Cambridge Assessment
International Education

Example Candidate Responses
Paper 1

Cambridge O Level
Mathematics (Syllabus D) 4024

For examination from 2018

Version 1.0

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Introduction

The main aim of this booklet is to exemplify standards for those teaching Cambridge O Level Mathematics (Syllabus D) 4024, and to show how different levels of candidates' performance relate to the subject's curriculum and assessment objectives.

In this booklet candidate responses have been chosen from June 2018 scripts to exemplify high, middle or low level answers.

For each question, the response is annotated with a clear explanation of where and why marks were awarded or omitted. This is followed by examiner comments on how the answer could have been improved. In this way, it is possible for you to understand what candidates have done to gain their marks and what they could do to improve their answers. There is also a list of common mistakes candidates made in their answers for each question.

This document provides illustrative examples of candidate work with examiner commentary. These help teachers to assess the standard required to achieve marks beyond the guidance of the mark scheme. Therefore, in some circumstances, such as where exact answers are required, there will not be much comment.

The questions and mark schemes and pre-release material used here are available to download from the School Support Hub. These files are:

June 2018 Question Paper 12

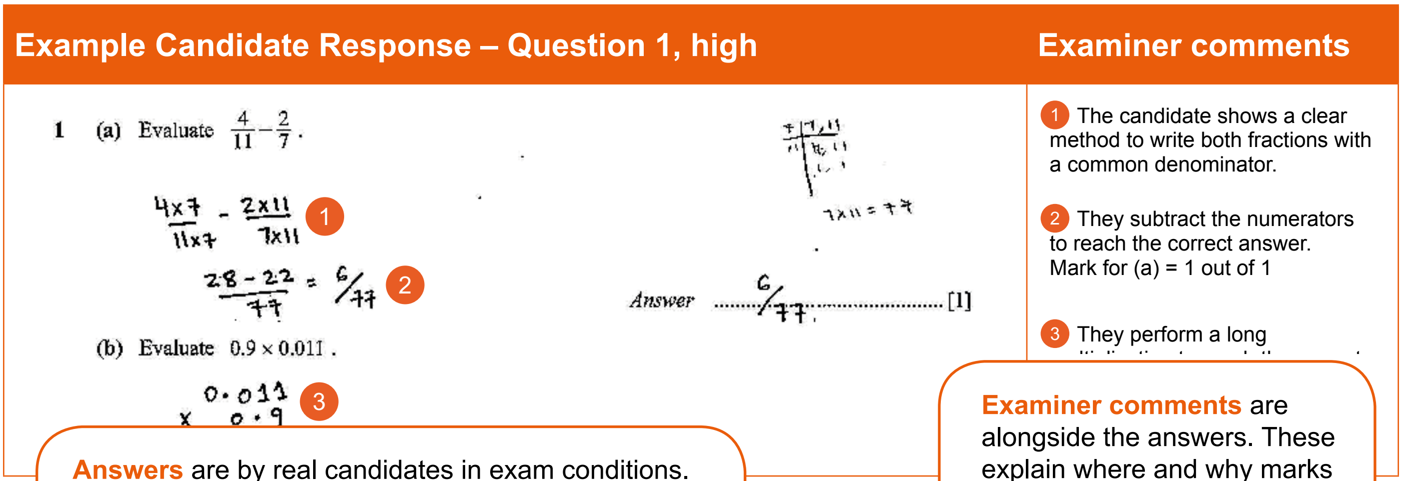
June 2018 Paper 12 Mark Scheme

Past exam resources and other teacher support materials are available on the School Support Hub:

www.cambridgeinternational.org/support

How to use this booklet

This booklet goes through the paper one question at a time, showing you the high-, middle- or low-level response for each question. The candidate answers are set in a table. In the left-hand column are the candidate answers, and in the right-hand column are the examiner comments.



Example Candidate Response – Question 1, high | **Examiner comments**

1 (a) Evaluate $\frac{4}{11}-\frac{2}{7}$.

$\frac{4\times7}{11\times7} - \frac{2\times11}{7\times11}$ ①

$\frac{28-22}{77} = 6/77$ ②

7x11 = 77

Answer 6/77 [1]

(b) Evaluate 0.9 × 0.011 .

$\begin{array}{r} 0.011 \\ \times\ \ 0.9 \end{array}$ ③

① The candidate shows a clear method to write both fractions with a common denominator.

② They subtract the numerators to reach the correct answer.
Mark for (a) = 1 out of 1

③ They perform a long

Answers are by real candidates in exam conditions. These show you the types of answers for each level. Discuss and analyse the answers with your learners in the classroom to improve their skills.

Examiner comments are alongside the answers. These explain where and why marks were awarded. This helps you to interpret the standard of Cambridge exams so you can help your learners to refine their exam technique.

How the candidate could have improved their answer

The candidate could have written the two equivalent fractions as the first step. It was not necessary to show the multiplications leading to these fractions.

This section explains how the candidate could have improved each answer. This helps you to interpret the standard of Cambridge exams and helps your learners to refine their exam technique.

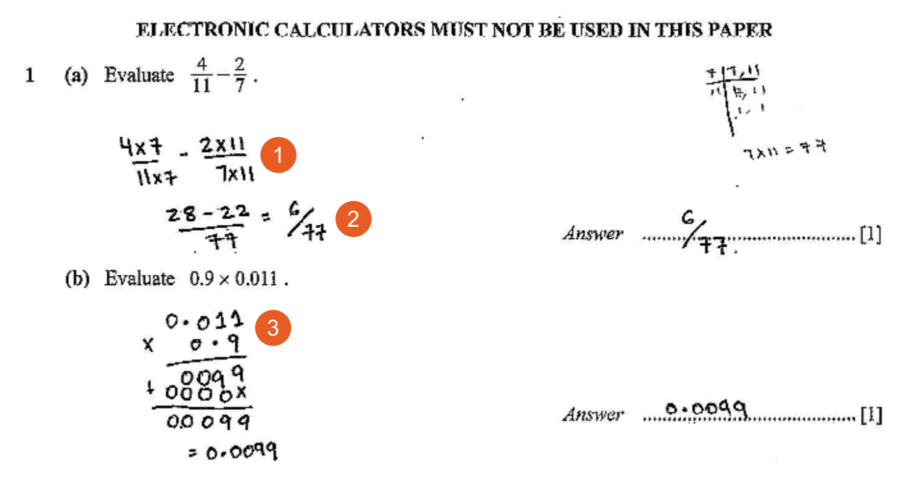
Common mistakes candidates made in this question

They did not write the fractions with a common denominator and simply subtracted the numerators and denominators separately leading to an answer of 2/4.

Often candidates were not awarded marks because they misread or misinterpreted the questions.

Lists the common mistakes candidates made in answering each question. This will help your learners to avoid these mistakes and give them the best chance of achieving the available marks.

