

While we're waiting ...

What do each of the below abbreviations stand for?

M method mark awarded for a correct method or partial method

P process mark awarded for a correct process as part of a problem solving question

B unconditional accuracy mark

C communication mark awarded for a fully correct statement(s) with no contradiction or ambiguity

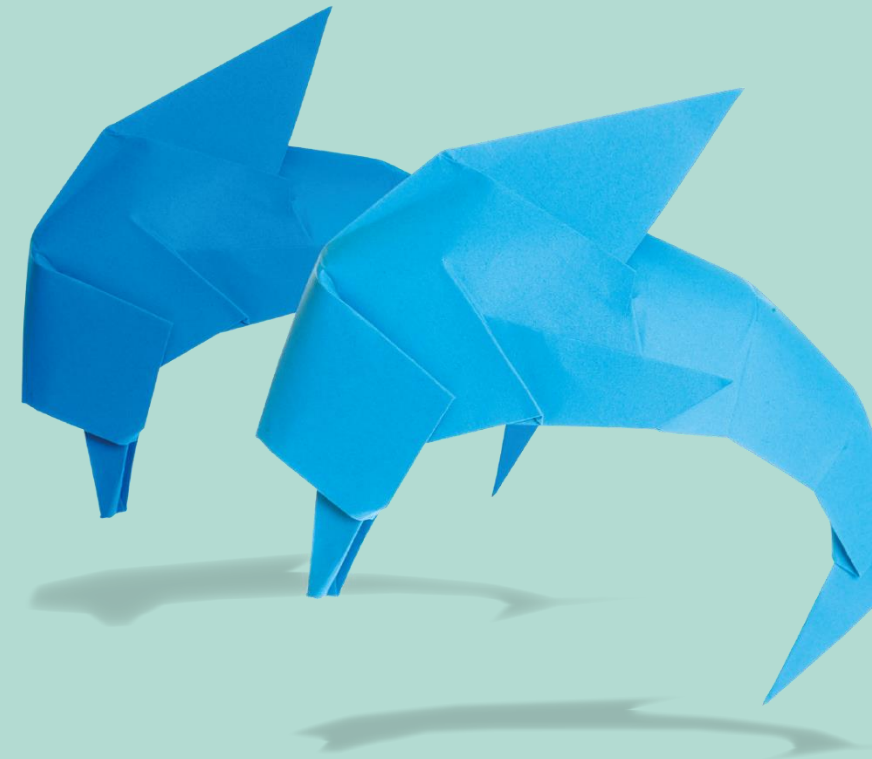
A accuracy mark (awarded after a correct method or process; if no method or process is seen then full marks for the question are implied but see individual mark schemes for more details)

NB: An accuracy mark cannot be awarded by itself, all previous marks must be awarded as well (may be by implication)

GCSE Mathematics

Summer 2023 Marking Guidance

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Practice v Theory

General marking guidance

These notes offer general guidance, but the specific notes for examiners appertaining to individual questions take precedence.

- 1 All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.

Where some judgement is required, mark schemes will provide the principles by which marks will be awarded; exemplification/indicative content will not be exhaustive. When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the response should be sent to review.

- 2 All the marks on the mark scheme are designed to be awarded; mark schemes should be applied positively. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme. If there is a wrong answer (or no answer) indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

Questions where working is not required: In general, the correct answer should be given full marks.

Questions that specifically require working: In general, candidates who do not show working on this type of question will get no marks – full details will be given in the mark scheme for each individual question.

- 3 **Crossed out work**

This should be marked **unless** the candidate has replaced it with an alternative response.

- 4 **Choice of method**

If there is a choice of methods shown, mark the method that leads to the answer given on the answer line.

If no answer appears on the answer line, mark both methods **then award the lower number of marks.**

- 5 **Incorrect method**

If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks. Send the response to review for your Team Leader to check.

- 6 **Follow through marks**

Follow through marks which involve a single stage calculation can be awarded without working as you can check the answer, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

- 7 **Ignoring subsequent work**
It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question or its context. (eg. an incorrectly cancelled fraction when the unsimplified fraction would gain full marks).
It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect (eg. incorrect algebraic simplification).
- 8 **Probability**
Probability answers must be given as a fraction, percentage or decimal. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).
Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.
If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.
- 9 **Linear equations**
Unless indicated otherwise in the mark scheme, full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously identified in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded (embedded answers).
- 10 **Range of answers**
Unless otherwise stated, when an answer is given as a range (e.g 3.5 – 4.2) then this is inclusive of the end points (e.g 3.5, 4.2) and all numbers within the range.
- 11 **Number in brackets after a calculation**
Where there is a number in brackets after a calculation E.g. $2 \times 6 (=12)$ then the mark can be awarded **either** for the correct method, implied by the calculation **or** for the correct answer to the calculation.
- 12 **Use of inverted commas**
Some numbers in the mark scheme will appear inside inverted commas E.g. "12" $\times 50$; the number in inverted commas cannot be any number – it must come from a correct method or process but the candidate may make an arithmetic error in their working.
- 13 **Word in square brackets**
Where a word is used in square brackets E.g. [area] $\times 1.5$: the value used for [area] does **not** have to come from a correct method or process but is the value that the candidate believes is the area. If there are any constraints on the value that can be used, details will be given in the mark scheme.
- 14 **Misread**
If a candidate misreads a number from the question. Eg. uses 252 instead of 255; method or process marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review.

oe	Or equivalent
cao	Correct answer only
ft	Follow through (when appropriate as per mark scheme)
sc	Special case
dep	Dependent (on a previous mark)
indep	Independent
awrt	Answer which rounds to
isw	Ignore subsequent working

Process (P) Marks

The P mark will work in exactly the same way as the M (method) mark does in our current mark schemes. We have used a different letter to remind examiners that they should be looking for alternative processes (and have used this language rather than method in our mark schemes for AO3 questions). So if a candidate gives a partially correct solution they will be awarded the appropriate P (process) marks provided the working they show is a possible route through to the solution. If a solution is fully correct then full marks will usually be awarded. The exception will be in questions where candidates are specifically instructed to show working. In these questions, the correct solution with no working will score no marks.



Where working is not required

- The correct answer should be awarded full marks (unless it has clearly been obtained from an incorrect method).
- If the answer is not correct, look at the working. Award marks as detailed by the mark scheme.

Where working IS required

- A correct answer by itself, with no working, will score no marks.
- Go through the working, awarding marks as detailed by the mark scheme.
- In the case of a question requiring proof or where the instruction is 'Show that...' each stage of working must be carefully checked.

Inverted commas

- Some numbers in the mark scheme will appear inside inverted commas, eg “12” \times 50 ;
- The number in inverted commas cannot be any number – it must come from a correct method or process but the candidate may make an arithmetic error in their working.

Examiners' Reports – F P1

The great majority of students seemed to be entered at the appropriate level and coverage of the specification was good. Questions on this paper covered a good range of the specification for a non-calculator paper and offered an opportunity for students of all abilities to demonstrate their understanding of a variety of mathematical concepts.

Students were generally well prepared, however many clearly missed having access to a calculator. Questions 11, 14c, 20, 21 and 27 in particular were littered with arithmetical errors.

The early questions acted as good confidence builders and provided an accessible way into the paper, many students gaining a good proportion of the early marks.

It was pleasing to see so many students successfully expressing their communication skills when required, as exemplified in questions 6, 8, 10, 11 and 14. Some would have benefitted from re-reading over their work to check the sense of their sentences.

The quality of handwriting from some candidates made their responses difficult to read. Students are advised to avoid rushing through their work. More students failed to present their work in a logical way which caused them to lose track of their own working. It was noticeable how many students also gave a choice of method and failed to use the answer line for their final answer. Candidates should be encouraged to use the space provided for responses more effectively and be reminded that writing above a question itself could mean that their work is not seen by the examiners.

Areas of the curriculum that need more attention are, Estimations (Q11bc), Equation of a straight line (Q9d), Fractions (Q15 and Q21), Algebraic expressions/formulae (Q18), Long Division (Q20) Venn diagrams (Q24), Reverse percentages (Q26) and Using probability tree diagrams (Q31).

Examiners' Reports – F P2

This paper was accessible to all students with a good amount of clear working shown over most of the paper. Some questions, mainly towards the end of the paper, were not as well answered by students but this was due to the differentiation and ramping of the level of demand of the questions. It was pleasing to see students making improvements in their approaches to questions that required a written response, and in longer multi-step questions. In particular, written responses in questions 12b, and 22 showed improvements.

This paper requires the use of a calculator and students are expected to have access to and a reasonable working knowledge of how to use a calculator. There is evidence that some students continue to try to use written methods even when they have a calculator. This often means that calculations take longer and increases the chance of inaccurate answers. One example of this is when break-down or build-up methods were used in attempts to work out percentages. This approach is often far less successful than a more direct approach using a calculator.

A ruler and protractor were also required for this paper, but evidence suggests that some students did not have access to one or both of these items. It is essential that students have a full set of the required equipment when sitting a GCSE mathematics paper.

Students should carefully read the question fully and ensure they read both the numbers given in the question and their own handwriting carefully. Inaccurate reading leads to inaccurate answers and means students lose marks unnecessarily. Similarly, poor handwriting and layout of work remains a big problem. The inclusion of working out to support answers is essential to gain full credit but remains an issue for many. Working out not only needs to be shown, it also needs to be shown in a clear and logical way, demonstrating the processes of calculation used. This is most important in longer questions, and in “show that” questions. Contradictory work also remains a common cause of lost marks and was most notably seen in question 18b in which a range of approaches were attempted and the method intended to be marked was not always clearly identified.

Examiners Reports – F P3

Centres are congratulated for the preparations they clearly undertook in preparing candidates for this paper. Overall, the quality of work was an improvement on the previous summer, with candidates showing their working to a greater degree. This enabled examiners to better consider the evidence for the award of marks.

However, the overall quality of the presentation of work has not improved. Of greatest concern is the proportion of work that is spoilt by miscopying of figures, either from the given question, or candidates who miscopy their own figures in working. This was most prolific in questions 5, 10, 12, 14, 23, 27 and both parts of 28 but was also seen in other questions. Poorly written (sometimes overwritten) figures prevented the award of marks significantly in questions 5 and 20.

There was little evidence that candidates did not have a calculator for this paper but there were many occasions when break-down methods were used in attempts to work out percentages, usually far less successful than a more direct approach using a calculator method. Although in most cases candidates used their calculator accurately, there were also instances seen where candidates prematurely rounded or truncated their figures, either their own figures or whilst in the process of taking them from the calculator, or the question. This was frequently seen in questions 12, 14, 19, 21 and 25. In most cases these errors prevent the award of any accuracy marks (A, B or C marks).

Most candidates demonstrated good use of both ruler and protractor though they need to ensure that these are used accurately. There were some surprising errors shown in questions 13 and 17 where evidence suggest that candidates either did not have a ruler or were using a ruler incorrectly.

Within a broad range of questions, the paper was able to discriminate well with nearly all candidates showing a broad range of proficiency across the specification content. Weakest areas continue to be the application of ratios, scales and rates, but also algebraic manipulation and problem solving. Time remains a weakness as in question 10, where some candidates were using their calculator inappropriately.

Questions which were slightly different and required more thought, caused immediate problems for many, even in the earlier part of the paper. This includes questions 12b, 14, 15 and 19. Question 24, 27 and 28 were the more challenging questions for those striving to demonstrate ability at the highest grades available.

The inclusion of working out to support answers remains an issue for many. Not only does working out need to be shown, it needs to be shown legibly, demonstrating the processes of the calculation used. This is most important in longer questions. Examiners reported frequent difficulty in interpreting complex responses, poorly laid out, in questions 10, 12, 14, 19 and particularly 21 and 24. Candidates occasionally gave their answers embedded in an expression in questions 11, 18 and 23, but full marks could not be awarded unless their embedded (correct) answer was highlighted (a different number was usually provided on the answer line). Confusing and contradictory work was also seen regularly in question 22.

Foundation P1



F P1 Q11 b/c Student A

For a different football match,

297 tickets were sold for £9.50 each.

399 tickets were sold for £19.50 each.

- (b) Work out an estimate for the total amount of money paid for these tickets.
You must show all your working.

$$9.50 \times 297$$

$$\begin{array}{r} 399 \\ \times 14.5 \\ \hline 1595 \\ 15950 \\ 39900 \\ \hline 57455 \end{array}$$

$$\begin{array}{r} 297 \\ \times 9.5 \\ \hline 1485 \\ 26730 \\ \hline 28215 \end{array}$$

$$\begin{array}{r} 574.55 \\ 282.15 \\ \hline 856.70 \end{array}$$

$$856.70$$

£

(3)

- (c) Is your answer to part (b) an underestimate or an overestimate?
Give a reason for your answer.

my answer is an overestimate

(1)

(b)	11000	P1	for evidence of rounding values to 1 significant figure, eg 300 or 400 or 10 or 9 or 20
		P1	(dep on P1) for beginning a process to work with ticket sales, eg. $300 \times 10 (= 3000)$ or $290 \times 10 (= 2900)$ or $297 \times 10 (= 2970)$ or $300 \times 9 (= 2700)$ or $300 \times 9.5 (= 2850)$ or $290 \times 9 (= 2610)$ or $297 \times 9 (= 2673)$ OR $400 \times 20 (= 8000)$ or $390 \times 20 (= 7800)$ or $399 \times 20 (= 7980)$ or $400 \times 19.5 (= 7800)$ or $400 \times 19 (= 7600)$
		A1	for using correct values giving an answer in the range 10 200 to 11 000 from calculations using their rounded values
(c)	Overestimate with reason	C1	(dep on P2 in (b)) for overestimate and reason, eg (ft from (b)) true total amount of money paid will be less as all values were rounded up

Note: **not** $290 \times 9.5 (= 2755)$
or $297 \times 9.5 (= 2821.5)$

Note: **not** $390 \times 19 (= 7410)$
or $390 \times 19.5 (= 7605)$
or $399 \times 19 (= 7581)$
or $399 \times 19.5 (= 7780.5)$

Award 0 marks for an answer in the
range with no supportive working

Must relate to estimation and not to
rounding of their final answer
and they must have a final answer to
part (b)

F P1 Q11 b/c Student B

For a different football match,

297 tickets were sold for £9.50 each.

399 tickets were sold for £19.50 each.

- (b) Work out an estimate for the total amount of money paid for these tickets.
You must show all your working.

(b)	11000	P1	for evidence of rounding values to 1 significant figure, eg 300 or 400 or 10 or 9 or 20	
		P1	(dep on P1) for beginning a process to work with ticket sales, eg. $300 \times 10 (= 3000)$ or $290 \times 10 (= 2900)$ or $297 \times 10 (= 2970)$ or $300 \times 9 (= 2700)$ or $300 \times 9.5 (= 2850)$ or $290 \times 9 (= 2610)$ or $297 \times 9 (= 2673)$ OR $400 \times 20 (= 8000)$ or $390 \times 20 (= 7800)$ or $399 \times 20 (= 7980)$ or $400 \times 19.5 (= 7800)$ or $400 \times 19 (= 7600)$	Note: not $290 \times 9.5 (= 2755)$ or $297 \times 9.5 (= 2821.5)$
		A1	for using correct values giving an answer in the range 10 200 to 11 000 from calculations using their rounded values	Note: not $390 \times 19 (= 7410)$ or $390 \times 19.5 (= 7605)$ or $399 \times 19 (= 7581)$ or $399 \times 19.5 (= 7780.5)$
(c)	Overestimate with reason	C1	(dep on P2 in (b)) for overestimate and reason, eg (ft from (b)) true total amount of money paid will be less as all values were rounded up	Award 0 marks for an answer in the range with no supportive working Must relate to estimation and not to rounding of their final answer and they must have a final answer to part (b)

$$9.50 \approx 10 \text{ £}$$

$$19.50 \approx 20 \text{ £}$$

$$10 \times 297 = 2970$$

$$399 \times 20 = 7980$$

$$\begin{array}{r} 2970 \\ 7980 \\ \hline 10950 \end{array}$$

$$\begin{array}{r} 399 \\ 399 \\ \hline 798 \\ \text{' ' } \end{array}$$

£ 10950

(3)

- (c) Is your answer to part (b) an underestimate or an overestimate?
Give a reason for your answer.

overestimate I rounded up the
numbers so the amount will be
higher

(1)

F P1 Q11 b/c Student C

For a different football match,

297 tickets were sold for £9.50 each.

