]$ or [0.0476, 0.048]	M1dep	oe eg $\frac{20}{21}$ or $1 - \frac{20}{21}$ or $\frac{1}{21}$ $5.6(0) \div 5.88$ oe scores M3 $1 - 5.6(0) \div 5.88$ oe scores M3
	4.76	A1	
	Alternative method 2		
	$5.88 \div 5.6(0)$ or 1.05	M1	oe eg $\frac{21}{20}$
	$1 \div \text{their } 1.05$	M1dep	oe eg $1 \div \frac{21}{20}$
	[0.952, 0.9524] or $1 - [0.952, 0.9524]$ or [0.0476, 0.048]	M1dep	oe eg $\frac{20}{21}$ or $1 - \frac{20}{21}$ or $\frac{1}{21}$ $5.6(0) \div 5.88$ oe scores M3 $1 - 5.6(0) \div 5.88$ oe scores M3
	4.76	A1	

Additional Guidance is on the next page

20 cont	Additional Guidance	
	Up to M3 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts	
	$\frac{0.28}{5.60} = 0.05$ is M0 unless 1.05 subsequently used	
	$5.60 \div 1.68$ with no further correct working	M0
	Note that 1.6 seen may be from an incorrect method eg $1.68 \times 0.95 = 1.6$ does not score because 1.68×0.95 is an incorrect method and the actual value of 1.68×0.95 is 1.596	
	Any single calculation or set of calculations that lead to $\frac{20}{21}$ or $\frac{1}{21}$	M3
	Some common oes for $1 - 5.6(0) \div 5.88$ are $\frac{5.88 - 5.6(0)}{5.88}$ or $\frac{0.28}{5.88}$ and $\frac{1.68 - 1.6}{1.68}$ or $\frac{0.08}{1.68}$	M3
	3rd M1 oes include [0.952, 0.9524] $\times 100$ or [95.2, 95.24]% $100\% - [0.952, 0.9524] \times 100$ [0.0476, 0.048] $\times 100$ or (4.76, 4.8)%	
	Values that score marks may be seen in ratios eg 5.88 : 1.68 (does not score at this stage) 3.50 : 1	M1
	Allow working in pence eg $588 \div 1.68$ or 350	M1
	Allow working in grams eg $5.88 \div 1680$ or 0.0035	M1

Q	Answer	Mark	Comment
21	$x^2 + y^2 = 6$	B1	

Q	Answer	Mark	Comment
22	8^{-5}	B1	

Q	Answer	Mark	Comments
23	$(3x + 2)(x - 6)$	B2	B1 $(3x + a)(x + b)$ where $ab = -12$ or $a + 3b = -16$ a and b must be integers SC1 $(-3x - 2)(6 - x)$
	Additional Guidance		
	Brackets in either order for B2 and B1 and SC1		
	$(3x + 6)(x - 2)$		B1
	$(3x + 4)(x - 3)$ or $(3x + 3)(x - 4)$ or $(3x - 3)(x + 4)$ or $(x + 3)(3x - 4)$		B1
	$(3x + 12)(x - 1)$ or $(x - 12)(3x + 1)$		B1
	Some B1 responses may be implied eg $3(x + 4)(x - 1)$ implies $(3x + 12)(x - 1)$		B1
	Do not allow answers involving fractions eg $3(x - 6)(x + \frac{2}{3})$		B0
	Some examples of B1 with $a + 3b = -16$ $(3x + 5)(x - 7)$ $(3x + 8)(x - 8)$ $(3x - 1)(x - 5)$ $(3x - 7)(x - 3)$		
	$(2 + 3x)$ is equivalent to $(3x + 2)$ etc		
	Condone use of multiplication signs in B2 or B1 responses eg $(3x + 2) \times (x - 6)$		B2
	Condone missing closing bracket in B2 or B1 responses eg $(3x + 6)(x - 2$		B1
	Ignore any attempt to 'solve' after B2 or B1 seen		