Question 1

Example Candidate Response – high	Examiner comments
 ELECTRONIC CALCULATORS MUST NOT BE USED IN THIS PAPER 1 (a) Evaluate $\frac{4}{11}-\frac{2}{7}$. $\frac{4\times7}{11\times7}-\frac{2\times11}{7\times11}$ ① $\frac{28-22}{77}=6/77$ ② $7\times11=77$ *Answer* $6/77$ [1] (b) Evaluate 0.9×0.011. 0.011 $\times\ 0.9$ ③ 0099 $+\ 0000\times$ 00099 $= 0.0099$ *Answer* 0.0099 [1]	① The candidate shows a clear method to write both fractions with a common denominator. ② They subtract the numerators to reach the correct answer. Mark for (a) = 1 out of 1 ③ They perform a long multiplication to reach the correct answer. Mark for (b) = 1 out of 1 **Total mark awarded = 2 out of 2**

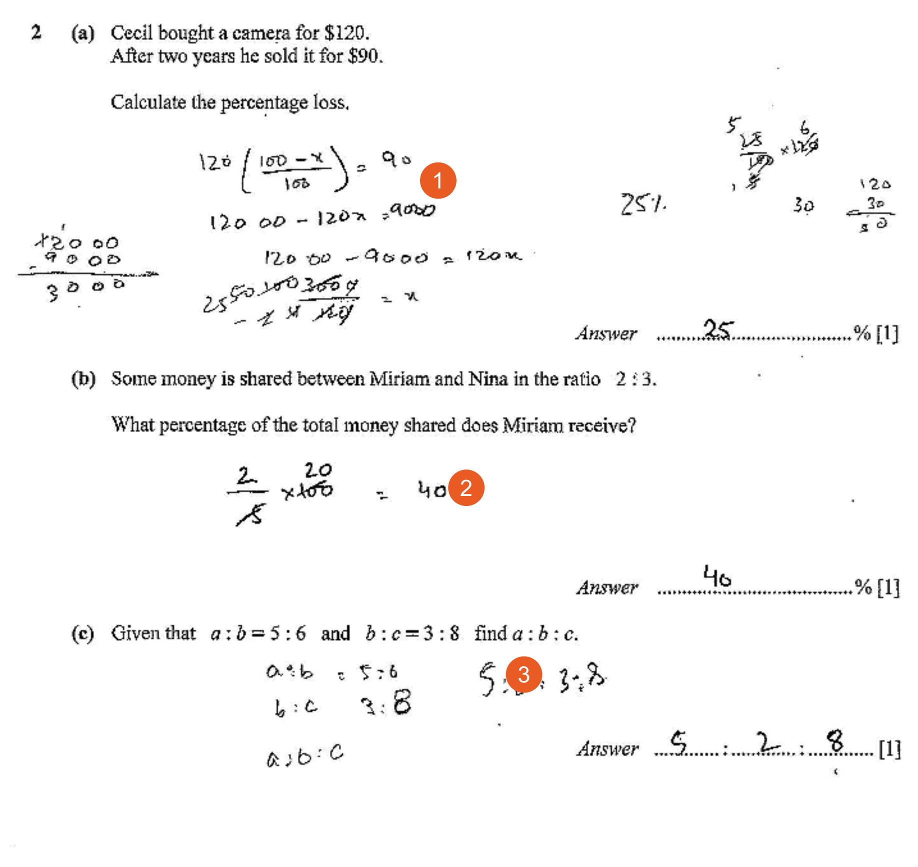
How the candidate could have improved their answer

- The candidate could have written the two equivalent fractions as the first step. It was not necessary to show the multiplications leading to these fractions.
- A more straightforward method would be to multiply 9 by 11 to reach 99 and then make a place value adjustment to arrive at the correct answer of 0.0099.

Common mistakes candidates made in this question

- **(a)** Not writing the fractions with a common denominator and simply subtracted the numerators and denominators separately leading to an answer of $\frac{2}{4}$.
- **(b)**
  - Evaluating 9 × 11 correctly but making errors in the position of the decimal point in their final answer leading to answers such as 9.900 or 00.099.
  - Those candidates who used a long multiplication method often made arithmetic errors and reached an incorrect answer.

Question 2

Example Candidate Response – high	Examiner comments
 **2** **(a)** Cecil bought a camera for $120. After two years he sold it for $90. Calculate the percentage loss. $120\left(\frac{100-x}{100}\right)=90$ ① $12000-120x=9000$ $12000-9000=120x$ $25 \; \frac{3000}{120}=x$ $12000-9000=3000$ 25% $\frac{25}{100}\times 120$ 30 $120-30=90$ *Answer* 25 % [1] **(b)** Some money is shared between Miriam and Nina in the ratio 2 : 3. What percentage of the total money shared does Miriam receive? $\frac{2}{5}\times 100 = 40$ ② *Answer* 40 % [1] **(c)** Given that $a:b=5:6$ and $b:c=3:8$ find $a:b:c$. a:b = 5:6 b:c 3:8 5: ③ 3:8 a:b:c *Answer* 5 : 2 : 8 [1]	① The candidate sets up an equation for the percentage loss and solves it to reach the correct answer. Mark for (a) = 1 out of 1 ② The candidate identifies the correct fraction of the money received by Miriam and converts this to a percentage. Mark for (b) = 1 out of 1 ③ The candidate understands that they need to combine the given ratios to create a 3-term ratio. They are not able to combine the values of (b) correctly to reach the answer. Mark for (c) = 0 out of 1 **Total mark awarded = 2 out of 3**

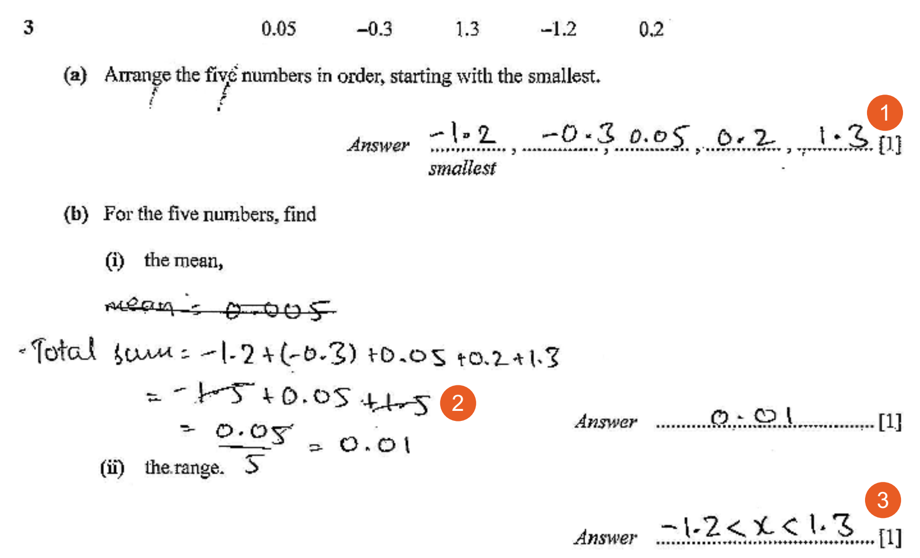
How the candidate could have improved their answer

- The candidate used a very long method in part (a) to reach the correct answer. A more direct approach would have been to subtract the given values to give a loss of $30 and then calculate 30 as a percentage of 120.
- The candidate used an appropriate method to reach the correct answer.
- The candidate should have used equivalent ratios to equate the value of *b* in the two ratios. The simplest approach would be to write *b*:*c* as 6:16. The two ratios could then be combined to give 5:6:16.

Common mistakes candidates made in this question

- **(a)**
  - Finding 90 as a percentage of 120 rather than the percentage loss.
  - Finding the loss as a percentage of 90 rather than of 120.
- **(b)**
  - Giving the answer as a fraction rather than a percentage.
  - Interpreting the ratio incorrectly and used the fraction $\frac{2}{3}$ rather than $\frac{2}{5}$.
- **(c)**
  - Not adjusting the given numbers and gave an answer of $\frac{5}{11}:\frac{6}{11}:\frac{8}{11}$.
  - Adding the two values of *b* leading to 5:9:8.