399 tickets were sold for £19.50 each.

- (b) Work out an estimate for the total amount of money paid for these tickets.
You must show all your working.

(b)	11000	P1	for evidence of rounding values to 1 significant figure, eg 300 or 400 or 10 or 9 or 20	
		P1	(dep on P1) for beginning a process to work with ticket sales, eg. $300 \times 10 (= 3000)$ or $290 \times 10 (= 2900)$ or $297 \times 10 (= 2970)$ or $300 \times 9 (= 2700)$ or $300 \times 9.5 (= 2850)$ or $290 \times 9 (= 2610)$ or $297 \times 9 (= 2673)$ OR $400 \times 20 (= 8000)$ or $390 \times 20 (= 7800)$ or $399 \times 20 (= 7980)$ or $400 \times 19.5 (= 7800)$ or $400 \times 19 (= 7600)$	Note: not $290 \times 9.5 (= 2755)$ or $297 \times 9.5 (= 2821.5)$
		A1	for using correct values giving an answer in the range 10 200 to 11 000 from calculations using their rounded values	Award 0 marks for an answer in the range with no supportive working
(c)	Overestimate with reason	C1	(dep on P2 in (b)) for overestimate and reason, eg (ft from (b)) true total amount of money paid will be less as all values were rounded up	Must relate to estimation and not to rounding of their final answer and they must have a final answer to part (b)

$$297 \quad 9.50$$

$$399 \quad 19.50$$

$$\begin{array}{r} 300 \\ \times 9.50 \\ \hline 000.00 \\ 1500.00 \\ 900.00 \\ \hline 2850.00 \end{array}$$

$$\begin{array}{r} 400 \\ \times 19.50 \\ \hline 000.00 \\ 1200.00 \\ 3600.00 \\ 400.00 \\ \hline 7800.00 \end{array}$$

6600
£

(3)

- (c) Is your answer to part (b) an underestimate or an overestimate?
Give a reason for your answer.

an overestimate as I rounded
297 to 300 and 399 to 400

(1)

On Friday,
500 people watched a film at the cinema.
70% of these people were children.

On Saturday,
720 people watched the film at the cinema.
 $\frac{5}{8}$ of these people were children.

Kasim thinks more children watched the film on Friday than on Saturday.

(c) Is Kasim correct?
You must show how you get your answer.

F P1 Q14c Student A

Fri
 $10\% : 50 \times 7 = 350$

SAT
 $720 \div 8 = 90$
$$\begin{array}{r} 90 \\ 8 \overline{) 720} \end{array}$$

Kasim was correct
as Friday had 350
children which is
more than the 90
which was Saturday

No (supported)	P1	for method to find the number of children on Friday eg 0.7×500 oe (= 350)	Award 0 marks for a correct answer with no supportive working.
	P1	for method to find the number of children on Saturday eg $720 \div 8 \times 5$ oe (= 450)	
	C1	for No with correct figures, eg No and 350 and 450 or No and 100 more on Saturday	

On Friday,
 500 people watched a film at the cinema.
 70% of these people were children.

On Saturday,
 720 people watched the film at the cinema.
 $\frac{5}{8}$ of these people were children.

Kasim thinks more children watched the film on Friday than on Saturday.

(c) Is Kasim correct?
 You must show how you get your answer.
No, 575 > 350

F P1 Q14c Student B

70% of 500 = 350
 $500 \div 10 = 50 \times 7 = 350$

$\frac{5}{8}$ of 720 $720 \div 8 = 115$
 $115 \times 5 = 575$

$$\begin{array}{r} 115 \\ 8 \overline{) 720} \end{array}$$

No (supported)	P1	for method to find the number of children on Friday eg 0.7×500 oe (= 350)	Award 0 marks for a correct answer with no supportive working.
	P1	for method to find the number of children on Saturday eg $720 \div 8 \times 5$ oe (= 450)	
	C1	for No with correct figures, eg No and 350 and 450 or No and 100 more on Saturday	

On Friday,
500 people watched a film at the cinema.
70% of these people were children.

On Saturday,
720 people watched the film at the cinema.
 $\frac{5}{8}$ of these people were children.

Kasim thinks more children watched the film on Friday than on Saturday.

(c) Is Kasim correct?
You must show how you get your answer.

F P1 Q14c Student C

F 500 70% = 350

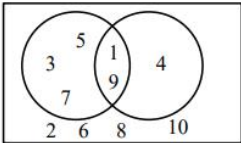
S 720 $\frac{5}{8}$ C

$360 = \frac{1}{2}$ $\frac{5}{8}$ is more than $\frac{1}{2}$

So Kasim is wrong.

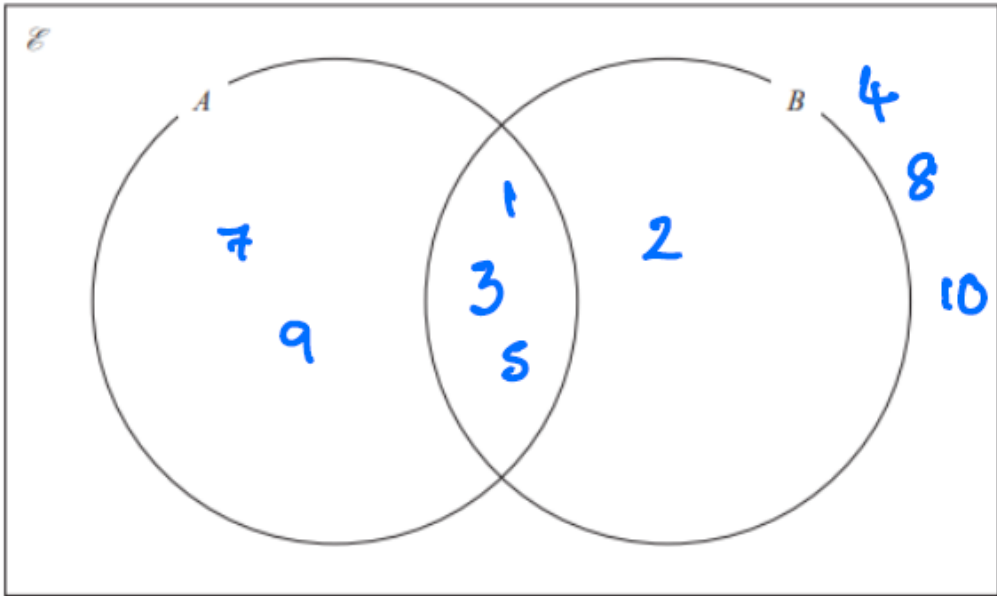
No (supported)	P1	for method to find the number of children on Friday eg 0.7×500 oe (= 350)	Award 0 marks for a correct answer with no supportive working.
	P1	for method to find the number of children on Saturday eg $720 \div 8 \times 5$ oe (= 450)	
	C1	for No with correct figures, eg No and 350 and 450 or No and 100 more on Saturday	

F P1 Q24 Student A

(a)	Venn diagram	B3	for a fully correct Venn diagram	<div>Ignore all entries except the region you are marking for each method mark</div> <div></div>
		(B2)	for two or three of the four regions correct)	
		(B1)	for just one of the four regions correct)	
(b)	$\frac{7}{10}$	M1	(ft diagram) for $\frac{a}{10}$ where $0 < a < 10$ and a is an integer or $\frac{7}{b}$ where $b > 7$ and b is an integer or $1 - \frac{3}{10}$ or $7 : 10$	<div>Repeated digits in the diagram should be counted as 2 elements</div>
		A1	(ft diagram) for $\frac{7}{10}$ or	

14 $\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
 $A = \{\text{odd numbers}\}$
 $B = \{\text{square numbers}\}$

(a) Complete the Venn diagram for this information.



(3)

A number is chosen at random from the universal set \mathcal{E}

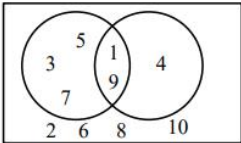
(b) Find the probability that this number is in the set B'

$\frac{7}{10}$

(2)

(Total for Question 24 is 5 marks)

F P1 Q24 Student B

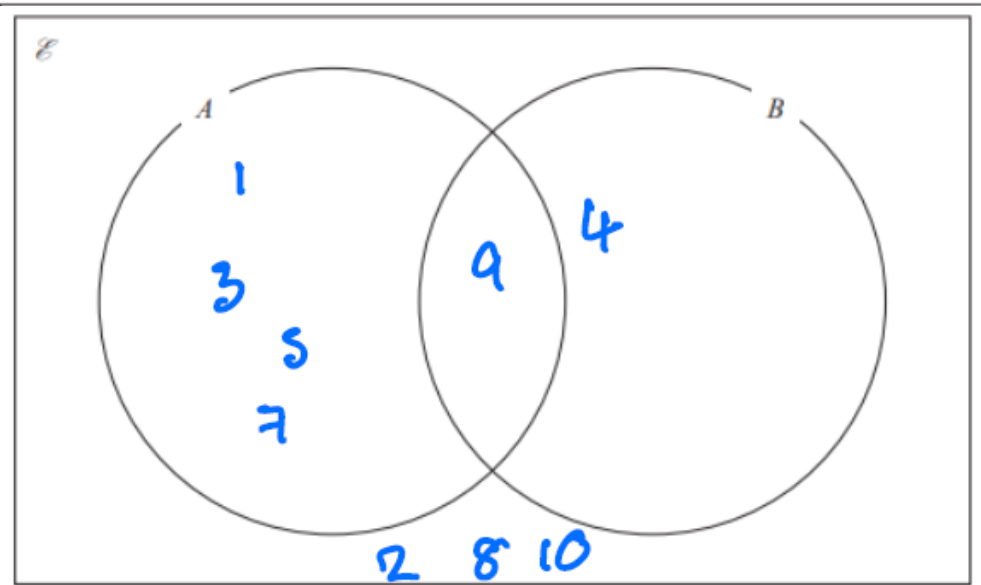
(a)	Venn diagram	B3	for a fully correct Venn diagram	<div>Ignore all entries except the region you are marking for each method mark</div> <div></div>
		(B2)	for two or three of the four regions correct)	
		(B1)	for just one of the four regions correct)	
(b)	$\frac{7}{10}$	M1	(ft diagram) for $\frac{a}{10}$ where $0 < a < 10$ and a is an integer or $\frac{7}{b}$ where $b > 7$ and b is an integer or $1 - \frac{3}{10}$ or $7 : 10$	<div>Repeated digits in the diagram should be counted as 2 elements</div>
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14 $\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$A = \{\text{odd numbers}\}$

$B = \{\text{square numbers}\}$

(a) Complete the Venn diagram for this information.



(3)

A number is chosen at random from the universal set \mathcal{E}

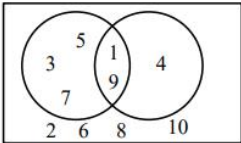
(b) Find the probability that this number is in the set B'

$\frac{2}{10} = \frac{1}{5}$

(2)

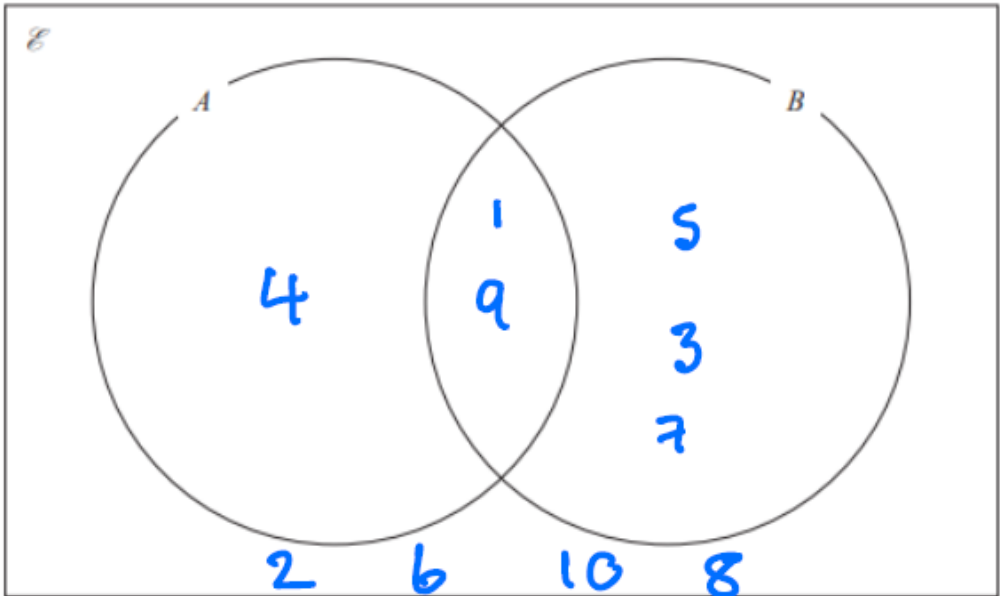
(Total for Question 24 is 5 marks)

F P1 Q24 Student C

(a)	Venn diagram	B3	for a fully correct Venn diagram	<div>Ignore all entries except the region you are marking for each method mark</div> <div></div>
		(B2)	for two or three of the four regions correct)	
		(B1)	for just one of the four regions correct)	
(b)	$\frac{7}{10}$	M1	(ft diagram) for $\frac{a}{10}$ where $0 < a < 10$ and a is an integer or $\frac{7}{b}$ where $b > 7$ and b is an integer or $1 - \frac{3}{10}$ or $7 : 10$	<div>Repeated digits in the diagram should be counted as 2 elements</div>
		A1	(ft diagram) for $\frac{7}{10}$ or	

14 $\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
 $A = \{\text{odd numbers}\}$
 $B = \{\text{square numbers}\}$

(a) Complete the Venn diagram for this information.



(3)

A number is chosen at random from the universal set \mathcal{E}

(b) Find the probability that this number is in the set B'

$\frac{5}{10}$

(2)

(Total for Question 24 is 5 marks)

Higher P1



7kg of carrots and 5kg of tomatoes cost a total of 480p
cost of 1 kg of carrots : cost of 1 kg of tomatoes = 5 : 9

Work out the cost of 1 kg of carrots and the cost of 1 kg of tomatoes.

Answer	Mark	Mark scheme
(c) 30 (t) 54	P1	for setting up an equation, eg $7c + 5t = 480$ or $c : t = 5 : 9$ or $\frac{c}{t} = \frac{5}{9}$ or $9c = 5t$ or for starting to work with ratio of total costs, eg $7 \times 5 (= 35)$ and $5 \times 9 (= 45)$ or $7 \times \frac{5}{14}$ and $5 \times \frac{9}{14}$ or $35 : 45$ or $7 : 9$
	P1	for a process to eliminate c or t from correct equations, eg $7c + 9c = 480$ or $7 \times \frac{5t}{9} + 5t = 480$ or $7c + \frac{9c}{5} \times 5 = 480$ or for $480 \div ("35" + "45") (= 6)$ or for a process to find total cost of carrots or total cost of tomatoes, eg $480 \div ("7" + "9") \times 7 (= 210)$ or $480 \div ("7" + "9") \times 9 (= 270)$
	P1	for a process to isolate t or c , eg $16c = 480$ or $80c = 2400$ oe or $80t = 4320$ oe or for one value correct eg $c = 30$ or $t = 54$ or for a process to find cost of 1 kg of carrots or 1 kg of tomatoes, eg $5 \times "6" (= 30)$ or $9 \times "6" (= 54)$ or $"210" \div 7 (= 30)$ or $"270" \div 5 (= 54)$
	A1	cao

let cost of carrots be c
cost of tomatoes t

$$5c = 9t \rightarrow c = \frac{9t}{5} \text{ or } t = \frac{5c}{9}$$

$$7c + 5t = 480$$

$$7 \times \frac{9t}{5} + 5t = 480$$

$$\frac{44t}{5} + \frac{25t}{5} = 480$$

$$\frac{69t}{5} = 480$$

$$69t = 2400$$

$$7t = \frac{2400}{69} \\ = \frac{800}{23}$$

(Total for Question 18 is 4 marks)

7kg of carrots and 5 kg of tomatoes cost a total of 480p
cost of 1 kg of carrots : cost of 1 kg of tomatoes = 5 : 9

Work out the cost of 1 kg of carrots and the cost of 1 kg of tomatoes.