Q	Answer	Mark	Comments
24	$\frac{15-8}{6-2}$ or $\frac{7}{4}$	M1	oe eg $\frac{8-15}{2-6}$ or 1.75 may be embedded in an attempt at equation of line eg $y = \frac{7}{4}x \dots$ may be implied
	$-1 \div \text{their } \frac{7}{4}$ or $-\frac{4}{7}$ or $\frac{17-9}{x-0} \times \text{their } \frac{7}{4} = -1$	M1	oe allow $[-0.57143, -0.57]$ may be embedded in an attempt at equation of a line eg $y = \text{their } -\frac{4}{7}x \dots$
	$17-9 = \text{their } -\frac{4}{7}x$ or $-4x = 56$ or $56 \div -4$	M1dep	oe equation must be of the form $ax = b$ (b can be unprocessed) dep on 2nd M1
	-14	A1	

Additional Guidance is on the next page

24 cont	Additional Guidance	
	The second mark is not dependent on the first – see examples below	
	(gradient of line through given points $\Rightarrow \frac{6-2}{15-8} = \frac{4}{7}$)	M0
	(gradient of perpendicular line $\Rightarrow -\frac{7}{4}$)	M1
	$17-9 = -\frac{7}{4}x$	M1
	(gradient of line through given points $\Rightarrow -\frac{7}{4}$)	M0
	$\frac{17-9}{x} \times -\frac{7}{4} = -1$	M1
	$-56 = -4x$	M1
	(gradient of line through given points $\Rightarrow \frac{7}{4}$)	M1
	(gradient of perpendicular line $\Rightarrow \frac{4}{7}$)	M0M0
	Condone use of letters for gradients eg $x = 1.75$	M1
	For the first two marks, condone inclusion of x in their gradients	
	Answer -14 that comes from rounding or truncating cannot score A1	
	eg1 (perp grad $\Rightarrow -0.57$ $8 = -0.57x$ Answer -14)	M3A1
	eg2 (perp grad $\Rightarrow -0.57$ $8 = -0.57x = -14.03$ Answer -14)	M3A0

Q	Answer	Mark	Comments
25	$x = 2y + 5$ or $x - 5 = 2y$ or $y - 5 = 2x$ or $\frac{y-5}{2}$	M1	oe eg $x = 2f^{-1} + 5$ or $f(x) - 5 = 2x$
	$\frac{x-5}{2}$	A1	oe eg $\frac{x}{2} - \frac{5}{2}$ may be implied eg by $12f^{-1}(x) = 6(x-5)$ implied by $\frac{y-5}{2}$ if $\frac{x-5}{2}$ used in subsequent working
	Correctly expands $3(2x + 5) - 12 \times \text{their } \frac{x-5}{2}$ to a linear expression	M1	$6x + 15 - 6x + 30$ if M1A1 their $\frac{x-5}{2}$ must be a function of x their $\frac{x-5}{2}$ cannot be $2x + 5$ implied by a correct linear expression or value for $3(2x + 5) - 12 \times \text{their } \frac{x-5}{2}$
	$\frac{x-5}{2}$ and 45	A1	
	Additional Guidance		
	45 with no working		Zero
	45 from wrong working does not score 4 marks – mark the working seen		
	First A1 Condone $y = \frac{x-5}{2}$ or $f = \frac{x-5}{2}$ or $f(x) = \frac{x-5}{2}$ or $x = \frac{x-5}{2}$		
	For $6x + 15 - 6x + 30$ allow $\frac{12x+30-12x+60}{2}$ but not $6x + 15 - \frac{12x-60}{2}$		
	$x = 2y + 5$ $\frac{x+5}{2}$ $6x + 15 - \frac{12x}{2} - \frac{60}{2}$ (implied by -15)		M1A0 M1A0
	$-2x - 5$ $6x + 15 + 24x + 60$ (implied by $30x + 75$)		M0A0 M1A0