Question 3

Example Candidate Response – high	Examiner comments
3 0.05 –0.3 1.3 –1.2 0.2 **(a)** Arrange the five numbers in order, starting with the smallest. *Answer* −1.2 , −0.3 0.05 , 0.2 , 1.3 [1] ① *smallest* **(b)** For the five numbers, find (i) the mean, ~~mean = 0.005~~ Total sum = $-1.2+(-0.3)+0.05+0.2+1.3$ $= \cancel{-1.5}+0.05\cancel{+1.5}$ ② $= \frac{0.05}{5} = 0.01$ *Answer* 0.01 [1] (ii) the range. *Answer* $-1.2 < x < 1.3$ [1] ③	① The candidate has ordered the numbers correctly. Mark for (a) = 1 out of 1 ② The candidate shows a correct calculation for the mean leading to the correct answer. Mark for (b)(i) = 1 out of 1 ③ The candidate identifies the highest and lowest values in the list but does not evaluate the range. Mark for (b)(ii) = 0 out of 1 **Total mark awarded = 2 out of 3**

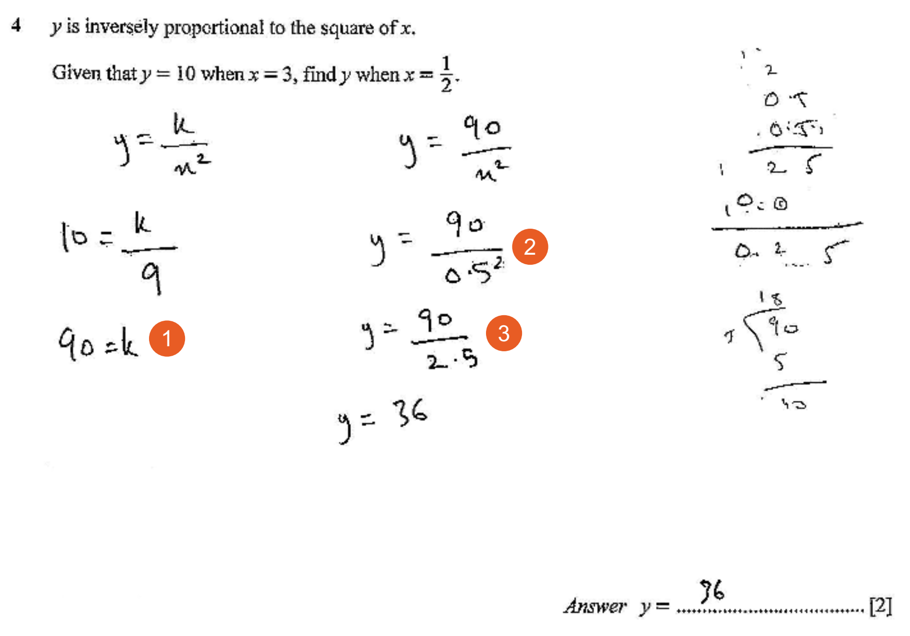
How the candidate could have improved their answer

- **(a)** The candidate ordered the list correctly.
- **(b)** The candidate showed a full method to find the mean that led to the correct answer.
- **(c)** The candidate should have subtracted the highest and lowest values to find the range of 2.5.

Common mistakes candidates made in this question

- **(a)** Considering only the magnitude of the negative numbers and identified –0.3 as smaller than –1.2.
- **(b)**
  - Leaving their answer as $\frac{0.05}{5}$ and did not evaluate this as $\frac{1}{100}$ or 0.01.
  - Making arithmetic errors when adding the numbers.
- **(c)** Not evaluating the range but left the answer in the form –1.2 to 1.3 or $-1.2 < x < 1.3$.

Question 4

Example Candidate Response – middle	Examiner comments
 4 y is inversely proportional to the square of x. Given that $y = 10$ when $x = 3$, find y when $x = \frac{1}{2}$. $y = \frac{k}{x^2}$ $10 = \frac{k}{9}$ $90 = k$ ① $y = \frac{90}{x^2}$ $y = \frac{90}{0.5^2}$ ② $y = \frac{90}{2.5}$ ③ $y = 36$ $0.5 \times 0.5 = 25$, 10.0, 0.25 $5\overline{)90}$ 18, 5, 10 *Answer* $y =$ 36 [2]	① The candidate uses the correct relationship between x and y to find the constant of proportionality. They are awarded B1 for finding $k = 90$. ② They substitute $x = 0.5$ correctly into the proportionality equation. ③ They have made an error when squaring 0.5 so their final answer is incorrect. **Total mark awarded = 1 out of 2**

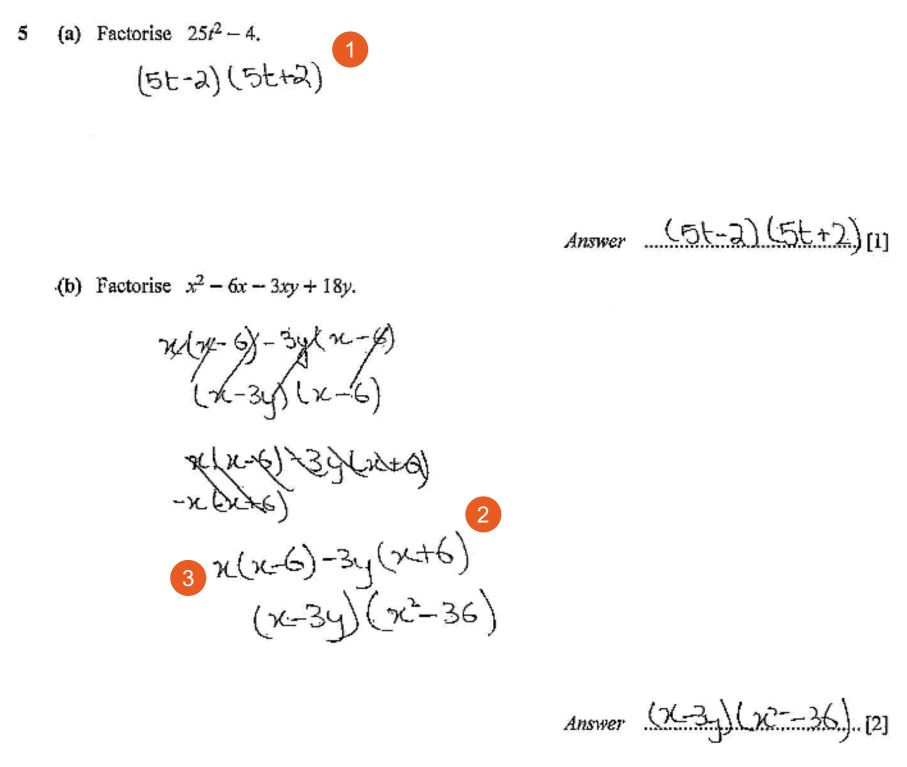
How the candidate could have improved their answer

The candidate showed 0.5 × 0.5 = 0.25 correctly in their working, but then divided 90 by 2.5. If they had divided by 0.25, they would have reached the correct answer as their method was fully correct.

Common mistakes candidates made in this question

- Not being able to square 0.5 correctly.
- After finding $k = 90$, some used $y = \frac{90}{x}$ rather than $y = \frac{90}{x^2}$ to find their answer.
- Using direct proportion rather than inverse proportion.
- Taking y to be inversely proportional to x rather than to x^2.