Answer	Mark	Mark scheme
(c) 30 (t) 54	P1	for setting up an equation, eg $7c + 5t = 480$ or $c : t = 5 : 9$ or $\frac{c}{t} = \frac{5}{9}$ or $9c = 5t$ or for starting to work with ratio of total costs, eg $7 \times 5 (= 35)$ and $5 \times 9 (= 45)$ or $7 \times \frac{5}{14}$ and $5 \times \frac{9}{14}$ or $35 : 45$ or $7 : 9$
	P1	for a process to eliminate c or t from correct equations, eg $7c + 9c = 480$ or $7 \times \frac{5t}{9} + 5t = 480$ or $7c + \frac{9c}{5} \times 5 = 480$ or for $480 \div ("35" + "45") (= 6)$ or for a process to find total cost of carrots or total cost of tomatoes, eg $480 \div ("7" + "9") \times 7 (= 210)$ or $480 \div ("7" + "9") \times 9 (= 270)$
	P1	for a process to isolate t or c , eg $16c = 480$ or $80c = 2400$ oe or $80t = 4320$ oe or for one value correct eg $c = 30$ or $t = 54$ or for a process to find cost of 1 kg of carrots or 1 kg of tomatoes, eg $5 \times "6" (= 30)$ or $9 \times "6" (= 54)$ or $"210" \div 7 (= 30)$ or $"270" \div 5 (= 54)$
	A1	cao

$7c + 5t = 480p$

$5 : 9 = 14$

$1 : 1 = 5 : 9$

$7 : 5 = 35 : 45$

$35 + 45 = 80 \quad \downarrow \times 6$

$210 + 270 = 480$

$\frac{210}{6} = 42p \quad \frac{270}{9} = 30p$

$c = 42p$

$t = 30p$

(Total for Question 18 is 4 marks)

H P1 Q18 Student C

7kg of carrots and 5 kg of tomatoes cost a total of 480p
cost of 1 kg of carrots : cost of 1 kg of tomatoes = 5 : 9

Work out the cost of 1 kg of carrots and the cost of 1 kg of tomatoes.

Answer	Mark	Mark scheme
(c) 30 (t) 54	P1	for setting up an equation, eg $7c + 5t = 480$ or $c : t = 5 : 9$ or $\frac{c}{t} = \frac{5}{9}$ or $9c = 5t$ or for starting to work with ratio of total costs, eg $7 \times 5 (= 35)$ and $5 \times 9 (= 45)$ or $7 \times \frac{5}{14}$ and $5 \times \frac{9}{14}$ or $35 : 45$ or $7 : 9$
	P1	for a process to eliminate c or t from correct equations, eg $7c + 9c = 480$ or $7 \times \frac{5t}{9} + 5t = 480$ or $7c + \frac{9c}{5} \times 5 = 480$ or for $480 \div ("35" + "45") (= 6)$ or for a process to find total cost of carrots or total cost of tomatoes, eg $480 \div ("7" + "9") \times 7 (= 210)$ or $480 \div ("7" + "9") \times 9 (= 270)$
	P1	for a process to isolate t or c , eg $16c = 480$ or $80c = 2400$ oe or $80t = 4320$ oe or for one value correct eg $c = 30$ or $t = 54$ or for a process to find cost of 1 kg of carrots or 1 kg of tomatoes, eg $5 \times "6" (= 30)$ or $9 \times "6" (= 54)$ or $"210" \div 7 (= 30)$ or $"270" \div 5 (= 54)$
	A1	cao

5 : 9
5x7 9x5
35 45
7 : 9
↓ ↘ 270p
210p

$\frac{210}{7} = 30p$

$270 \div 5 = 54p$

$5 \overline{) 270}$
54

$c = 30p$
 $t = 54p$


(Total for Question 18 is 4 marks)

H P1 Q24 Student A

24 Find the set of possible values of x for which

$4x^2 - 25 < 0$ **and** $12 - 5x - 3x^2 > 0$

You must show all your working.

$(2x-5)(2x+5) < 0$
 $x = -\frac{5}{2} \quad x = \frac{5}{2} < 0$
 $\downarrow \qquad \downarrow$
 $-2.5 \quad 2.5$

 $-2.5 < x < 2.5$

$3x^2 + 5x - 12 < 0$
 $3x - 12 = -36$
 $(3x+9)(3x-4) < 0$
 $(x+3)(3x-4) < 0$
 $x = -3 \quad x = \frac{4}{3}$
 $-3 < x < \frac{4}{3}$

$-2, -1, 0, 1$

Answer	Mark	Mark scheme	Additional guidance
$-2.5 < x < \frac{4}{3}$	M1	for method to find the critical values of $4x^2 - 25 < 0$ eg $(2x + 5)(2x - 5)$ or critical values -2.5 and 2.5 oe	accept use of = or incorrect inequality symbol for 1st and 3rd M marks
	M1	(dep on M1) for $x > -2.5$ and $x < 2.5$ or $x > a$ and $x < b$ where a and b are their critical values and $a < b$	This may be implied by a suitable diagram
	M1	for method to find the critical values of $12 - 5x - 3x^2 > 0$ or $3x^2 + 5x - 12 < 0$ eg $(4 - 3x)(x + 3)$ or $(3x - 4)(x + 3)$ $\frac{-5 \pm \sqrt{(-5)^2 - 4 \times (-3) \times 12}}{2 \times (-3)}$ or $\frac{-5 \pm \sqrt{5^2 - 4 \times 3 \times (-12)}}{2 \times 3}$ $3 \left[\left(x + \frac{5}{6} \right)^2 - \left(\frac{5}{6} \right)^2 \right] - 12 = 0$ oe or critical values -3 and $\frac{4}{3}$ oe	
	M1	(dep on previous M1) for $x > -3$ and $x < \frac{4}{3}$ or $x > c$ and $x < d$ where c and d are their critical values and $c < d$	This may be implied by a suitable diagram
	A1	for $-2.5 < x < \frac{4}{3}$ oe eg $x < \frac{4}{3}, x > -2.5$	A correct answer with no supportive working gets 0 marks

(Total for Question 24 is 5 marks)

24 Find the set of possible values of x for which

$$4x^2 - 25 < 0 \quad \text{and} \quad 12 - 5x - 3x^2 > 0$$

You must show all your working.

Answer	Mark	Mark scheme	Additional guidance
$-2.5 < x < \frac{4}{3}$	M1	for method to find the critical values of $4x^2 - 25 < 0$ eg $(2x + 5)(2x - 5)$ or critical values -2.5 and 2.5 oe	accept use of = or incorrect inequality symbol for 1st and 3rd M marks
	M1	(dep on M1) for $x > -2.5$ and $x < 2.5$ or $x > a$ and $x < b$ where a and b are their critical values and $a < b$	This may be implied by a suitable diagram
	M1	for method to find the critical values of $12 - 5x - 3x^2 > 0$ or $3x^2 + 5x - 12 < 0$ eg $(4 - 3x)(x + 3)$ or $(3x - 4)(x + 3)$ $\frac{-5 \pm \sqrt{(-5)^2 - 4 \times (-3) \times 12}}{2 \times (-3)}$ or $\frac{-5 \pm \sqrt{5^2 - 4 \times 3 \times (-12)}}{2 \times 3}$ $3 \left[\left(x + \frac{5}{6} \right)^2 - \left(\frac{5}{6} \right)^2 \right] - 12 = 0$ oe or critical values -3 and $\frac{4}{3}$ oe	
	M1	(dep on previous M1) for $x > -3$ and $x < \frac{4}{3}$ or $x > c$ and $x < d$ where c and d are their critical values and $c < d$	This may be implied by a suitable diagram
	A1	for $-2.5 < x < \frac{4}{3}$ oe eg $x < \frac{4}{3}, x > -2.5$	A correct answer with no supportive working gets 0 marks

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

$$x = \frac{2.5}{5} \quad x = -\frac{2.5}{5}$$



$$12 - 5x - 3x^2$$

$$(3x + 4)(x - 3)$$

$$-\frac{3}{4} \quad x = 3$$



$$-\frac{2.5}{5} < 0 < \frac{2.5}{5} \quad -\frac{3}{4} < 0 < 3$$

(Total for Question 24 is 5 marks)

24 Find the set of possible values of x for which

$$4x^2 - 25 < 0 \quad \text{and} \quad 12 - 5x - 3x^2 > 0$$

You must show all your working.

$$4x^2 - 25 \quad (2x+5)(2x-5)$$

$$x = -\frac{5}{2} \quad x = \frac{5}{2}$$

$$-3x^2 - 5x + 12$$

$$-3x(x+3) + 4(x+3)$$

$$(x+3)(-3x+4)$$

$$x = -3 \quad x = \frac{-4}{-3} = \frac{4}{3}$$

$$\underline{-2.5 < x < \frac{4}{3}}$$

(Total for Question 24 is 5 marks)

Answer	Mark	Mark scheme	Additional guidance
$-2.5 < x < \frac{4}{3}$	M1	for method to find the critical values of $4x^2 - 25 < 0$ eg $(2x+5)(2x-5)$ or critical values -2.5 and 2.5 oe	accept use of = or incorrect inequality symbol for 1st and 3rd M marks
	M1	(dep on M1) for $x > -2.5$ and $x < 2.5$ or $x > a$ and $x < b$ where a and b are their critical values and $a < b$	This may be implied by a suitable diagram
	M1	for method to find the critical values of $12 - 5x - 3x^2 > 0$ or $3x^2 + 5x - 12 < 0$ eg $(4-3x)(x+3)$ or $(3x-4)(x+3)$ $\frac{-5 \pm \sqrt{(-5)^2 - 4 \times (-3) \times 12}}{2 \times (-3)}$ or $\frac{-5 \pm \sqrt{5^2 - 4 \times 3 \times (-12)}}{2 \times 3}$ $3 \left[\left(x + \frac{5}{6} \right)^2 - \left(\frac{5}{6} \right)^2 \right] - 12 = 0$ oe or critical values -3 and $\frac{4}{3}$ oe	
	M1	(dep on previous M1) for $x > -3$ and $x < \frac{4}{3}$ or $x > c$ and $x < d$ where c and d are their critical values and $c < d$	This may be implied by a suitable diagram
	A1	for $-2.5 < x < \frac{4}{3}$ oe eg $x < \frac{4}{3}, x > -2.5$	A correct answer with no supportive working gets 0 marks

Foundation P2



6 Paulo drives at an average speed of 56 km/h for 1 hour 45 minutes.

Work out the distance Paulo drives.

F P2 Q16 Student A



distance = speed \times time

= 56 \times 1 hr and 45 mins \rightarrow 60 + 45 = 105 mins

= 56 \times 105 = 5880

= 5880 km

98	M1	for method to use speed, distance and time, eg $56 \times [\text{time}]$ or $56 \times 105 (= 5880)$ or $56 \div 4 \times 3 (= 42)$ or $56 \div 60 (= 0.933\dots)$ OR for method to convert decimal time, eg $(60 + 45) \div 60 (= 1.75)$ or $45 \div 60 (= 0.75)$	For this mark accept [time] written unconventionally eg as 1.45, 145, 175, 75
	M1	for a complete method using decimal time, eg $56 \times "1.75"$ or $"5880" \div 60$ or $"0.933\dots" \times 105$ or $56 + "42"$ or $56 + "28" + "14"$	
	A1	for 97.65 to 98.3	

(Total for Question 16 is 3 marks)

6 Paulo drives at an average speed of 56 km/h for 1 hour 45 minutes.

Work out the distance Paulo drives.

F P2 Q16 Student B

$$s = \frac{d}{t}$$

$$D = s \times t$$

$$56 \times 145 = 8120$$

$$= \underline{8120 \text{ km}}$$

98	M1	for method to use speed, distance and time, eg $56 \times [\text{time}]$ or $56 \times 105 (= 5880)$ or $56 \div 4 \times 3 (= 42)$ or $56 \div 60 (= 0.933\dots)$ OR for method to convert decimal time, eg $(60 + 45) \div 60 (= 1.75)$ or $45 \div 60 (= 0.75)$	For this mark accept [time] written unconventionally eg as 1.45, 145, 175, 75
	M1	for a complete method using decimal time, eg $56 \times "1.75"$ or $"5880" \div 60$ or $"0.933\dots" \times 105$ or $56 + "42"$ or $56 + "28" + "14"$	
	A1	for 97.65 to 98.3	

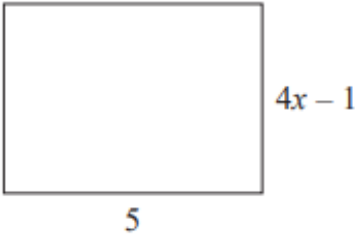
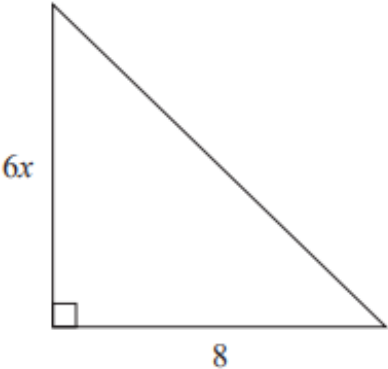
(Total for Question 16 is 3 marks)

6 Paulo drives at an average speed of 56km/h for 1 hour 45 minutes.
Work out the distance Paulo drives.

$56 \div 60 = 0.93$
 $0.93 \times 45 = 41.85$
 $56 + 41.85 = \underline{97.85 \text{ km}}$

98	M1	for method to use speed, distance and time, eg $56 \times [\text{time}]$ or $56 \times 105 (= 5880)$ or $56 \div 4 \times 3 (= 42)$ or $56 \div 60 (= 0.933\dots)$ OR for method to convert decimal time, eg $(60 + 45) \div 60 (= 1.75)$ or $45 \div 60 (= 0.75)$	For this mark accept [time] written unconventionally eg as 1.45, 145, 175, 75
	M1	for a complete method using decimal time, eg $56 \times "1.75"$ or $"5880" \div 60$ or $"0.933\dots" \times 105$ or $56 + "42"$ or $56 + "28" + "14"$	
	A1	for 97.65 to 98.3	

Here is a triangle and a rectangle.



All measurements are in centimetres.

The area of the triangle is 10 cm^2 greater than the area of the rectangle.

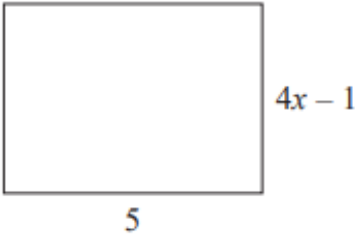
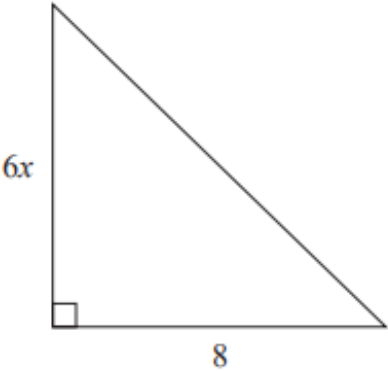
Work out the value of x .

$6x \times 8 = 42x^2$
 $5 \times 4x = 20 - 1 = 19\text{ cm}x$

Answer	Mark	Mark scheme	Additional guidance
1.25	P1	for finding an expression for the area of one shape, eg $\frac{1}{2} \times 8 \times 6x (= 24x)$ or $5(4x - 1) (= 20x - 5)$ oe	Condone missing brackets for area of rectangle for all process marks
	P1	for finding an expression for the area of both shapes, eg $\frac{1}{2} \times 8 \times 6x$ and $5(4x - 1)$ oe or [area of triangle] $- 10$ or [area of rectangle] $+ 10$ oe or [area of triangle] $-$ [area of rectangle]	
	P1	for writing a correct equation, eg $\frac{1}{2} \times 8 \times 6x = 5(4x - 1) + 10$ oe or (dep on 1st P1) eg [area of triangle] $- 10 =$ [area of rectangle] or [area of triangle] $=$ [area of rectangle] $+ 10$ or [area of triangle] $-$ [area of rectangle] $= 10$	
	A1	for 1.25 oe	

(Total for Question 24 is 4 marks)

Here is a triangle and a rectangle.



All measurements are in centimetres.

The area of the triangle is 10 cm^2 greater than the area of the rectangle.

Work out the value of x .