Q	Answer	Mark	Comments
26	$18.9 \div 0.45$ or 42	M1	oe
	their $42 \div 7 \times 8$ or 48	M1dep	oe eg $\frac{8}{7} \times$ their 42 or $[1.14, 1.143] \times$ their 42
	$0.45 \div 9 \times 5$ or 0.25	M1	oe eg $\frac{5}{9} \times 0.45$ or $[0.55, 0.56] \times 0.45$ $\frac{8}{7} \times \frac{5}{9} \times 18.9$ oe scores M3
	12	A1	
	Additional Guidance		
	Up to M3 may be awarded for correct work with no, or incorrect answer, even if this is seen amongst multiple attempts		
	Any single calculation or set of calculations that are a correct method and lead to 12		M3
	Note that the single calculation $\frac{8}{7} \times \frac{5}{9} \times 18.9$ does not use 0.45		M3
	An oe for $\frac{8}{7} \times \frac{5}{9} \times 18.9$ is $\frac{8}{7} \times \frac{18.9}{0.45} \times \frac{5}{9} \times 0.45$		M3
	Values may be seen in ratios eg 42 : 48		M1M1

Q	Answer	Mark	Comment
27	Alternative method 1		
	Sight of at least one of 2.35 or 2.45 or 2.85 or 2.95	M1	allow $2.44\dot{9}$ for 2.45 and $2.94\dot{9}$ for 2.95
	their $2.35 \times$ their 2.85	M1	$2.3 \leq$ their $2.35 < 2.4$ $2.8 \leq$ their $2.85 < 2.9$
	2.35×2.85 selected and 6.6(975)	A1	accept 6.7(0) or 6.698 with 2.35×2.85 selected
	Alternative method 2		
	Sight of at least one of 2.35 or 2.45 or 2.85 or 2.95	M1	allow $2.44\dot{9}$ for 2.45 and $2.94\dot{9}$ for 2.95
	$6.51 \div$ their 2.35 or $6.51 \div$ their 2.85	M1	$2.3 \leq$ their $2.35 < 2.4$ $2.8 \leq$ their $2.85 < 2.9$
	$6.51 \div 2.35$ and 2.7(7...) and 2.85 or $6.51 \div 2.85$ and 2.2(8...) and 2.35	A1	
	Additional Guidance		
	Alt 1 2.35×2.85 amongst other calculations eg 2.45×2.95 and/or 2.35×2.95 can still score the second M1 but it must be clear that they are considering $2.35 \times 2.85 = 6.6(975)$ to show that the bedroom can be rented eg1 $2.35 \times 2.85 = 6.6975$ $2.45 \times 2.95 = 7.2275$ eg2 $2.35 \times 2.85 = 6.6975$ $2.45 \times 2.95 = 7.2275$ $2.35 \times 2.95 = 6.9325$ The lower bounds show it can be rented		M1M1A0 M1M1A1
	Ignore the calculation 2.4×2.9 throughout		
	Alt 1 6.6(975) or 6.7 or 6.698 without 2.35×2.85 selected		A0
	6.6975 only		M0M0A0
	Alt 2 2.7(7...) without $6.51 \div 2.35$ and 2.85 seen		A0
	Alt 2 2.2(8...) without $6.51 \div 2.85$ and 2.35 seen		A0

Q	Answer	Mark	Comments
28	interior angle = 150 or exterior angle = 30 or angle $BCN = 120$	B1	method not required may be seen on diagram
	interior angle = 150 with a valid method shown or exterior angle = 30 with a valid method shown or angle $BCN = 120$ with a valid method shown	B1dep	angles may be seen on diagram but methods will be in working lines eg $180 - \frac{360}{12} = 150$ or $\frac{1800}{12} = 150$ or $360 - 120 - 90 = 150$ or $\frac{360}{12} = 30$ or $\frac{180 - 120}{2} = 30$ or $180 - 150 = 30$ or $360 - 150 - 90 = 120$ or $360 - 240 = 120$ or $180 - 2 \times 30 = 120$
	interior angle = 150 with a valid method shown and exterior angle = 30 with a valid method shown and angle $BCN = 120$ with a valid method shown	B1dep	angles may be seen on diagram but methods will be in working lines eg $\frac{1800}{12} = 150$ and $\frac{180 - 120}{2} = 30$ and $360 - 240 = 120$ angles worked out in any order
	Fully correct working that must show correct progression and show all valid methods Valid methods shown must be appropriate for the approach used A reason must be included in the final step	B1dep	examples of the final step are (i) angle $ABC + \text{angle } CBN = 180$ (ii) interior angle = 150 in two different ways (iii) exterior angle = 30 in two different ways (iv) angle $BCN = 120$ in two different ways (v) sum of three angles at $C = 360$ (vi) sum of angles of triangle $BCN = 180$