Question 5

Example Candidate Response – high	Examiner comments
 5 (a) Factorise $25t^2 - 4$. ① $(5t-2)(5t+2)$ Answer $(5t-2)(5t+2)$ [1] (b) Factorise $x^2 - 6x - 3xy + 18y$. ~~$x(x-6) - 3y(x-6)$~~ ~~$(x-3y)(x-6)$~~ ~~$x(x-6) - 3y(x+6)$~~ ~~$-x(x+6)$~~ ② ③ $x(x-6) - 3y(x+6)$ $(x-3y)(x^2-36)$ Answer $(x-3y)(x^2-36)$ [2]	① The candidate identifies this expression as the difference of two squares and factorises it correctly. Mark for (a) = 1 out of 1 ② The candidate identifies common factors in pairs of terms and attempts to factorise into two sets of brackets. ③ They are awarded B1 for a correct factorisation of the first pair of terms. Mark for (b) = 1 out of 2 **Total mark awarded = 2 out of 3**

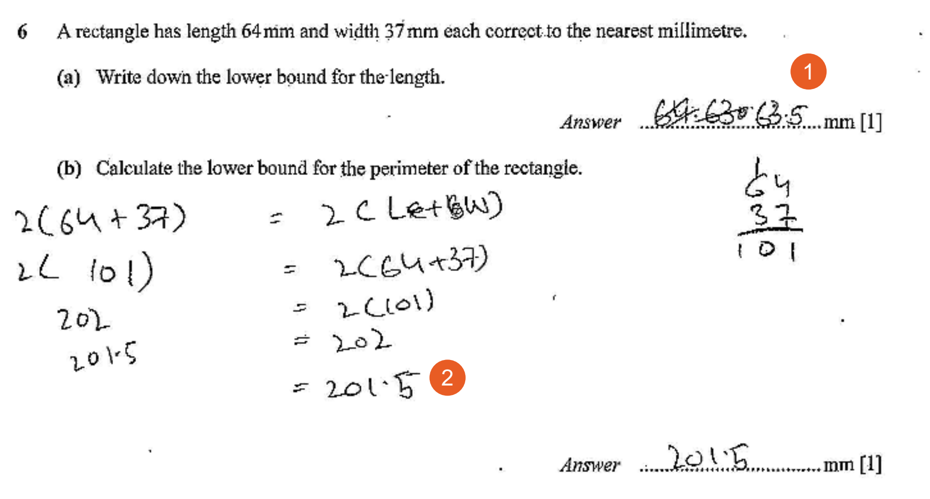
How the candidate could have improved their answer

- **(a)** The candidate factorised the difference of two squares correctly.
- **(b)** The candidate should have identified that taking –3*x* as a factor should have led to (*x* – 6) rather than (*x* + 6) in their second bracket. They would have then been able to simplify this correctly to (*x* – 3*y*)(*x* – 6).

Common mistakes candidates made in this question

- **(a)** Factorising the expression incorrectly to give (5t – 4)(5t + 4), (5t – 2)2 or (25t – 4)(25t + 4).
- **(b)**
  - Not being able to deal with the negative correctly when factorising –3*xy* + 18*y*.
  - Reaching the correct answer of (*x* – 6)(*x* – 3*y*), but then went on to try to find solutions for the equation (*x* – 6)(*x* – 3*y*) = 0.

Question 6

Example Candidate Response – middle	Examiner comments
 6 A rectangle has length 64 mm and width 37 mm each correct to the nearest millimetre. (a) Write down the lower bound for the length. ① *Answer* ~~64~~ ~~63~~ 63.5 mm [1] (b) Calculate the lower bound for the perimeter of the rectangle. 2(64 + 37) = 2(Le+BW) 2(101) = 2(64+37) 202 = 2(101) 201.5 = 202 = 201.5 ② 64 37 101 *Answer* 201.5 mm [1]	① The candidate has made several attempts but decides on the correct answer for the lower bound of the length. Mark for (a) = 1 out of 1 ② The candidate finds the perimeter of the rectangle and then attempts to adjust to give the lower bound. Mark for (b) = 0 out of 1 **Total mark awarded = 1 out of 2**

How the candidate could have improved their answer

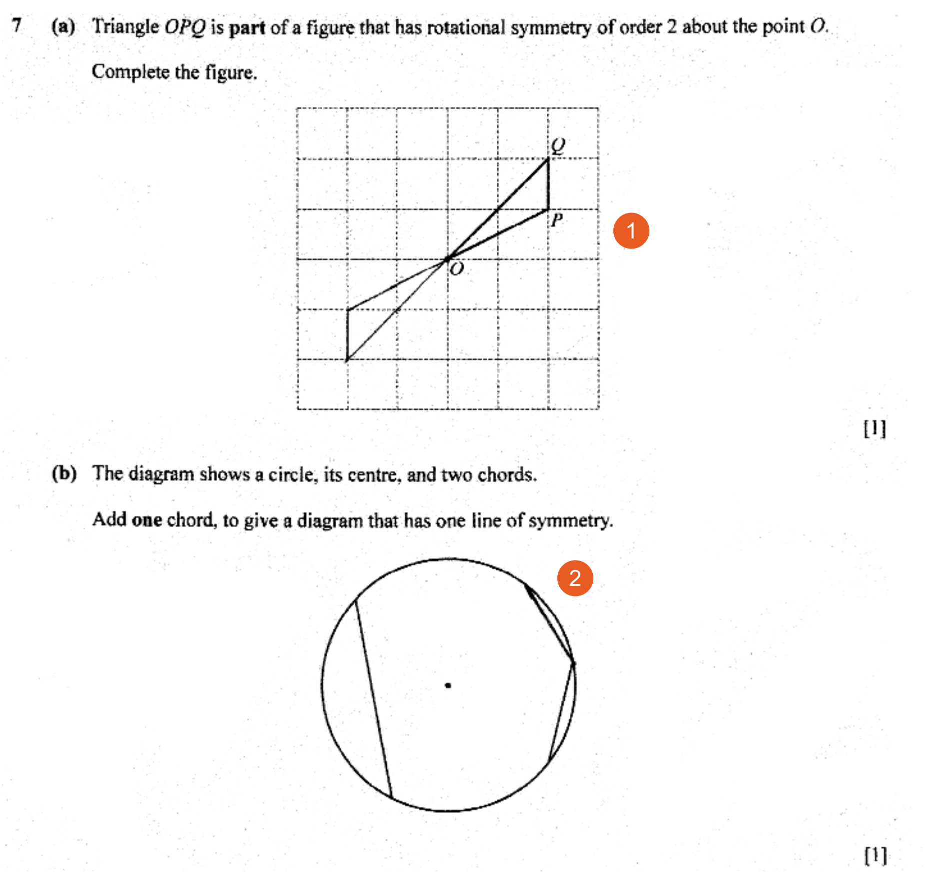
- **(a)** The candidate demonstrated that they understood that a length accurate to the nearest millimetre has a lower bound of the value 0.5 below that length.
- **(b)** The candidate should have found the lower bound of the length and width first and then used these values to find the perimeter of the rectangle.

Common mistakes candidates made in this question

- **(a)** Giving a lower bound of 63 mm, 1 mm lower than the given length rather than 0.5 mm lower.
- **(b)**
  - Finding the perimeter using the given lengths and adjusted this by 0.5 mm rather than adjusting the values before calculating the perimeter.
  - Adding the lower bounds of the length and width and did not double their answer to find the perimeter.

Question 7

Example Candidate Response – high



7 **(a)** Triangle *OPQ* is **part** of a figure that has rotational symmetry of order 2 about the point *O*.

Complete the figure.

[1]

(b) The diagram shows a circle, its centre, and two chords.

Add **one** chord, to give a diagram that has one line of symmetry.