F P2 Q24 Student B

$$\begin{aligned} & (4x-1) + (4x-1) + (4x-1) + (4x-1) \\ & \quad + (4x-1) \\ & = 20x - 5 \end{aligned}$$

$$8 \times 6x = \frac{48x}{2} = 24x$$

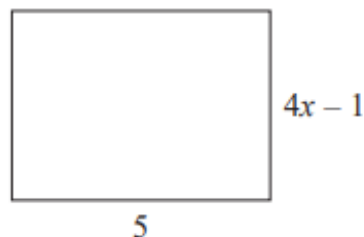
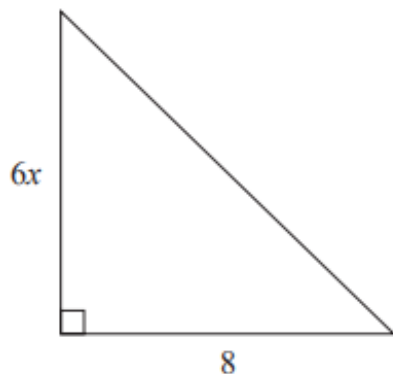
$$20x - 5 + 10 = 24x$$

$$\begin{aligned} 20x \times 10 &= 200x \\ 200x &= 290 \\ x &= 1.45 \end{aligned}$$

(Total for Question 24 is 4 marks)

Answer	Mark	Mark scheme	Additional guidance
1.25	P1	for finding an expression for the area of one shape, eg $\frac{1}{2} \times 8 \times 6x (= 24x)$ or $5(4x - 1) (= 20x - 5)$ oe	Condone missing brackets for area of rectangle for all process marks
	P1	for finding an expression for the area of both shapes, eg $\frac{1}{2} \times 8 \times 6x$ and $5(4x - 1)$ oe or [area of triangle] $- 10$ or [area of rectangle] $+ 10$ oe or [area of triangle] $-$ [area of rectangle]	
	P1	for writing a correct equation, eg $\frac{1}{2} \times 8 \times 6x = 5(4x - 1) + 10$ oe or (dep on 1st P1) eg [area of triangle] $- 10 =$ [area of rectangle] or [area of triangle] $=$ [area of rectangle] $+ 10$ or [area of triangle] $-$ [area of rectangle] $= 10$	
	A1	for 1.25 oe	

Here is a triangle and a rectangle.



All measurements are in centimetres.

The area of the triangle is 10 cm^2 greater than the area of the rectangle.

Work out the value of x .

F P2 Q24 Student C

$$6 \times 2 = 12$$

$$\cancel{12 \times 8 = 96 \div 2 = 48}$$

$$6 \times 1.25 = 7.5$$

$$\text{triangle} = 7.5 \times 8 = 60 \div 2 = 30$$

$$\text{rectangle} = 4 \times 1.25 = 5 - 1 = 4$$

$$4 \times 5 = 20$$

$$\underline{x = 1.25}$$

Answer	Mark	Mark scheme	Additional guidance
1.25	P1	for finding an expression for the area of one shape, eg $\frac{1}{2} \times 8 \times 6x (= 24x)$ or $5(4x - 1) (= 20x - 5)$ oe	Condone missing brackets for area of rectangle for all process marks
	P1	for finding an expression for the area of both shapes, eg $\frac{1}{2} \times 8 \times 6x$ and $5(4x - 1)$ oe or [area of triangle] $- 10$ or [area of rectangle] $+ 10$ oe or [area of triangle] $-$ [area of rectangle]	
	P1	for writing a correct equation, eg $\frac{1}{2} \times 8 \times 6x = 5(4x - 1) + 10$ oe or (dep on 1st P1) eg [area of triangle] $- 10 =$ [area of rectangle] or [area of triangle] $=$ [area of rectangle] $+ 10$ or [area of triangle] $-$ [area of rectangle] $= 10$	
	A1	for 1.25 oe	

(Total for Question 24 is 4 marks)

Last year a family recycled 800 kg of household waste.
57% of this waste was paper and glass.

weight of paper recycled : weight of glass recycled = 12 : 7

Calculate the weight of glass the family recycled.

$\frac{12}{19} \quad \frac{7}{19}$

$800 \div 19 = 42.10526318$

12×42.105263
 $= 505.263.. \text{ kg}$

$7 \times 42.105263.$
 $= 294.73... .$

295

Answer	Mark	Mark scheme	Additional guidance
168	P1	for a start to the process, eg $\frac{57}{100} \times 800 (= 456)$ or $57 \div (12 + 7) (= 3)$ or $800 \div (12 + 7) (= 42.1...)$ or [amount] $\times \frac{57}{100}$ or [amount] $\times \frac{7}{12 + 7}$	May be seen as part of other calculations, eg $\frac{7}{12 + 7} \times 57 (= 21)$ or $\frac{7}{12 + 7} \times 800 (= 294.7...)$ [amount] can be any figure considered as being 57% of 800 or 43% calculated incorrectly or a figure calculated from using full or partial ratio incorrectly as a first step
	P1	for a complete process to find the weight of glass, eg $\frac{57}{100} \times 800 \times \frac{7}{12 + 7}$ oe	
	A1	for an answer in the range 167.9 to 168 SCB2 for an answer of 288	

Last year a family recycled 800 kg of household waste.
57% of this waste was paper and glass.

weight of paper recycled : weight of glass recycled = 12 : 7

Calculate the weight of glass the family recycled.

Paper : Glass

12 : 7

$$12 + 7 = 19$$

$$800 \div 19 = 42.1$$

57% of 800

$$10\% = 80$$

$$1\% = 8$$

$$80 \times 5 = 400$$

$$8 \times 7 = 56$$

$$400 + 56 = 456$$

$$456 \div 19 = 24 \text{ kg}$$

$$24 \div 7 = 3$$

$$24 \div 19 = 1.3$$

$$1.3 \times 7 = 9.1$$

$$\underline{9.1 \text{ kg}}$$

Answer	Mark	Mark scheme	Additional guidance
168	P1	for a start to the process, eg $\frac{57}{100} \times 800 (= 456)$ or $57 \div (12 + 7) (= 3)$ or $800 \div (12 + 7) (= 42.1...)$ or [amount] $\times \frac{57}{100}$ or [amount] $\times \frac{7}{12 + 7}$	May be seen as part of other calculations, eg $\frac{7}{12 + 7} \times 57 (= 21)$ or $\frac{7}{12 + 7} \times 800 (= 294.7...)$
	P1	for a complete process to find the weight of glass, eg $\frac{57}{100} \times 800 \times \frac{7}{12 + 7}$ oe	[amount] can be any figure considered as being 57% of 800 or 43% calculated incorrectly or a figure calculated from using full or partial ratio incorrectly as a first step
	A1	for an answer in the range 167.9 to 168 SCB2 for an answer of 288	

(Total for Question 25 is 3 marks)

F P2 Q25 Student C

Last year a family recycled 800 kg of household waste.
57% of this waste was paper and glass.

weight of paper recycled: weight of glass recycled = 12 : 7

Calculate the weight of glass the family recycled.

$$57\% \text{ of } 800 = 456$$

$$12:7 = 19 \text{ altogether}$$

$$456 \div 19 = 24$$

$$12 \times 24 = 288$$

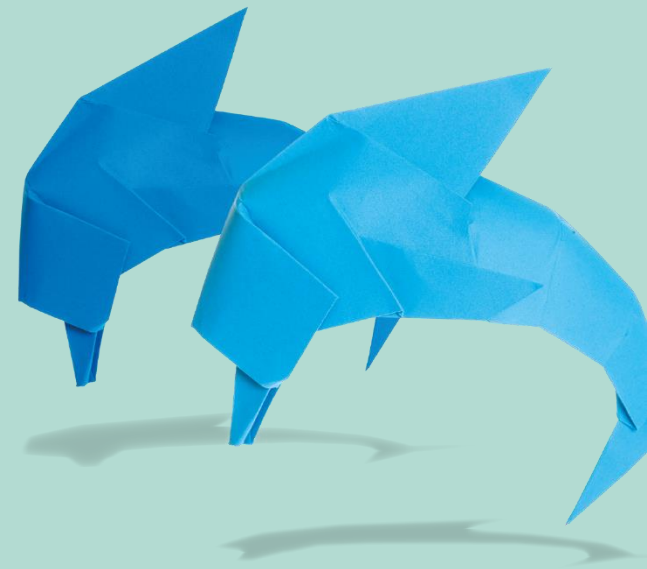
$$7 \times 24 = 168$$

$$\underline{\underline{456}}$$

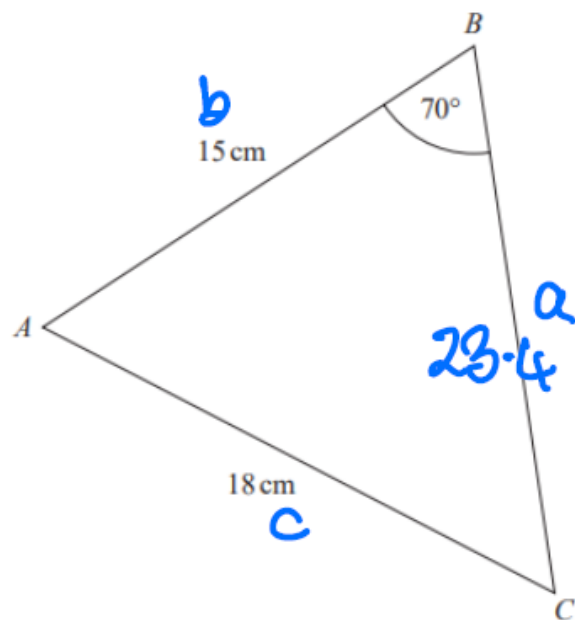
Answer	Mark	Mark scheme	Additional guidance
168	P1	for a start to the process, eg $\frac{57}{100} \times 800 (= 456)$ or $57 \div (12 + 7) (= 3)$ or $800 \div (12 + 7) (= 42.1...)$ or [amount] $\times \frac{57}{100}$ or [amount] $\times \frac{7}{12 + 7}$	May be seen as part of other calculations, eg $\frac{7}{12 + 7} \times 57 (= 21)$ or $\frac{7}{12 + 7} \times 800 (= 294.7...)$ [amount] can be any figure considered as being 57% of 800 or 43% calculated incorrectly or a figure calculated from using full or partial ratio incorrectly as a first step
	P1	for a complete process to find the weight of glass, eg $\frac{57}{100} \times 800 \times \frac{7}{12 + 7}$ oe	
	A1	for an answer in the range 167.9 to 168 SCB2 for an answer of 288	

(Total for Question 25 is 3 marks)

Higher P2



13 ABC is a triangle.



Calculate the size of angle BAC .
Give your answer correct to 1 decimal place.

$$a^2 + b^2 = c^2$$

$$15^2 + 18^2 = c^2$$

$$c = \sqrt{549}$$

$$= 23.43$$

H P2 Q13 Student A

sine rule

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{18}{\sin 70} = 19.155199..$$

$$\frac{23.4}{\sin 23.4} = 58.0...$$

$$\frac{15}{\sin 18} = 57.955.$$

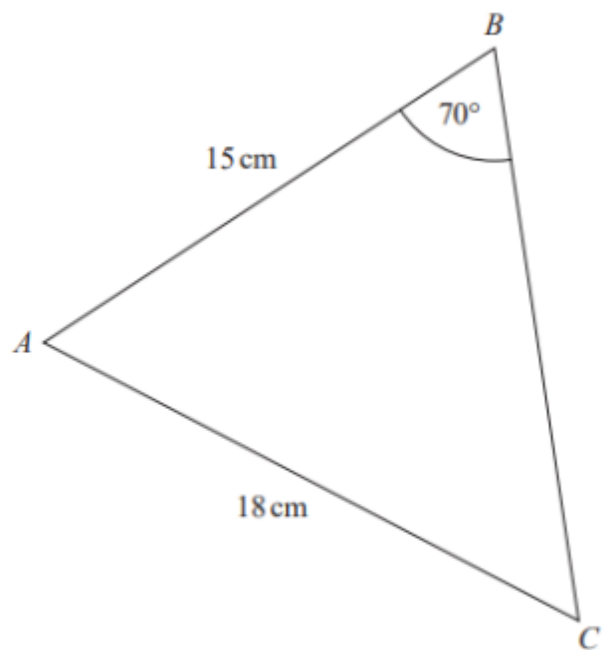
$$\frac{18}{\sin 18} = 58.249..$$

$$\underline{58.2}$$

Answer	Mark	Mark scheme	Additional guidance
58.5	P1	for start of process to find angle BCA , eg $\frac{18}{\sin 70} = \frac{15}{\sin BCA}$ or $\frac{\sin 70}{18} = \frac{\sin BCA}{15}$	Angle BCA must be correctly identified to gain marks $\sin 70 = 0.939...$ $\sin 70 \div 18 = 0.052...$ $18 \div \sin 70 = 19.1...$
	P1	for rearrangement, eg $(\sin BCA) = \frac{15 \sin 70}{18}$ ($= 0.783...$) oe or $BCA = 51.5...$	
	P1	for complete process to find angle BAC , eg $180 - 70 - \sin^{-1}\left(\frac{15 \sin 70}{18}\right)$	
	A1	for answer in the range 58.4 to 58.5	
$x + 2$	M1	for correctly factorising one expression,	If an answer is given in the range in working and then rounded incorrectly award full marks.

(Total for Question 13 is 4 marks)

13 ABC is a triangle.



Calculate the size of angle BAC .
Give your answer correct to 1 decimal place.

H P2 Q13 Student B

$$\frac{18}{\sin 70} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$= 19.155$$

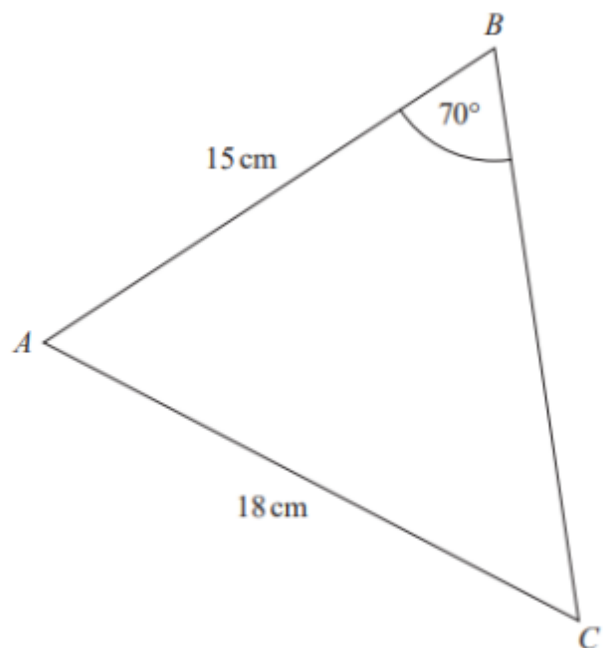
$$\frac{15}{\sin C} = 19.155 \dots$$

$$\sin C = \frac{15}{19.155} = 0.783 \dots$$

Answer	Mark	Mark scheme	Additional guidance
58.5	P1	for start of process to find angle BCA , eg $\frac{18}{\sin 70} = \frac{15}{\sin BCA}$ or $\frac{\sin 70}{18} = \frac{\sin BCA}{15}$	Angle BCA must be correctly identified to gain marks $\sin 70 = 0.939 \dots$ $\sin 70 \div 18 = 0.052 \dots$ $18 \div \sin 70 = 19.1 \dots$
	P1	for rearrangement, eg $(\sin BCA) = \frac{15 \sin 70}{18}$ ($= 0.783 \dots$) oe or $BCA = 51.5 \dots$	
	P1	for complete process to find angle BAC , eg $180 - 70 - \sin^{-1}\left(\frac{15 \sin 70}{18}\right)$	
	A1	for answer in the range 58.4 to 58.5	
$x + 2$	M1	for correctly factorising one expression,	If an answer is given in the range in working and then rounded incorrectly award full marks.

(Total for Question 13 is 4 marks)

13 ABC is a triangle.



Calculate the size of angle BAC .
Give your answer correct to 1 decimal place.