Additional Guidance is on the next page

28 cont	Additional Guidance	
	Condone incorrect use of equals signs throughout eg interior angle = $12 - 2 = 10 \times 180 = 1800 \div 12 = 150$	B1B1
	interior angle may be seen as angle ABC or angle BCD exterior angle may be seen as angle CBN	
	It must be clear which angle they are working out eg1 Do not accept 150 if it is not correctly identified or not in the correct position on diagram eg2 Do accept 150 if it is identified as an interior angle or angle ABC or is in the correct position on the diagram	
	Do not accept incorrect statements eg1 exterior angle = 150 (even if 150 in correct position on the diagram) eg2 angle $ACB = 150$ (even if 150 in correct position on the diagram)	
	Ignore reasons for the first three marks	
	Angles on the diagram with no valid methods can score a maximum of B1B0B0B0	
	For the 2nd and 3rd marks the methods shown do not have to show progression	
	Example of fully correct working for (i) interior angle = $\frac{1800}{12} = 150$ angle $BCN = 360 - 150 - 90 = 120$ angle $CBN = \frac{180 - 120}{2} = 30$ $150 + 30 = 180$ angles on a (straight) line	B1B1 B1 B1
	Example of fully correct working for (ii) exterior angle = $\frac{360}{12} = 30$ angle $BCN = 180 - 2 \times 30 = 120$ interior angle = $360 - 120 - 90 = 150$ interior angle = $\frac{1800}{12} = 150$ (interior) angle of polygon	B1B1 B1 B1

Q	Answer	Mark	Comments								
29	$(x - 9)^2 \dots$	M1	allow $\left(x - \frac{18}{2}\right)^2 \dots$ may be implied by a grid for $(x - 9)^2$								
	$(x - 9)^2 - 9^2 + 70$ or $(x - 9)^2 - 81 + 70$ or $(x - 9)^2 - 11$	M1dep	oe completing the square eg $\left(x - \frac{18}{2}\right)^2 - \left(\frac{18}{2}\right)^2 + 70$								
	(9, -11) with correct completing the square seen	A1	eg (9, -11) with $(x - 9)^2 - 9^2 + 70$ seen SC1 (9, -11) with correct completing the square not seen								
	Additional Guidance										
	Allow $(x - 9)^2$ to be $(9 - x)^2$ throughout										
	Allow $(x - 9)^2$ to be $(x - 9)(x - 9)$ throughout										
	Condone expression = 0 throughout										
	$(x - 9)^2 = 11$ with $(x - 9)^2 - 11 (= 0)$ also seen scores M1M1 Also scores A1 if answer correct										
	$(x - 9)^2 = 11$ without $(x - 9)^2 - 11 (= 0)$ also seen Answer correct would still mean M1M0 (or SC1)		M1M0								
	Allow as a slip if completing the square seen but the squared is omitted in a subsequent line eg $(x - 9)^2 - 81 + 70 = (x - 9) - 11$ Answer (9, -11)		M1M1 A1								
	$(x - 9) - 11$ and answer (9, -11)		SC1								
	$(x - 9) - 11$ and answer not (9, -11)		M0M0A0								
	(9, -11) with no method or from a different method eg calculus		SC1								
	<table border="1"><tr><td></td><td>x</td><td>-9</td></tr><tr><td>x</td><td>x^2</td><td>$-9x$</td></tr><tr><td>-9</td><td>$-9x$</td><td>81</td></tr></table> Condone one of the products missing or incorrect			x	-9	x	x^2	$-9x$	-9	$-9x$	81
	x	-9									
x	x^2	$-9x$									
-9	$-9x$	81									