[1]

Examiner comments

① The candidate has completed the diagram correctly to give rotational symmetry of order 2.
Mark for (a) =1 out of 1

② The candidate has added one chord to give a diagram that is approximately correct.
Mark for (b) = 1 out of 1

Total mark awarded =
2 out of 2

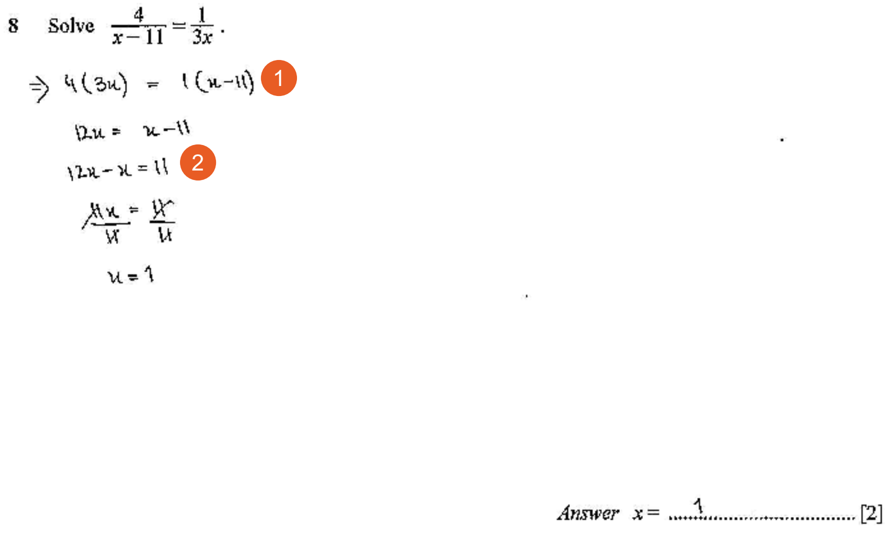
How the candidate could have improved their answer

- **(a)** The candidate demonstrated that they understood rotational symmetry and were able to complete the diagram correctly.
- **(b)** The candidate made a clear attempt to produce a diagram with one line of symmetry. If they had started by drawing a line of symmetry from the midpoint of one of the given chords through the centre of the circle, they would have been able to use this to help them identify the position of their chord with greater accuracy.

Common mistakes candidates made in this question

- **(a)**
  - Using an incorrect centre of rotation, usually the midpoint of *OQ*.
  - Producing a diagram with line symmetry rather than rotational symmetry.
  - Producing a diagram with rotational symmetry of order 3 or 4.
- **(b)**
  - Drawing a line joining the end of one chord to the end of the other chord.
  - Drawing another chord that did not meet either of the given chords.

Question 8

Example Candidate Response – middle	Examiner comments
 8 Solve $\frac{4}{x-11} = \frac{1}{3x}$. $\Rightarrow 4(3x) = 1(x-11)$ ① $12x = x-11$ $12x - x = 11$ ② $\frac{\cancel{11}x}{\cancel{11}} = \frac{\cancel{11}}{\cancel{11}}$ $x = 1$ *Answer* $x =$ 1 [2]	① The candidate eliminates the fraction correctly and is awarded M1 at this point. ② They collect the *x* terms on the left-hand side of the equation correctly but omit the negative on the right-hand side, leading to an incorrect final answer. **Total mark awarded = 1 out of 2**

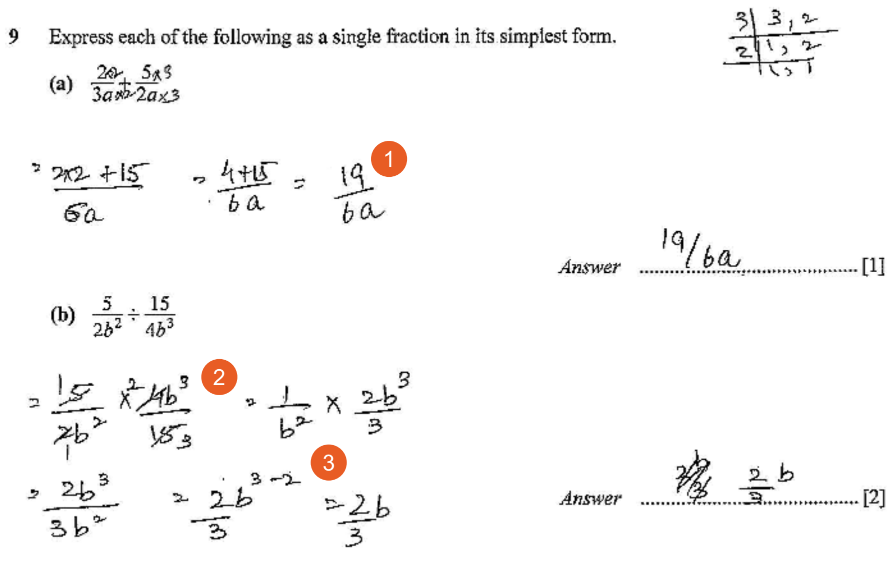
How the candidate could have improved their answer

The candidate showed all the stages of their working clearly which allowed a method mark to be awarded for a correct stage of working seen. In the third line where they collected terms, they wrote 11 rather than –11 which led to the answer of $x = 1$ rather than $x = –1$. If the candidate had checked their answer by substituting $x = 1$ back into the original equation they could have identified that their answer was incorrect and then checked their working to find and correct the error.

Common mistakes candidates made in this question

- Making sign errors when collecting terms leading to $x = 1$ or $x = -\frac{11}{13}$.
- Attempting to use a common denominator which gave a more complex equation and usually led to errors in rearrangement.

Question 9

Example Candidate Response – high	Examiner comments
 9 Express each of the following as a single fraction in its simplest form. $3 \mid 3, 2$ $2 \mid 1, 2$ $\quad 1, 1$ (a) $\frac{2\times2}{3a\times2}+\frac{5\times3}{2a\times3}$ $=\frac{2\times2+15}{6a} = \frac{4+15}{6a} = \frac{19}{6a}$ ① Answer 19/6a [1] (b) $\frac{5}{2b^2}\div\frac{15}{4b^3}$ $=\frac{\cancel{5}^{1}}{\cancel{2}_{1}b^2}\times\frac{\cancel{4}^{2}b^3}{\cancel{15}_{3}}$ ② $=\frac{1}{b^2}\times\frac{2b^3}{3}$ $=\frac{2b^3}{3b^2} = \frac{2b^{3-2}}{3}$ ③ $=\frac{2b}{3}$ Answer ~~$\frac{2b}{3}$~~ $\frac{2}{3}b$ [2]	① The candidate uses a common denominator and adds the fractions leading to the correct answer. Mark for (a) = 1 out of 1 ② The candidate inverts the second fraction and shows the correct product. They start by cancelling the numerical terms and then multiply the fractions. ③ The candidate uses index laws to simplify the terms in (b) to reach the correct answer. Mark for (b) = 2 out of 2 **Total mark awarded = 3 out of 3**

How the candidate could have improved their answer

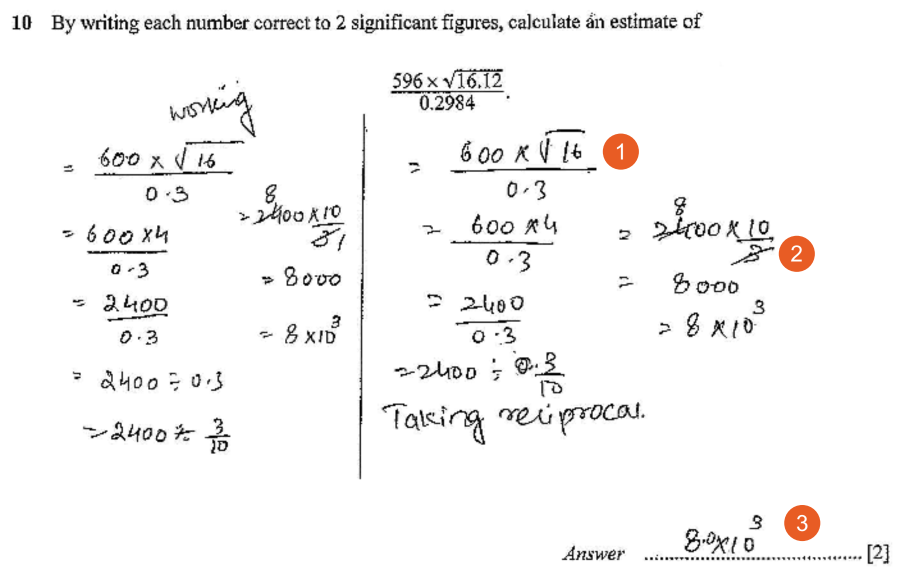
- **(a)** The candidate showed a complete correct method leading to the answer.
- **(b)** The candidate partially cancelled the fractions before multiplying them together. If they had cancelled the *b* terms at this stage, they would not have had to do a second stage of cancelling to reach a fully simplified answer.