Answer	Mark	Mark scheme	Additional guidance
58.5	P1	for start of process to find angle BCA , eg $\frac{18}{\sin 70} = \frac{15}{\sin BCA}$ or $\frac{\sin 70}{18} = \frac{\sin BCA}{15}$	Angle BCA must be correctly identified to gain marks $\sin 70 = 0.939\dots$ $\sin 70 \div 18 = 0.052\dots$ $18 \div \sin 70 = 19.1\dots$
	P1	for rearrangement, eg $(\sin BCA) = \frac{15 \sin 70}{18}$ ($= 0.783\dots$) oe or $BCA = 51.5\dots$	
	P1	for complete process to find angle BAC , eg $180 - 70 - \sin^{-1}\left(\frac{15 \sin 70}{18}\right)$	
	A1	for answer in the range 58.4 to 58.5	
$x + 2$	M1	for correctly factorising one expression,	If an answer is given in the range in working and then rounded incorrectly award full marks.

H P2 Q13 Student C

$$\frac{18}{\sin 70} = \frac{15}{\sin ?}$$

$$18 \sin ? = 15 \sin 70$$

$$\sin ? = \frac{15 \sin 70}{18}$$

$$\sin^{-1}\left(\frac{15 \sin 70}{18}\right)$$

$$BCA = 51.593\dots$$

$$180 - 70 - 51.593\dots$$

$$= 58.4068\dots$$

$$= \underline{58.4}$$

(Total for Question 13 is 4 marks)

H P2 Q22 Student A

There are only blue pens and red pens in a box.

The number of blue pens is four times the number of red pens.

Rita takes at random one pen from the box.

She records the colour of the pen and then replaces it in the box.

Rita does this n times, where $n \geq 2$

Write down an expression, in terms of n , for the probability that Rita gets a blue pen at least once and a red pen at least once.

$$P(\text{Red}) = \frac{1}{5} \quad P(\text{B}) = \frac{4}{5}$$

$$\begin{aligned} & \text{R } \frac{1}{5} \rightarrow \text{R } \frac{1}{5} \times \frac{1}{5} \\ & \text{B } \frac{4}{5} \rightarrow \text{B } \frac{4}{5} \times \frac{4}{5} = 0.16 \\ & \text{B } \frac{4}{5} \rightarrow \text{R } \frac{4}{5} \times \frac{1}{5} = 0.16 \\ & \text{B } \frac{1}{5} \times \frac{4}{5} \\ & 0.32 \text{ chance of each} \end{aligned}$$

1/2H				
Answer	Mark	Mark scheme		
$1 - \left(\frac{4}{5}\right)^n - \left(\frac{1}{5}\right)^n$	P1	for start to the process, eg $P(\text{at least one blue and at least one red}) = 1 - P(\text{all blue}) - P(\text{all red})$ oe		
		or $P(\text{all blue}) = \left(\frac{4}{5}\right)^n$ oe or $P(\text{all red}) = \left(\frac{1}{5}\right)^n$		
	A1	for $1 - \left(\frac{4}{5}\right)^n - \left(\frac{1}{5}\right)^n$ oe		
Shown	M1	for start to process using ratio. eg $1 : 1 + 2 : 1 + 2 + 3 (= 1 : 3 : 6)$		

(Total for Question 22 is 2 marks)

H P2 Q22 Student B

There are only blue pens and red pens in a box.

The number of blue pens is four times the number of red pens.

Rita takes at random one pen from the box.

She records the colour of the pen and then replaces it in the box.

Rita does this n times, where $n \geq 2$

Write down an expression, in terms of n , for the probability that Rita gets a blue pen at least once and a red pen at least once.

$$b = 4r$$

$$\frac{4}{5}b \quad \frac{1}{5}r$$

$$\frac{8}{10}b \quad \frac{2}{10}r$$

$$n = \left(\frac{4}{5}\right)^n + \left(\frac{1}{5}\right)^n$$

1/2H			
Answer	Mark	Mark scheme	
$1 - \left(\frac{4}{5}\right)^n - \left(\frac{1}{5}\right)^n$	P1	for start to the process, eg $P(\text{at least one blue and at least one red}) = 1 - P(\text{all blue}) - P(\text{all red})$ oe or $P(\text{all blue}) = \left(\frac{4}{5}\right)^n$ oe or $P(\text{all red}) = \left(\frac{1}{5}\right)^n$	
	A1	for $1 - \left(\frac{4}{5}\right)^n - \left(\frac{1}{5}\right)^n$ oe	
Shown	M1	for start to process using ratio. eg $1 : 1 + 2 : 1 + 2 + 3 (= 1 : 3 : 6)$	V

(Total for Question 22 is 2 marks)

H P2 Q22 Student C

There are only blue pens and red pens in a box.

The number of blue pens is four times the number of red pens.

Rita takes at random one pen from the box.

She records the colour of the pen and then replaces it in the box.

Rita does this n times, where $n \geq 2$

Write down an expression, in terms of n , for the probability that Rita gets a blue pen at least once and a red pen at least once.

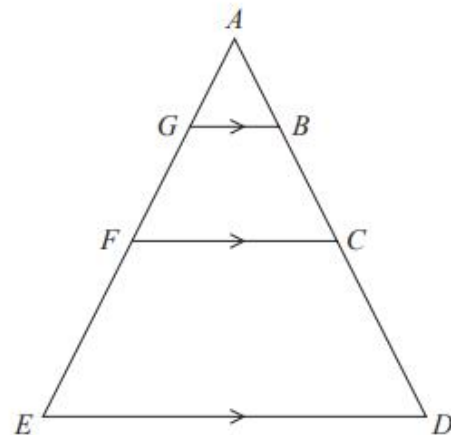
$$b = 4r \quad n = 2$$

$$1 - \left(\frac{4}{5}\right)^n - \left(\frac{1}{5}\right)^n$$

1/2H				
Answer	Mark	Mark scheme		
$1 - \left(\frac{4}{5}\right)^n - \left(\frac{1}{5}\right)^n$	P1	for start to the process, eg $P(\text{at least one blue and at least one red}) = 1 - P(\text{all blue}) - P(\text{all red})$ oe		
	A1	or $P(\text{all blue}) = \left(\frac{4}{5}\right)^n$ oe or $P(\text{all red}) = \left(\frac{1}{5}\right)^n$ for $1 - \left(\frac{4}{5}\right)^n - \left(\frac{1}{5}\right)^n$ oe		
Shown	M1	for start to process using ratio. eg $1 : 1 + 2 : 1 + 2 + 3 (= 1 : 3 : 6)$		
				V

(Total for Question 22 is 2 marks)

3 Here are three similar triangles, ABG , ACF and ADE .



$ABCD$ and $AGFE$ are straight lines.

$AB:BC:CD = 1:2:3$

Show that

area of ABG :area of $BCFG$:area of $CDEF = 1:8:27$

H P2 Q23 Student A

$$AB = \frac{1}{6} AD$$

$$BC = \frac{2}{6} AD$$

$$CD = \frac{3}{6} AD$$

$$\frac{1}{6} : \frac{2}{6} : \frac{3}{6}$$

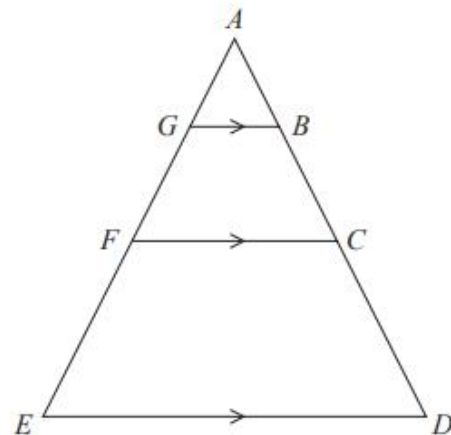
$$1^3 : 2^3 : 3^3$$

$$1 : 8 : 27$$

Shown	M1	for start to process using ratio, eg $1 : 1 + 2 : 1 + 2 + 3 (= 1 : 3 : 6)$	Values may not be seen in a ratio, can still award M marks May be seen combined with algebra
	M1	for process to write down ratio of areas of triangles eg $1^2 : 3^2 : 6^2 (= 1 : 9 : 36)$	
	C1	for correct working leading to answer, eg $1 : 9 - 1 : 36 - 9 = 1 : 8 : 27$	

(Total for Question 23 is 3 marks)

3 Here are three similar triangles, ABG , ACF and ADE .



$ABCD$ and $AGFE$ are straight lines.

$$AB:BC:CD = 1:2:3$$

Show that

$$\text{area of } ABG : \text{area of } BCFG : \text{area of } CDEF = 1:8:27$$



H P2 Q23 Student B

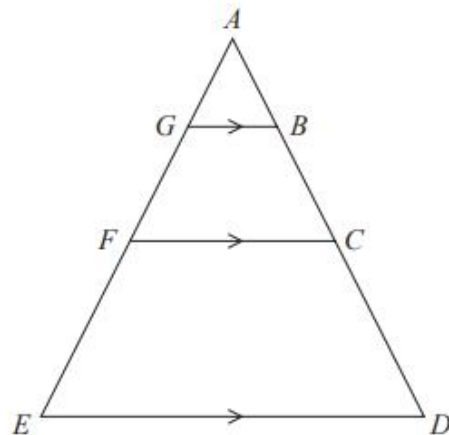
Shown

M1	for start to process using ratio, eg $1 : 1 + 2 : 1 + 2 + 3 (= 1 : 3 : 6)$
M1	for process to write down ratio of areas of triangles eg $1^2 : 3^2 : 6^2 (= 1 : 9 : 36)$
C1	for correct working leading to answer, eg $1 : 9 - 1 : 36 - 9 = 1 : 8 : 27$

Values may not be seen in a ratio, can still
award M marks
May be seen combined with algebra

(Total for Question 23 is 3 marks)

3 Here are three similar triangles, ABG , ACF and ADE .



$ABCD$ and $AGFE$ are straight lines.

$AB:BC:CD = 1:2:3$

Show that

area of ABG : area of $BCFG$: area of $CDEF = 1:8:27$

H P2 Q23 Student C

$$AB = 1 \text{ arbitrary unit}$$

$$AC = 1 + 2 \text{ a.u.} = 3 \text{ a.u.}$$

$$AD = 1 + 2 + 3 = 6 \text{ a.u.}$$

$$\text{Area of } ABG = 1 \text{ unit}^2$$

$$\text{Area of } BCFG = 9 - 1 = 8 \text{ unit}^2$$

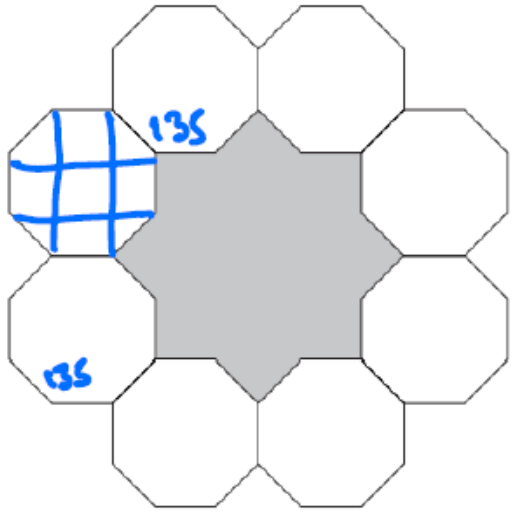
$$\text{Area of } CDEF = 36 - 9 = 27 \text{ unit}^2$$

$$\therefore 1:8:27$$

Shown	M1	for start to process using ratio, eg $1:1+2:1+2+3 (=1:3:6)$	Values may not be seen in a ratio, can still award M marks May be seen combined with algebra
	M1	for process to write down ratio of areas of triangles eg $1^2:3^2:6^2 (=1:9:36)$	
	C1	for correct working leading to answer, eg $1:9-1:36-9 = 1:8:27$	

(Total for Question 23 is 3 marks)

24 The diagram shows 8 identical regular octagons joined to enclose a shaded shape.



Each octagon has sides of length a .

Find, in terms of a , an expression for the area of the shaded shape.

Give your answer in the form $p(2 + \sqrt{2})a^2$ where p is an integer.

You must show all your working.

H P2 Q24 Student A

sum of angles = 8
= $6 \times 180 = 1080$
angle = 135
 $135 + 135 = 270$ $360 - 270 = 90$

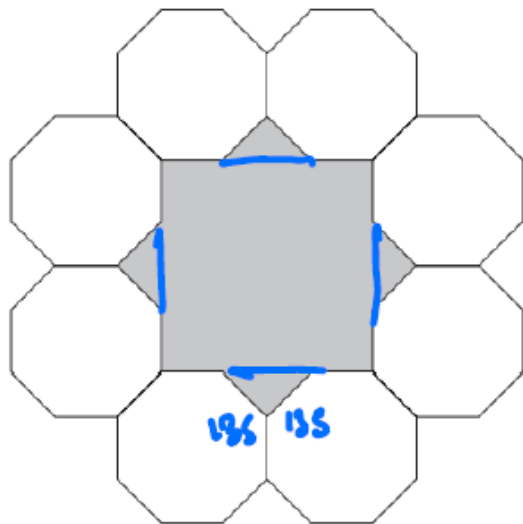


length $a = 1080$

Answer	Mark	Mark scheme	Additional guidance
$4(2 + \sqrt{2})a^2$	P1	for process to find area required and identifying 135° or 45° or 90° angle(s), eg splitting shape into square and 4 triangles and an angle relevant to the triangle clearly identified.	90° must be in a triangle to gain credit. May be seen on diagram.
	P1	for process to find the area of a relevant triangle using 45° , eg $\frac{1}{2} \times a \times \left(2 \times \frac{a}{\sqrt{2}}\right) \times \frac{1}{\sqrt{2}} \left(= \frac{a^2}{2}\right)$ or using 90° , eg $\frac{1}{2} \times a \times a \left(= \frac{a^2}{2}\right)$ or process to find the area of a square made from 2 small triangles, eg $a \times a \left(= a^2\right)$	Accept $0.49 \dots a^2$
	P1	for process to find the length of the square, eg $a + a + \sqrt{a^2 + a^2} \left(= 2a + a\sqrt{2}\right)$	Accept $3.41a$
	P1	for process to find the total area, eg $\left(2a + a\sqrt{2}\right)^2 + 4 \times \frac{a^2}{2}$	Accept $(11.655 + 4 \times 0.49) a^2$
	A1	(dep on P3) for $4(2 + \sqrt{2})a^2$	Answer only award no marks. If working in decimals accept $\frac{13.656}{2 + \sqrt{2}}$ leading to 4 Accept $p = 4$ if supported by correct working

(Total for Question 24 is 5 marks)

24 The diagram shows 8 identical regular octagons joined to enclose a shaded shape.



Each octagon has sides of length a .

Find, in terms of a , an expression for the area of the shaded shape.

Give your answer in the form $p(2 + \sqrt{2})a^2$ where p is an integer.

You must show all your working.

H P2 Q24 Student B

$$\text{interior angle} = \frac{1080}{8} = 135$$

$$\text{ext. angle} = 360$$

$$\frac{360}{8} = 45$$

Pythagoras

$$\sqrt{a^2 + a^2} = \sqrt{2}a$$



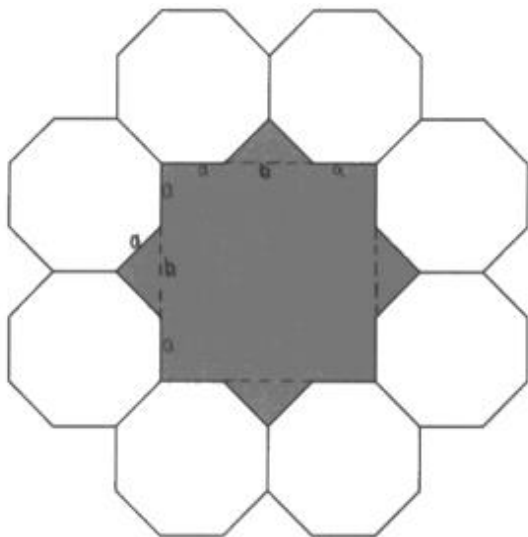
must be a right angle
due to 2 ext. angles

$$\begin{aligned} \text{Total area} &= 4a^2 + 2\sqrt{2}a + 2\sqrt{2}a + 2a \cdot 2a^2 \\ &= 6a^2 + 4\sqrt{2}a + 2a \\ &= 2(3a^2 + 2\sqrt{2}a + a) \\ &= 2a(3a + 2\sqrt{2} + 1) \\ &= 2(3 + 2\sqrt{2} + 1)a^2 \\ &= 2(4 + 2\sqrt{2})a^2 = 4(2 + \sqrt{2})a^2 \end{aligned}$$

(Total for Question 24 is 5 marks)

Answer	Mark	Mark scheme	Additional guidance
$4(2 + \sqrt{2})a^2$	P1	for process to find area required and identifying 135° or 45° or 90° angle(s), eg splitting shape into square and 4 triangles and an angle relevant to the triangle clearly identified.	90° must be in a triangle to gain credit. May be seen on diagram.
	P1	for process to find the area of a relevant triangle using 45° , eg $\frac{1}{2} \times a \times \left(2 \times \frac{a}{\sqrt{2}}\right) \times \frac{1}{\sqrt{2}} \left(= \frac{a^2}{2}\right)$ or using 90° , eg $\frac{1}{2} \times a \times a \left(= \frac{a^2}{2}\right)$ or process to find the area of a square made from 2 small triangles, eg $a \times a \left(= a^2\right)$	Accept $0.49 \dots a^2$ May be seen as the area of 2 squares (from 4 small triangles)
	P1	for process to find the length of the square, eg $a + a + \sqrt{a^2 + a^2} \left(= 2a + a\sqrt{2}\right)$	Accept $3.41a$
	P1	for process to find the total area, eg $(2a + a\sqrt{2})^2 + 4 \times \frac{a^2}{2}$	Accept $(11.655 + 4 \times 0.49)a^2$
	A1	(dep on P3) for $4(2 + \sqrt{2})a^2$	Answer only award no marks. If working in decimals accept $\frac{13.656}{2 + \sqrt{2}}$ leading to 4 Accept $p = 4$ if supported by correct working

24 The diagram shows 8 identical regular octagons joined to enclose a shaded shape.



Each octagon has sides of length a .