Common mistakes candidates made in this question

- **(a)** Not simplifying their answer and left it as $\frac{19a}{6a^2}$.
- **(b)**
  - Not fully simplifying their answer and left it as $\frac{20b^3}{30b^2}$, for example.
  - Making errors in cancelling, usually with the *b* terms.

Question 10

Example Candidate Response – high



10 By writing each number correct to 2 significant figures, calculate an estimate of

$$\frac{596 \times \sqrt{16.12}}{0.2984}.$$

working

$= \frac{600 \times \sqrt{16}}{0.3}$

$= \frac{600 \times 4}{0.3}$

$= \frac{2400}{0.3}$

$= 2400 \div 0.3$

$= 2400 \div \frac{3}{10}$

$= \overset{8}{\cancel{24}}00 \times \frac{10}{\cancel{3}_{1}}$

$= 8000$

$= 8 \times 10^{3}$

$= \frac{600 \times \sqrt{16}}{0.3}$ ①

$= \frac{600 \times 4}{0.3}$

$= \frac{2400}{0.3}$

$= 2400 \div \cancel{0.}\frac{3}{10}$

Taking reciprocal.

$= \overset{8}{\cancel{24}}00 \times \frac{10}{\cancel{3}}$ ②

$= 8000$

$= 8 \times 10^{3}$

Answer 8.0×10^{3} ③ [2]

Examiner comments

① The candidate starts by rounding each value correct to 2 significant figures as the question requires.

② The candidate shows all the stages in their calculation and reaches the correct answer.

③ The candidate converts their answer to standard form and gives this as the final answer.

Total mark awarded = 2 out of 2

How the candidate could have improved their answer

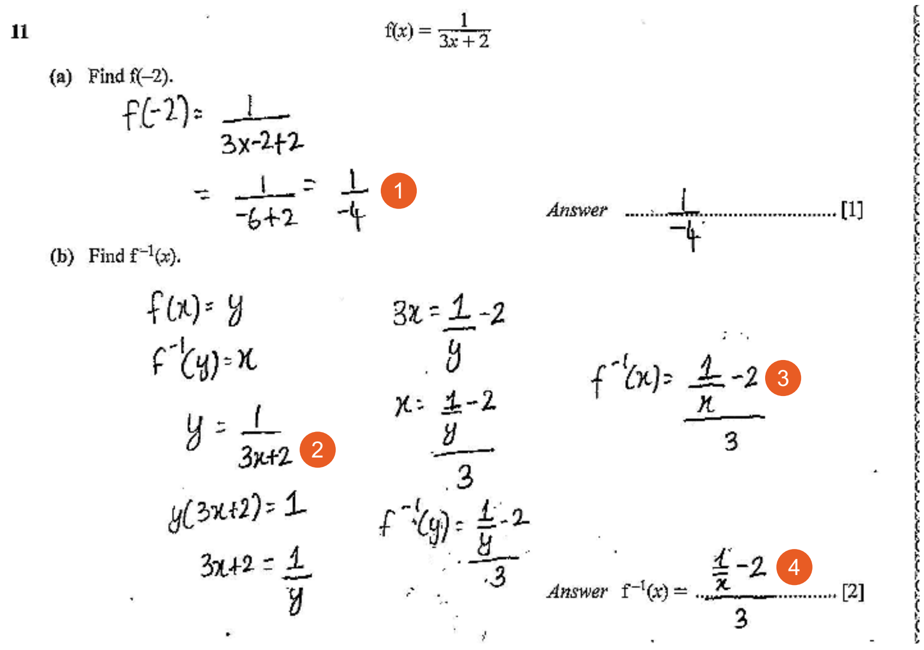
- This candidate showed their full method twice, which was unnecessary. Both methods were correct, however, it would have been better if the candidate had indicated clearly which method was the one they wanted to be marked as one method may have contained errors.
- This candidate reached the correct answer of 8000, but then converted this to standard form. This stage was not required, and if it had been done incorrectly, the candidate would not have gained full credit even though a correct answer had been seen in their working.

Common mistakes candidates made in this question

- Not being able to round to 2 significant figures correctly and 590 or 60 were sometimes used in place of 600 and 0.29 in place of 0.30.
- Not being able to divide by 0.30 leading to answers such as 800 rather than 8000.
- Attempting long division or long multiplication with the values given in the question rather than rounding them before performing the calculation.

Question 11

Example Candidate Response – high



11 $f(x) = \frac{1}{3x+2}$

(a) Find f(–2).

$f(-2) = \frac{1}{3x-2+2}$

$= \frac{1}{-6+2} = \frac{1}{-4}$ ①

Answer $\frac{1}{-4}$ [1]

(b) Find $f^{-1}(x)$.

$f(x) = y$

$f^{-1}(y) = x$

$y = \frac{1}{3x+2}$ ②

$y(3x+2) = 1$

$3x+2 = \frac{1}{y}$

$3x = \frac{1}{y} - 2$

$x = \frac{\frac{1}{y} - 2}{3}$

$f^{-1}(y) = \frac{\frac{1}{y} - 2}{3}$

$f^{-1}(x) = \frac{\frac{1}{x} - 2}{3}$ ③

Answer $f^{-1}(x) = \frac{\frac{1}{x} - 2}{3}$ ④ [2]

Examiner comments

① The candidate substitutes $x = -2$ correctly to evaluate f(–2).
Mark for (a) = 1 out of 1

② They use $y = f(x)$ and start to rearrange correctly to find x in terms of y. At this point they have shown a correct stage of rearrangement and are awarded M1.

③ When they reach a formula for x in terms of y, they replace y with x to reach the inverse function.

④ Their final answer contains a fraction in the numerator.
Mark for (b) = 1 out of 2

Total mark awarded = 2 out of 3

How the candidate could have improved their answer

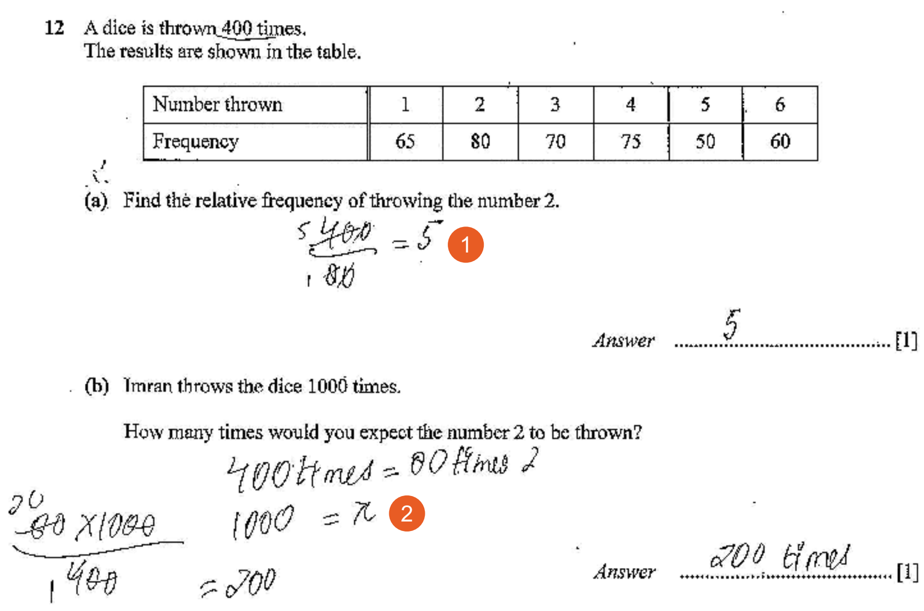
- **(a)** The candidate could have given their answer as $-\frac{1}{4}$, rather than leaving the negative sign in the denominator.
- **(b)** The candidate rearranged the function correctly, however, it is not acceptable to leave fractions in either the numerator or denominator of a fraction as a final answer.
- When the candidate reached $3x = \frac{1}{y} - 2$, the next step should have been to divide each term by 3 resulting in $x = \frac{1}{3y} - \frac{2}{3}$. This would have led to the acceptable answer of $f^{-1}(x) = \frac{1}{3x} - \frac{2}{3}$.

Common mistakes candidates made in this question

- Leaving answers in terms of y rather than x.
- Giving an answer containing a fraction in the numerator.
- Some candidates were unable to manipulate the algebraic fraction correctly.
- Making sign errors when rearranging.

Question 12

Example Candidate Response – middle



12 A dice is thrown 400 times.
The results are shown in the table.

Number thrown	1	2	3	4	5	6
Frequency	65	80	70	75	50	60

(a) Find the relative frequency of throwing the number 2.

$\frac{\cancel{400}^{5}}{\cancel{80}_{1}} = 5$ ①

Answer 5 [1]

(b) Imran throws the dice 1000 times.

How many times would you expect the number 2 to be thrown?

400 times = 80 times 2

1000 = x ②

$\frac{\cancel{80}^{20} \times 1000}{\cancel{400}_{1}} = 200$

Answer 200 times [1]

Examiner comments

① The candidate attempts to relate 80 and 400 to find the relative frequency.
Mark for (a) = 0 out of 1

② Despite not finding the correct relative frequency in part (a), they use proportion correctly to find the expected number of 2s thrown.
Mark for (b) = 1 out of 1

Total mark awarded =
1 out of 2

How the candidate could have improved their answer

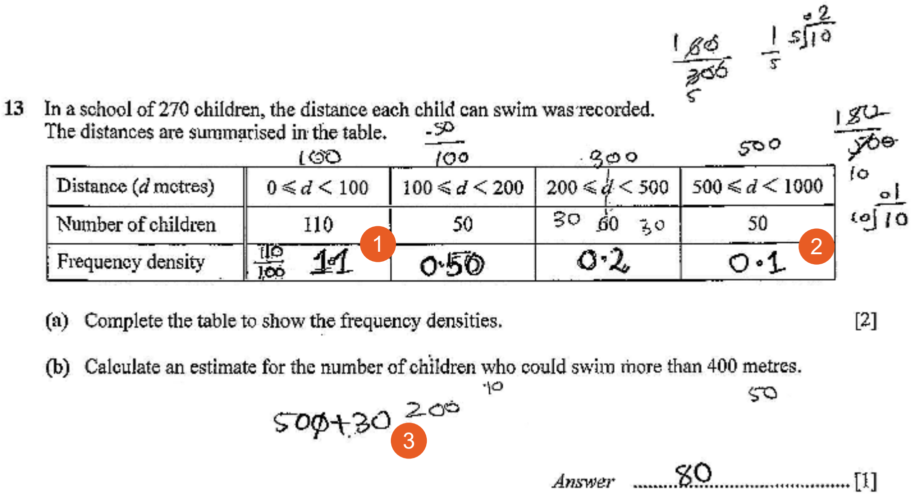
- **(a)** If this candidate had understood that relative frequency must be between 0 and 1, they would have realised that their answer could not be correct. They could have then divided these values correctly to give the answer $\frac{80}{400}$ or 0.2.
- **(b)** The candidate demonstrated that they understood how to find the expected outcome, even although they did not understand the term relative frequency.

Common mistakes candidates made in this question

- Part **(a)**
  - Often giving the answer of the frequency, 80, rather than the relative frequency, $\frac{80}{400}$.
  - Dividing the total frequency, 400, by the frequency of throwing a 2.
  - Giving a correct fraction, $\frac{80}{400}$, but simplified it incorrectly.
- Part **(b)** Candidates gave a fractional answer such as $\frac{200}{1000}$.

Question 13

Example Candidate Response – high



$\frac{180}{300}$ 5 $\frac{1}{5}$ 5)10 0.2

13 In a school of 270 children, the distance each child can swim was recorded.
The distances are summarised in the table.   -50 / 100

Distance (*d* metres)	$0 \leqslant d < 100$	$100 \leqslant d < 200$	$200 \leqslant d < 500$	$500 \leqslant d < 1000$
Number of children	110	50	30 60 30	50
Frequency density	$\frac{110}{100}$ 11 ①	0·50	0·2	0·1 ②

100   300   500 $\frac{180}{500}$ 10   10)10 0.1

(a) Complete the table to show the frequency densities. [2]

(b) Calculate an estimate for the number of children who could swim more than 400 metres.

500+30 ③ 200   10   50

Answer ....80........ [1]

Examiner comments

① The candidate gives two alternative answers for this frequency density, but they are equivalent so this is acceptable.

② The other three frequency densities are written clearly and are correct.
Mark for (a) = 2 out of 2

③ They have estimated that the number who can swim between 400 and 500 metres is 30, half of the number in that interval. They have added this to the number in the 500 to 1000 interval.
Mark for (b) = 0 out of 1

Total mark awarded =
2 out of 3

How the candidate could have improved their answer

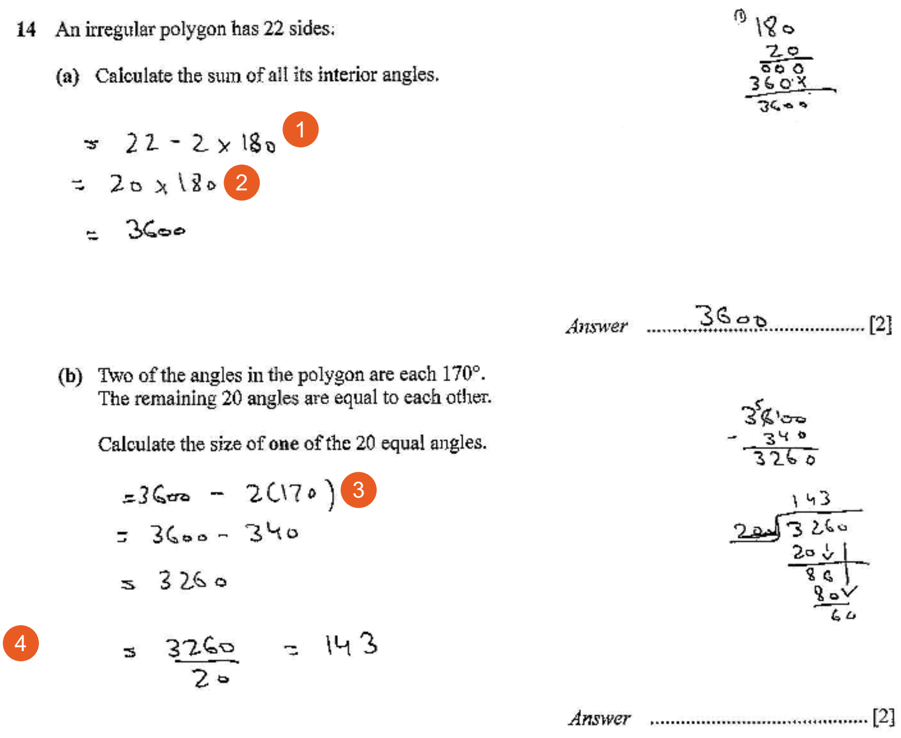
- **(a)** The candidate should have clearly indicated which value was their frequency density for $0 \leqslant d < 100$. If one of these values had been incorrect, the candidate would have been awarded B1 for the correct frequency densities for the other three groups.
- **(b)** The candidate should have used proportion to find the number of children in the range 400 to 500 metres. They needed to use the group width of 300, which gave $\frac{1}{3}$ of the 60 children, or 20, in that range. They should then have added 20 to the 50 in the final group to give an estimate of 70.