Find, in terms of a , an expression for the area of the shaded shape.

Give your answer in the form $p(2 + \sqrt{2})a^2$ where p is an integer.

You must show all your working.

H P2 Q24 Student C

$$\text{triangle} = \frac{a \times a}{2} = \frac{1}{2}a^2$$

$$4 \text{ triangles} = \frac{1}{2}a^2 \times 4 = 2a^2$$

$$\text{Square} = 2a + b$$

$$= a^2 + a^2 = b^2$$

$$b = \sqrt{2a^2} = \sqrt{2}a$$

$$\text{area} = (2a + a\sqrt{2})^2$$

$$= 4a^2 + 2a^2\sqrt{2} + 2a^2\sqrt{2} + 2a^2$$

$$= 6a^2 + 4a^2\sqrt{2} + 2a^2$$

$$= 8a^2 + 4a^2\sqrt{2}$$

$$= 4(2 + \sqrt{2})a^2$$

(Total for Question 24 is 5 marks)

Answer	Mark	Mark scheme	Additional guidance
$4(2 + \sqrt{2})a^2$	P1	for process to find area required and identifying 135° or 45° or 90° angle(s), eg splitting shape into square and 4 triangles and an angle relevant to the triangle clearly identified.	90° must be in a triangle to gain credit. May be seen on diagram.
	P1	for process to find the area of a relevant triangle using 45° , eg $\frac{1}{2} \times a \times \left(2 \times \frac{a}{\sqrt{2}}\right) \times \frac{1}{\sqrt{2}} \left(= \frac{a^2}{2}\right)$ or using 90° , eg $\frac{1}{2} \times a \times a \left(= \frac{a^2}{2}\right)$ or process to find the area of a square made from 2 small triangles, eg $a \times a \left(= a^2\right)$	Accept $0.49 \dots a^2$ May be seen as the area of 2 squares (from 4 small triangles)
	P1	for process to find the length of the square, eg $a + a + \sqrt{a^2 + a^2} \left(= 2a + a\sqrt{2}\right)$	Accept $3.41a$
	P1	for process to find the total area, eg $\left(2a + a\sqrt{2}\right)^2 + 4 \times \frac{a^2}{2}$	Accept $(11.655 + 4 \times 0.49)a^2$
	A1	(dep on P3) for $4(2 + \sqrt{2})a^2$	Answer only award no marks. If working in decimals accept $\frac{13.656}{2 + \sqrt{2}}$ leading to 4 Accept $p = 4$ if supported by correct working

Foundation P3

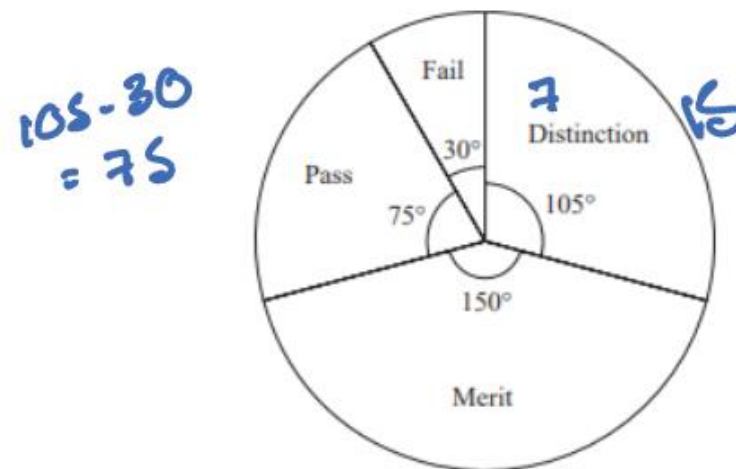


F P3 Q12 Student A

(a)	Merit	B1	cao
(b)	24	M1	for beginning to work with proportion eg $105 \div 7 (= 15)$ or $7 \div 105 (= 0.07 \text{ or } 0.06\dots)$ or $360 \times 7 (= 2520)$ or $\frac{360}{105} (= 3.4\dots)$ or works out a quantity for one sector eg $\frac{7}{105} \times 30 (= 2)$, $\frac{7}{105} \times 75 (= 5)$, $\frac{7}{105} \times 150 (= 10)$,
		M1	for a complete method eg $\frac{360}{105} \times 7$ oe or “3.4...” $\times 7$ or $360 \div “15”$ or $360 \times “0.06\dots”$ or “2520” $\div 105$ or $7 + “2” + “5” + “10”$
		A1	cao

2 Some students took a guitar exam.

The pie chart shows information about the grades the students got.



(a) Write down the modal grade.

7 students got distinction.

(b) Work out the total number of students who took the guitar exam.

255

(1)

D m f p
7 12 2 5

26

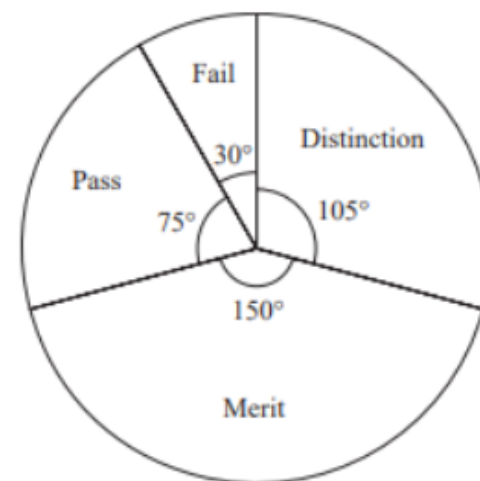
(Total for Question 12 is 4 marks)

F P3 Q12 Student B

(a)	Merit	B1	cao
(b)	24	M1	for beginning to work with proportion eg $105 \div 7 (= 15)$ or $7 \div 105 (= 0.07 \text{ or } 0.06\dots)$ or $360 \times 7 (= 2520)$ or $\frac{360}{105} (= 3.4\dots)$ or works out a quantity for one sector eg $\frac{7}{105} \times 30 (= 2)$, $\frac{7}{105} \times 75 (= 5)$, $\frac{7}{105} \times 150 (= 10)$,
		M1	for a complete method eg $\frac{360}{105} \times 7$ oe or “3.4...” $\times 7$ or $360 \div “15”$ or $360 \times “0.06\dots”$ or “2520” $\div 105$ or $7 + “2” + “5” + “10”$
		A1	cao

2 Some students took a guitar exam.

The pie chart shows information about the grades the students got.



$$\begin{aligned}
 105 &= 7 \\
 1 &= 0.06 \\
 0.06 \times 30 &= 1.8 \\
 0.06 \times 75 &= 4.5 \\
 150 &= 9
 \end{aligned}$$

(a) Write down the modal grade.

distinction
(1)

7 students got distinction.

(b) Work out the total number of students who took the guitar exam.

$$7 + 9 + 4.5 + 1.8 =$$

22.3
(3)

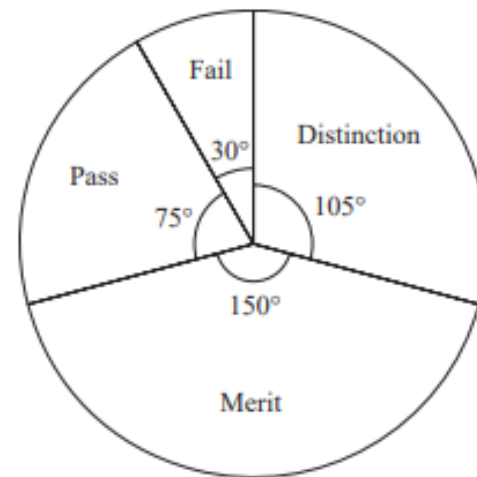
(Total for Question 12 is 4 marks)

F P3 Q12 Student C

(a)	Merit	B1	cao
(b)	24	M1	for beginning to work with proportion eg $105 \div 7 (= 15)$ or $7 \div 105 (= 0.07 \text{ or } 0.06\dots)$ or $360 \times 7 (= 2520)$ or $\frac{360}{105} (= 3.4\dots)$ or works out a quantity for one sector eg $\frac{7}{105} \times 30 (= 2)$, $\frac{7}{105} \times 75 (= 5)$, $\frac{7}{105} \times 150 (= 10)$,
		M1	for a complete method eg $\frac{360}{105} \times 7$ oe or “3.4...” $\times 7$ or $360 \div “15”$ or $360 \times “0.06\dots”$ or “2520” $\div 105$ or $7 + “2” + “5” + “10”$
		A1	cao

2 Some students took a guitar exam.

The pie chart shows information about the grades the students got.



(a) Write down the modal grade.

7 students got distinction.

(b) Work out the total number of students who took the guitar exam.

merit
(1)

7 = distinction

$105 \div 7 = 15$ $30 \div 15 = 2$

$150 \div 15 = 10$

$75 \div 15 = 5$

24

(3)

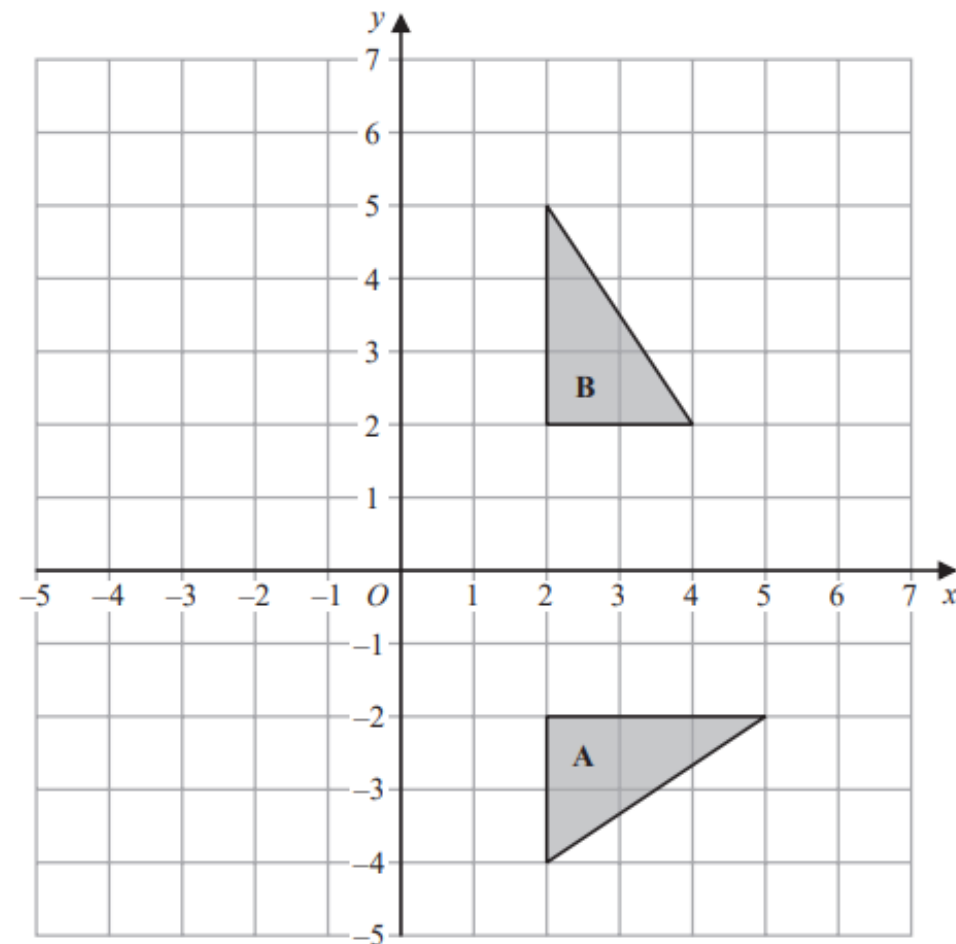
(Total for Question 12 is 4 marks)

F P3 Q16 Student A

Rotation of $90(^{\circ})$, centre $(0,0)$	B2	Rotation of 90 about $(0,0)$ or Rotation of 270 , clockwise about centre $(0,0)$
	(B1	Rotation and 90 or Rotation and 270 , clockwise or Rotation about $(0,0)$

Accept "origin" or "O" for $(0,0)$

16



Describe fully the single transformation that maps shape A onto shape B.

move shape A 2 squares across
and rotate from the point anti
clockwise and 4 squares up

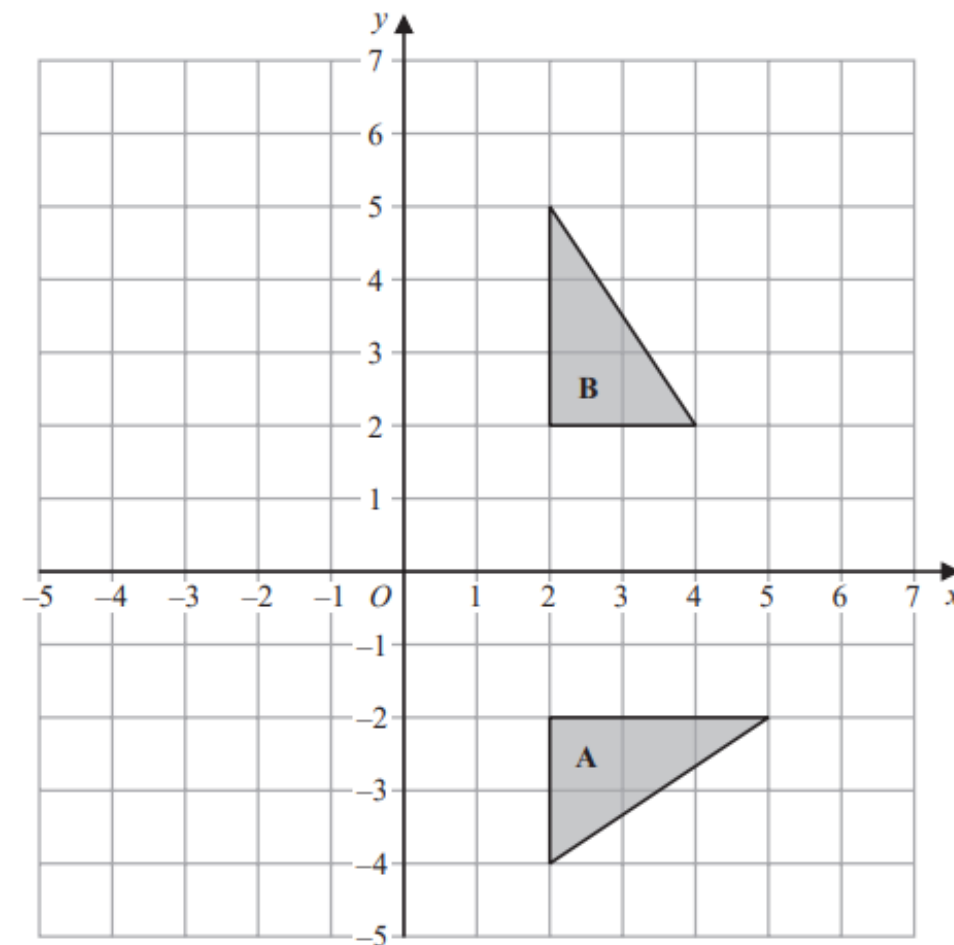
(Total for Question 16 is 2 marks)

F P3 Q16 Student B

Rotation of $90(^{\circ})$, centre $(0,0)$	B2	Rotation of 90 about $(0,0)$ or Rotation of 270 , clockwise about centre $(0,0)$
	(B1	Rotation and 90 or Rotation and 270 , clockwise or Rotation about $(0,0)$

Accept "origin" or "O" for $(0,0)$

16



Describe fully the single transformation that maps shape A onto shape B.

Rotation from the origin by 180 degrees

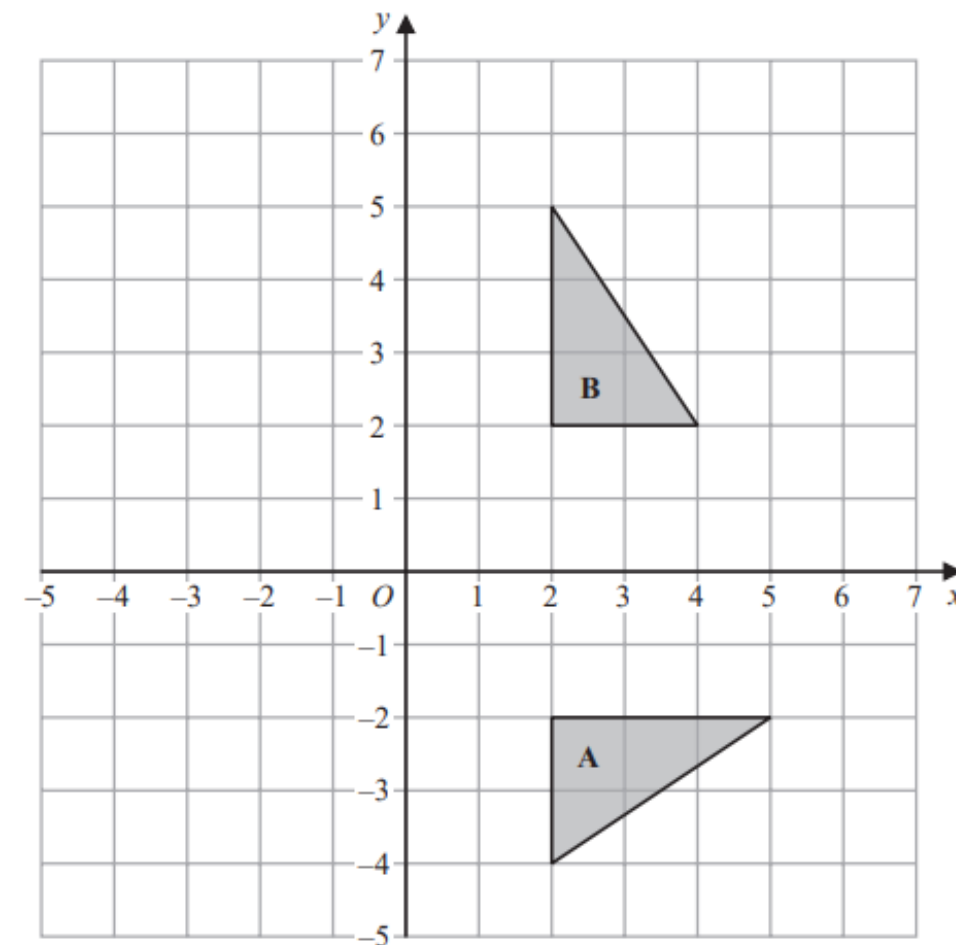
(Total for Question 16 is 2 marks)

F P3 Q16 Student C

Rotation of 90° , centre (0,0)	B2	Rotation of 90 about (0,0) or Rotation of 270 , clockwise about centre (0,0)
	(B1	Rotation and 90 or Rotation and 270 , clockwise or Rotation about (0,0))

Accept "origin" or "O" for (0,0)

16



Describe fully the single transformation that maps shape A onto shape B.

Rotation 90° anti-clockwise (OP)

(Total for Question 16 is 2 marks)

21 Jonny wants to know how much coffee he will need for 800 people at a meeting.

Each person who drinks coffee will drink 2 cups of coffee.

10.6 g of coffee is needed for each cup of coffee.

Jonny assumes 68% of the people will drink coffee.

(a) Using this assumption, work out the amount of coffee Jonny needs.

Give your answer correct to the nearest gram.

Jonny's assumption is wrong.

72% of the people will drink coffee.

(b) How does this affect your answer to part (a)?

F P3 Q21 Student A

$$\begin{aligned}\frac{800}{2} &: 400 \times 10.6 \\ &= 37.735 \times 68\% \\ &= \underline{2565g}\end{aligned}$$

b. This affects my answer in part A because the percentage of people who drink coffee is larger.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	11533	P1	for working with 68%, eg $800 \times 0.68 (= 544 \text{ people})$ or $"16960" \times 0.68$ or	Percentage calculation could be done at any stage
		P1	for a correct process, other than that of finding a %, eg $"544" \times 2 (= 1088)$ or $10.6 \times 2 (= 21.2)$ or $800 \times 2 (= 1600)$ or $"544" \times 10.6 (= 5766.4)$ or $800 \times 10.6 (= 8480)$	
		P1	for full process to find amount of coffee required eg $"1088" \times 10.6$ or $"544" \times "21.2"$ or $"5766.4" \times 2 (= 11532.8)$ or for an answer of 11532	
		A1	for answer in the range 11532.5 to 11533	
(b)	Statement	C1	for a correct statement Acceptable examples the amount will be more; he will need more coffee it is an underestimate my answer in part (a) means there would not be enough for everyone he will need 12211(.2); needs 678(.4) more Not acceptable examples amount will decrease, amount of coffee will change	If a correct answer within the range is shown in working but incorrectly rounded award full marks. If figures are given as part of the answer they must be correct, but can allow ft.

(Total for Question 21 is 5 marks)

21 Jonny wants to know how much coffee he will need for 800 people at a meeting.

Each person who drinks coffee will drink 2 cups of coffee.
10.6 g of coffee is needed for each cup of coffee.

Jonny assumes 68% of the people will drink coffee.

- (a) Using this assumption, work out the amount of coffee Jonny needs.
Give your answer correct to the nearest gram.

Jonny's assumption is wrong.
72% of the people will drink coffee.

- (b) How does this affect your answer to part (a)?

F P3 Q21 Student B

68% of 800

$$0.68 \times 800 = 544 \quad \frac{544}{2} = 272$$

$$10.6 \times 544 = 5872.4g$$

$$\frac{5872.4}{272} = 21.58 \quad \text{so } 22g$$

(b) I would have to find out what 72% of 800 would be and add extra grams to how much coffee would be needed

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	11533	P1	for working with 68%, eg $800 \times 0.68 (= 544 \text{ people})$ oe or $"16960" \times 0.68$ oe	Percentage calculation could be done at any stage
		P1	for a correct process, other than that of finding a %, eg $"544" \times 2 (= 1088)$ or $10.6 \times 2 (= 21.2)$ or $800 \times 2 (= 1600)$ or $"544" \times 10.6 (= 5766.4)$ or $800 \times 10.6 (= 8480)$	
		P1	for full process to find amount of coffee required eg $"1088" \times 10.6$ or $"544" \times "21.2"$ or $"5766.4" \times 2 (= 11532.8)$ or for an answer of 11532	
		A1	for answer in the range 11532.5 to 11533	
(b)	Statement	C1	for a correct statement Acceptable examples the amount will be more; he will need more coffee it is an underestimate my answer in part (a) means there would not be enough for everyone he will need 12211(.2); needs 678(.4) more Not acceptable examples amount will decrease, amount of coffee will change	If a correct answer within the range is shown in working but incorrectly rounded award full marks. If figures are given as part of the answer they must be correct, but can allow ft.

(Total for Question 21 is 5 marks)

21 Jonny wants to know how much coffee he will need for 800 people at a meeting.

Each person who drinks coffee will drink 2 cups of coffee.
10.6 g of coffee is needed for each cup of coffee.

Jonny assumes 68% of the people will drink coffee.

- (a) Using this assumption, work out the amount of coffee Jonny needs.
Give your answer correct to the nearest gram.

Jonny's assumption is wrong.
72% of the people will drink coffee.

- (b) How does this affect your answer to part (a)?

F P3 Q21 Student C

$$2 \times 800 = 1600$$

$$10.6 \times 1600 = 16960$$

$$1\% = 169 \quad 169 \times 8 = 1352$$

$$10\% = 1696$$

$$1696 \times 6 = 10176$$

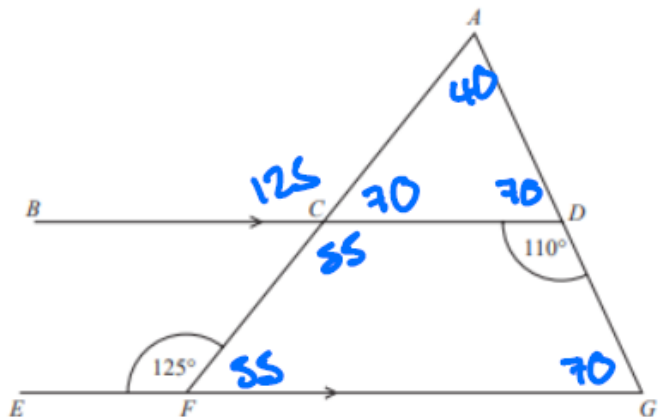
$$10176 + 1352 = \underline{\underline{11528}}$$

(b) he will need more grams of coffee

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	11533	P1	for working with 68%, eg $800 \times 0.68 (= 544 \text{ people})$ oe or $"16960" \times 0.68$ oe	Percentage calculation could be done at any stage
		P1	for a correct process, other than that of finding a %, eg $"544" \times 2 (= 1088)$ or $10.6 \times 2 (= 21.2)$ or $800 \times 2 (= 1600)$ or $"544" \times 10.6 (= 5766.4)$ or $800 \times 10.6 (= 8480)$	
		P1	for full process to find amount of coffee required eg $"1088" \times 10.6$ or $"544" \times "21.2"$ or $"5766.4" \times 2 (= 11532.8)$ or for an answer of 11532	
		A1	for answer in the range 11532.5 to 11533	
(b)	Statement	C1	for a correct statement Acceptable examples the amount will be more; he will need more coffee it is an underestimate my answer in part (a) means there would not be enough for everyone he will need 12211(.2); needs 678(.4) more Not acceptable examples amount will decrease, amount of coffee will change	If a correct answer within the range is shown in working but incorrectly rounded award full marks. If figures are given as part of the answer they must be correct, but can allow ft.

(Total for Question 21 is 5 marks)

22 ACF and ADG are straight lines.
 BCD and EFG are parallel lines.



Show that triangle ACD is isosceles.
 Give a reason for each stage of your working.

angles on a straight line
 add up to 180

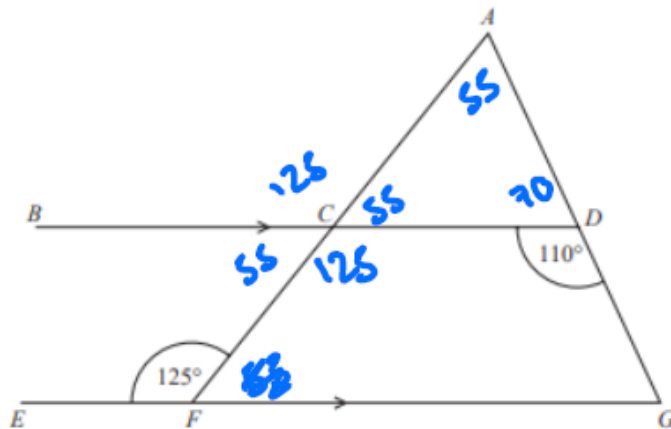
parallel lines add up to 180

all angles in an isosceles
 triangle add up to 180.

Shown with reasons	<p>M1 for method to find ACD using parallel lines eg $BCA = 125$ and $ACD = 180 - 125 (= 55)$ or $BCF = 180 - 125 (= 55) = ACD$ or $FCD = 125$ and $ACD = 180 - 125 (= 55)$ or $CFG = 180 - 125 (= 55) = ACD$</p> <p>M1 for method to find ADC eg $180 - 110 (= 70)$ or for method to find CAD eg $180 - ("70" + "55") (= 55)$ or $110 - "55" (= 55)$</p> <p>A1 for $ACD = 55$ and $CAD = 55$</p> <p>C1 for one correct parallel lines reason linked to their method eg <u>Corresponding</u> angles are equal <u>Allied</u> angles / <u>Co-interior</u> angles add up to 180 <u>Alternate</u> angles are equal</p> <p>C1 for one other reason stated linked to their method eg <u>Angles</u> on a straight line add up to 180 <u>Angles</u> in a <u>triangle</u> add up to 180 Vertically <u>opposite angles</u> are equal OR <u>Vertically opposite</u> angles are equal The <u>exterior angle</u> of a triangle is <u>equal</u> to the sum of the <u>interior opposite angles</u>. <u>Angles</u> in a <u>quadrilateral</u> add up to 360. Accept "4-sided shape"</p>	<p>Angles must be clearly labelled on the diagram or otherwise identified. Correct method can be implied from angles on the diagram if no ambiguity or contradiction.</p> <p>Underlined words need to be shown; reasons need to be linked to their method, which can be implied from correctly identified angles (stated or written on the diagram).</p>
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(Total for Question 22 is 5 marks)

- 22 ACF and ADG are straight lines.
 BCD and EFG are parallel lines.



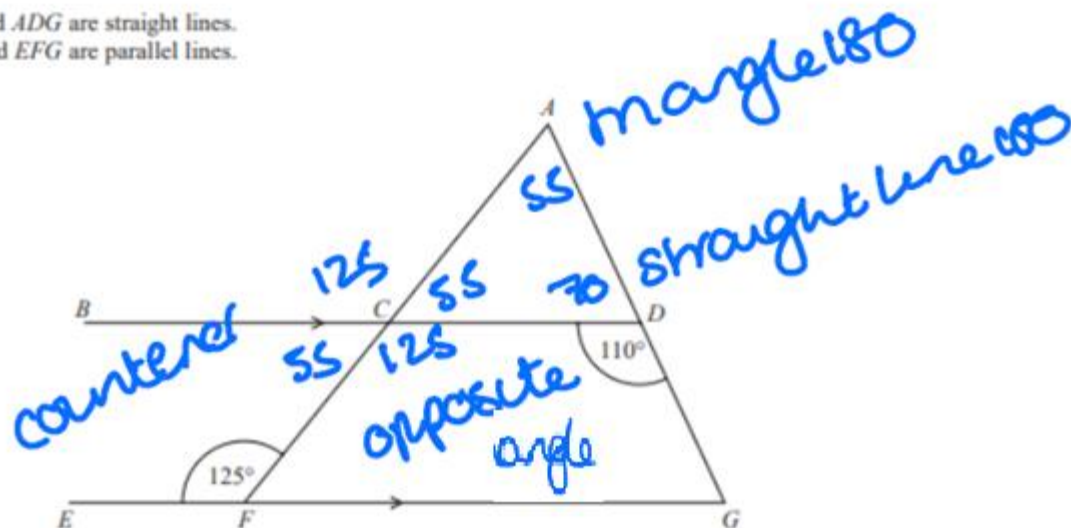
Show that triangle ACD is isosceles.
 Give a reason for each stage of your working.

one angle is larger than
 the others which are equal

Shown with reasons	<p>M1 for method to find ACD using parallel lines eg $BCA = 125$ and $ACD = 180 - 125 (= 55)$ or $BCF = 180 - 125 (= 55) = ACD$ or $FCD = 125$ and $ACD = 180 - 125 (= 55)$ or $CFG = 180 - 125 (= 55) = ACD$</p> <p>M1 for method to find ADC eg $180 - 110 (= 70)$ or for method to find CAD eg $180 - ("70" + "55") (= 55)$ or $110 - "55" (= 55)$</p> <p>A1 for $ACD = 55$ and $CAD = 55$</p> <p>C1 for one correct parallel lines reason linked to their method eg <u>Corresponding</u> angles are equal <u>Allied</u> angles / <u>Co-interior</u> angles add up to 180 <u>Alternate</u> angles are equal</p> <p>C1 for one other reason stated linked to their method eg <u>Angles</u> on a straight line add up to 180 <u>Angles</u> in a <u>triangle</u> add up to 180 Vertically <u>opposite angles</u> are equal OR <u>Vertically opposite</u> angles are equal The <u>exterior angle</u> of a triangle is <u>equal</u> to the sum of the <u>interior opposite angles</u>. <u>Angles</u> in a <u>quadrilateral</u> add up to 360. Accept "4-sided shape"</p>	<p>Angles must be clearly labelled on the diagram or otherwise identified. Correct method can be implied from angles on the diagram if no ambiguity or contradiction.</p> <p>Underlined words need to be shown; reasons need to be linked to their method, which can be implied from correctly identified angles (stated or written on the diagram).</p>
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(Total for Question 22 is 5 marks)

- 12 ACF and ADG are straight lines.
 BCD and EFG are parallel lines.



Show that triangle ACD is isosceles.
 Give a reason for each stage of your working.

F P3 Q22 Student C

$$180 - 125 = 55 \text{ counter}$$

$$180 - 110 = 70 \text{ straight line}$$

$$180 - 55 - 70 = 55 \text{ mangle}$$



Shown with reasons

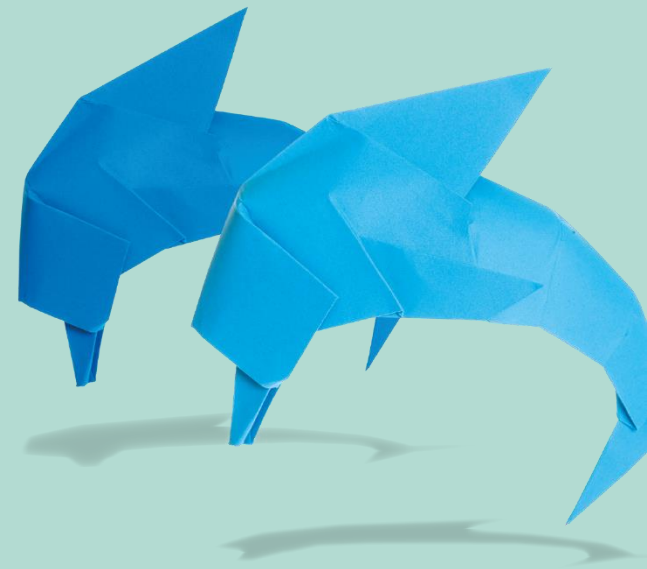
- M1 for method to find ACD using parallel lines
 eg $BCA = 125$ and $ACD = 180 - 125 (= 55)$
 or $BCF = 180 - 125 (= 55) = ACD$
 or $FCD = 125$ and $ACD = 180 - 125 (= 55)$
 or $CFG = 180 - 125 (= 55) = ACD$
- M1 for method to find ADC eg $180 - 110 (= 70)$
 or for method to find CAD
 eg $180 - ("70" + "55") (= 55)$ or $110 - "55" (= 55)$
- A1 for $ACD = 55$ and $CAD = 55$
- C1 for one correct parallel lines reason linked to their method
 eg Corresponding angles are equal
Allied angles / Co-interior angles add up to 180
Alternate angles are equal
- C1 for one other reason stated linked to their method
 eg Angles on a straight line add up to 180
Angles in a triangle add up to 180
Vertically opposite angles are equal OR Vertically opposite angles are equal
 The exterior angle of a triangle is equal to the sum of the interior opposite angles.
Angles in a quadrilateral add up to 360. Accept "4-sided shape"

Angles must be clearly labelled on the diagram or otherwise identified.
 Correct method can be implied from angles on the diagram if no ambiguity or contradiction.

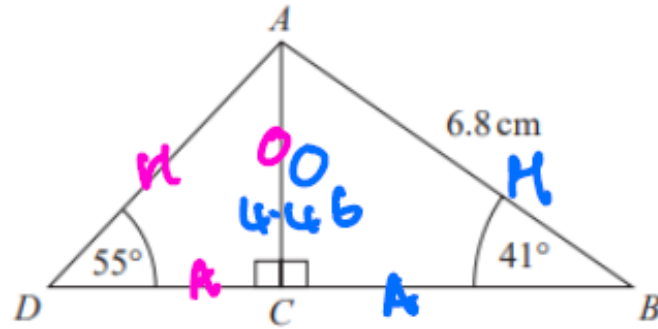
Underlined words need to be shown; reasons need to be linked to their method, which can be implied from correctly identified angles (stated or written on the diagram).

(Total for Question 22 is 5 marks)

Higher P3



- 10 ABD is a triangle.
 C is a point on BD .



Work out the length of DC .
 Give your answer correct to 1 decimal place.

H P3 Q10 Student A

$$\sin 41 = \frac{AC}{6.8}$$

$$AC = 6.8 \times \sin 41 \\ = 4.46 \dots$$

$$\tan 55 = \frac{4.4}{DC}$$

$$DC = \frac{4.4}{\tan 55} = 3.0809 \dots$$

3.1

P1

for using sin to find length of AC , eg $6.8 \times \sin 41$
or a full process to find AC or $(AC =) 4.46 \dots$
or a full process to find AD or $(AD =) 5.44 \dots$

P1

for a complete process to find a relationship involving DC
 eg $\tan 55 = \frac{4.46 \dots}{DC}$ **or** $(DC =) \frac{4.46 \dots}{\tan 55}$ **or** $\cos 55 = \frac{DC}{5.44 \dots}$

A1

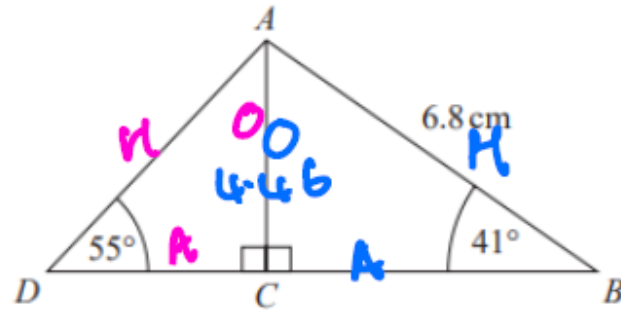
answer in the range 3.1 to 3.2

Accept rounded or truncated figures.

If a correct answer within the range is shown in working but is incorrectly rounded, award full marks

(Total for Question 10 is 3 marks)

- 10 ABD is a triangle.
 C is a point on BD .



Work out the length of DC .
 Give your answer correct to 1 decimal place.

H P3 Q10 Student B

$$\sin 41 = \frac{AC}{6.8} \quad AC = 6.8 \times \sin 41$$

$$= 4.46...$$

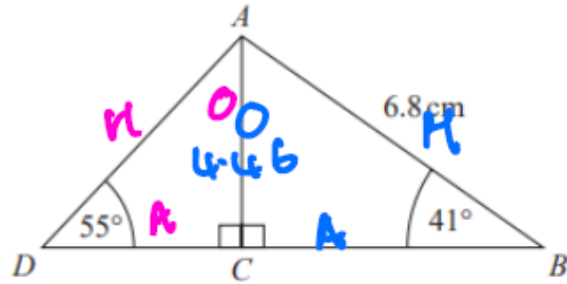
$$\tan 55 = \frac{4.46...}{DC}$$

$$DC = \frac{4.46...}{\tan 55} = 3.1237... \text{ so } 3.1$$

3.1	P1	for using sin to find length of AC , eg $6.8 \times \sin 41$ or a full process to find AC or $(AC =) 4.46...$ or a full process to find AD or $(AD =) 5.44...$	Accept rounded or truncated figures. If a correct answer within the range is shown in working but is incorrectly rounded, award full marks
	P1	for a complete process to find a relationship involving DC eg $\tan 55 = \frac{4.46...}{DC}$ or $(DC =) \frac{4.46...}{\tan 55}$ or $\cos 55 = \frac{DC}{5.44...}$	
	A1	answer in the range 3.1 to 3.2	

(Total for Question 10 is 3 marks)

- 10 ABD is a triangle.
 C is a point on BD .



Work out the length of DC .
 Give your answer correct to 1 decimal place.

H P3 Q10 Student C

$$\sin 41 = \frac{AC}{6.8}$$

$$AC = 6.8 \times \sin 41 \\ = 4.46...$$

$$\tan 55 = \frac{4.5}{DC}$$

$$DC = \frac{4.5}{\tan 55} = 3.1509... \\ 3.2$$

3.1	P1	for using sin to find length of AC , eg $6.8 \times \sin 41$ or a full process to find AC or $(AC =) 4.46...$ or a full process to find AD or $(AD =) 5.44...$	Accept rounded or truncated figures. If a correct answer within the range is shown in working but is incorrectly rounded, award full marks
	P1	for a complete process to find a relationship involving DC eg $\tan 55 = \frac{4.46...}{DC}$ or $(DC =) \frac{4.46...}{\tan 55}$ or $\cos 55 = \frac{DC}{5.44...}$	
	A1	answer in the range 3.1 to 3.2	

(Total for Question 10 is 3 marks)

Prove algebraically that $0.1\dot{2}3$ can be written as $\frac{61}{495}$

H P3 Q20 Student A

$$\begin{aligned} x &= 0.12323 \\ 100x &= 12.32323 \\ \hline 99x &= 12.2 \\ x &= \frac{122}{990} = \frac{61}{495} \end{aligned}$$

Answer	Mark	Mark scheme	Additional guidance
Proof	M1	for $(10x =) 1.2323\dots$ or $(100x =) 12.323\dots$ or $(1000x =) 123.23\dots$	Any recurring notation acceptable throughout. Proofs with terminating decimals (at least 5 figures) score M1M1C0
	M1	(dep M1) for a method using two recurring decimals that leads to a terminating decimal difference, using correct multiples of x eg $(1000x - 10x =) 123.23\dots - 1.23\dots (= 122)$ or $\frac{122}{990}$ or $(100x - x =) 12.323\dots - 0.123\dots (= 12.2)$ or $\frac{12.2}{99}$	
	C1	for completing algebra to $\frac{61}{495}$	

(Total for Question 20 is 3 marks)

Prove algebraically that $0.1\dot{2}3$ can be written as $\frac{61}{495}$

H P3 Q20 Student B

$$\begin{aligned} x &= 0.12323\ldots \\ 100x &= 12.32323\ldots \\ \hline 99x &= 12.2 \\ x &= \frac{122}{990} = \frac{61}{495} \end{aligned}$$

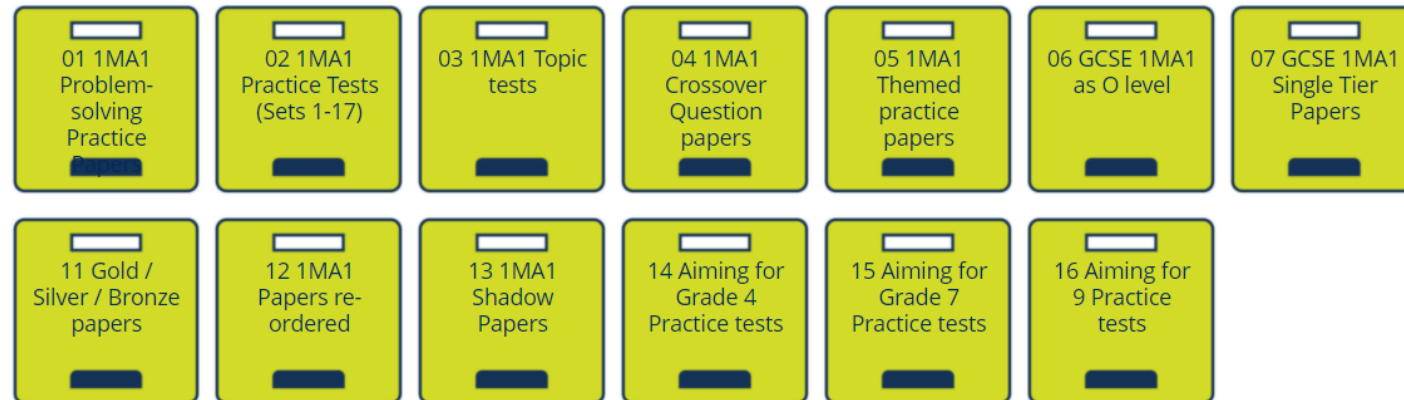
Answer	Mark	Mark scheme	Additional guidance
Proof	M1	for $(10x =) 1.2323\ldots$ or $(100x =) 12.323\ldots$ or $(1000x =) 123.23\ldots$	Any recurring notation acceptable throughout. Proofs with terminating decimals (at least 5 figures) score M1M1C0
	M1	(dep M1) for a method using two recurring decimals that leads to a terminating decimal difference, using correct multiples of x eg $(1000x - 10x =) 123.23\ldots - 1.23\ldots (= 122)$ or $\frac{122}{990}$ or $(100x - x =) 12.323\ldots - 0.123\ldots (= 12.2)$ or $\frac{12.2}{99}$	
	C1	for completing algebra to $\frac{61}{495}$	

(Total for Question 20 is 3 marks)

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Examiners' Reports – H P1

This paper proved accessible to students with many excellent responses seen to the most challenging questions on the paper. It was pleasing to see that most students attempted most of the questions with few left completely blank.

Students were well-prepared for topics such as subtraction of fractions (Q2), scatter graphs (Q6), direct proportion (Q13) and the product rule for counting (Q19). Students often struggled with a correct method to divide by decimals and with division in general. A large number of students had difficulty interpreting the set notation in Q5b and working consistently in terms of π in Q16. Poor algebraic manipulation in Q15, Q16 and Q17 let students down when rearranging formulae and equations. Simplification of surds was an issue for many students in Q16 and Q23.

It was pleasing that many students presented their working clearly and logically. However, answers to some questions, particularly the ratio problem (Q18), changing the subject of a formula (Q17) and finding an inverse function (Q20a) were not as well presented. Attempts were often quite messy with incomplete methods shown which made them difficult for examiners to follow. Centres should advise students to cross out unnecessary working to avoid leaving a choice of methods.

Carelessness in their working proved costly to some students. This carelessness included errors in simple calculations and imprecise notation when working with algebra, for example brackets missing in Q17 and Q23. Being a non-calculator paper there were frequent instances of arithmetic errors, for example $90 \div 30 = 30$ and $\sqrt{25} = 12.5$, which led to a loss of marks. Often, students did not consider whether or not their answer was reasonable – had they done so, they could have spotted and corrected errors. Once again, there were many cases across many different questions of students miscopying their own figures or misreading the numbers in questions.

Examiners' Reports – H P2

There was evidence of good work across the cohort sitting this Higher paper and as such it appears that candidates had been entered for the appropriate tier. Candidates were well prepared and able to access questions throughout the paper. Weaker candidates found success in the first half of the paper and a number of familiar style questions helped throughout.

There was evidence of calculator use from all candidates and it is pleasing to see that centres are ensuring no one is disadvantaged through lack of equipment. Compared to last year, it seems candidates are getting better at using their calculators, but there is still evidence of many rounding prematurely often leading to answers outside of the given range.

It was also good to see candidates taking on advice from previous series and showing their working. Candidates would benefit however from being clearer in their working and structuring it or annotating, rather than the haphazard working we sometimes see.

Examiners' Reports – H P3

Students entered for this examination generally presented their working in a clear and logical way and found that the time allowed for the examination was sufficient for them to complete the paper. Only a small proportion of students presented very weak scripts, suggesting that most students who sat this paper were entered appropriately for the higher tier.

Nearly all students showed enough working to enable examiners to award partial credit where answers were not correct. However, examiners noticed a significant number of occasions where it was difficult to read the candidate's writing, for example where indices were written or when numbers or algebraic expressions were miscopied. Calculators were usually used efficiently to evaluate numerical expressions with accuracy.

All questions were accessible to some students but, as expected, only the higher attaining students were able to work with confidence on questions towards the end of the paper. Questions 1 (indices and expansion), 2 (multi stage problem), 3 (geometry), 8 (mass, volume and density), 9 (percentages), 11 (box plots) and 12 (product of three linear expressions) were answered well by a large majority of students whereas questions, 4 (inverse proportionality), 13 (algebraic proof), 15(b) (factorisation), 16 (enlargement), 21 (equation with algebraic fractions) and 22 (vectors) proved more of a challenge for students in the target attainment range.



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