Common mistakes candidates made in this question

- **(a)**
  - Dividing the frequencies by 270, the total number of children, rather than by the group widths.
  - Multiplying the frequencies by the group widths.
  - Dividing by the midpoint of the group.
  - Using a group width of 100 for all the groups.
- **(b)** Not using proportion to find the number of children in the range 400 to 500, and common answers were 60, 80 or 110.

Question 14

Example Candidate Response – high



14 An irregular polygon has 22 sides.

(a) Calculate the sum of all its interior angles.

$= 22 - 2 \times 180$ ①

$= 20 \times 180$ ②

$= 3600$

180
$\underline{20}$
000
$\underline{3600 \times}$
3600

Answer 3600 [2]

(b) Two of the angles in the polygon are each 170°.
The remaining 20 angles are equal to each other.

Calculate the size of **one** of the 20 equal angles.

$= 3600 - 2(170)$ ③

$= 3600 - 340$

$= 3260$

④ $= \frac{3260}{20} = 143$

3600
$\underline{-\ 340}$
3260

143
$20 \overline{)3260}$
20
86
80
60

Answer .... [2]

Examiner comments

① The candidate does not include brackets around (22 – 2) in the first line of working.

② They correct the error in the line above, and perform the subtraction before multiplying. They reach the correct answer.
Mark for (a) = 2 out of 2

③ They subtract the two angles of 170 from the total of the interior angles.

④ The candidate attempts to divide 3260 by 20 but make an arithmetic error. They have shown a full method, so are awarded M1 at this stage.
Mark for (b) = 1 out of 2

Total mark awarded =
3 out of 4

How the candidate could have improved their answer

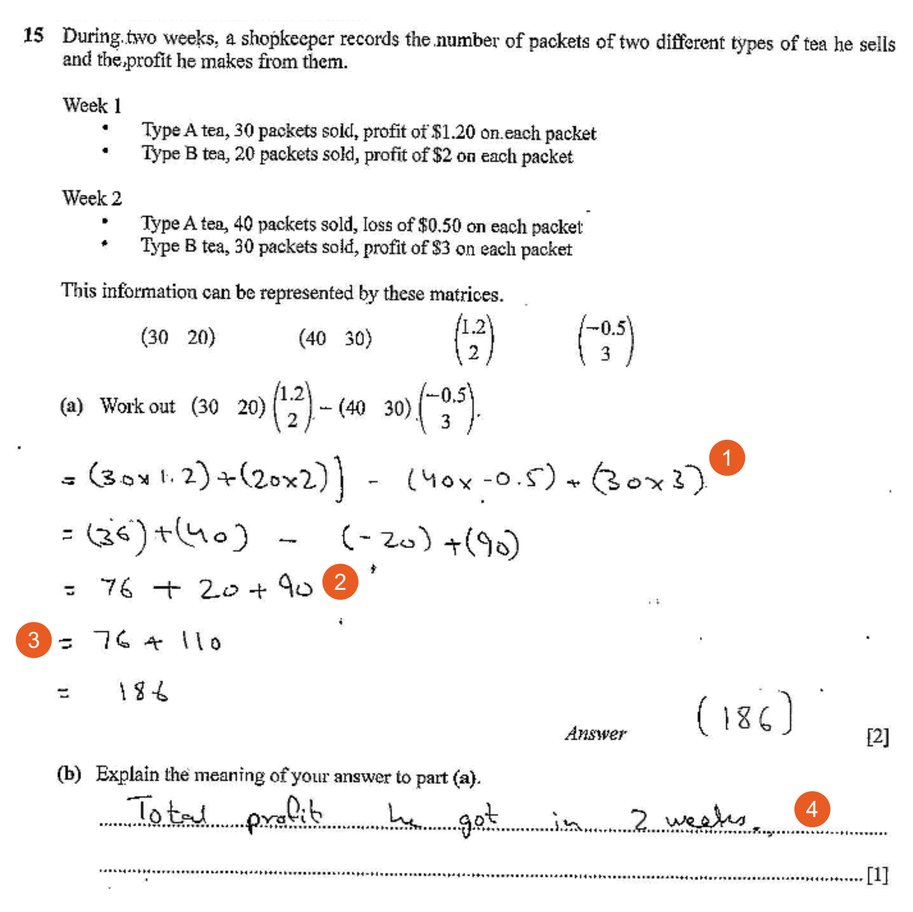
- **(a)** The candidate should have shown (22 – 2) × 180 as their first line. Their omission of brackets could have led to them reaching an incorrect answer.
- **(b)** The candidate could have checked the answer to their division. A simple check of multiplying 143 by 20 to give 2860 would have identified the error.

Common mistakes candidates made in this question

- **(a)**
  - Correctly calculating 3600 but then dividing by 22 to find the size of one interior angle in a regular 22-sided polygon.
  - Finding 22 × 180 or 21 × 180 rather than 20 × 180.
- **(b)**
  - Not using the angle total found in the previous part, but using a different total, often 360.
  - Misreading the question and only including one angle of 170°.
  - Misinterpreting the question and found the interior angle of a regular 20-sided polygon.

Question 15

Example Candidate Response – low



15 During two weeks, a shopkeeper records the number of packets of two different types of tea he sells and the profit he makes from them.

Week 1
- Type A tea, 30 packets sold, profit of $1.20 on each packet
- Type B tea, 20 packets sold, profit of $2 on each packet

Week 2
- Type A tea, 40 packets sold, loss of $0.50 on each packet
- Type B tea, 30 packets sold, profit of $3 on each packet

This information can be represented by these matrices.

$$(30\quad 20) \qquad (40\quad 30) \qquad \begin{pmatrix}1.2\\2\end{pmatrix} \qquad \begin{pmatrix}-0.5\\3\end{pmatrix}$$

(a) Work out $(30\quad 20)\begin{pmatrix}1.2\\2\end{pmatrix} - (40\quad 30)\begin{pmatrix}-0.5\\3\end{pmatrix}$.

$= (30\times1.2)+(20\times2)] - (40\times-0.5)+(30\times3)$ ①

$= (36)+(40) - (-20)+(90)$

$= 76 + 20 + 90$ ②

③ $= 76 + 110$

$= 186$

Answer (186) [2]

(b) Explain the meaning of your answer to part (a).

Total profit he got in 2 weeks. ④

[1]

Examiner comments

① The candidate has attempted the correct method for multiplying these matrices. They have not put brackets around the product of the second pair of matrices.

② This line should be 76 + 20 - 90.

③ They are awarded B1 for 76 which is the correct product for the first pair of matrices.
Mark for (a) = 1 out of 2

④ They identify that the answer relates to the profit gained in two weeks, but have incorrectly identified it as a total rather than a difference.
Mark for (b) = 0 out of 1

Total mark awarded = 1 out of 3

How the candidate could have improved their answer

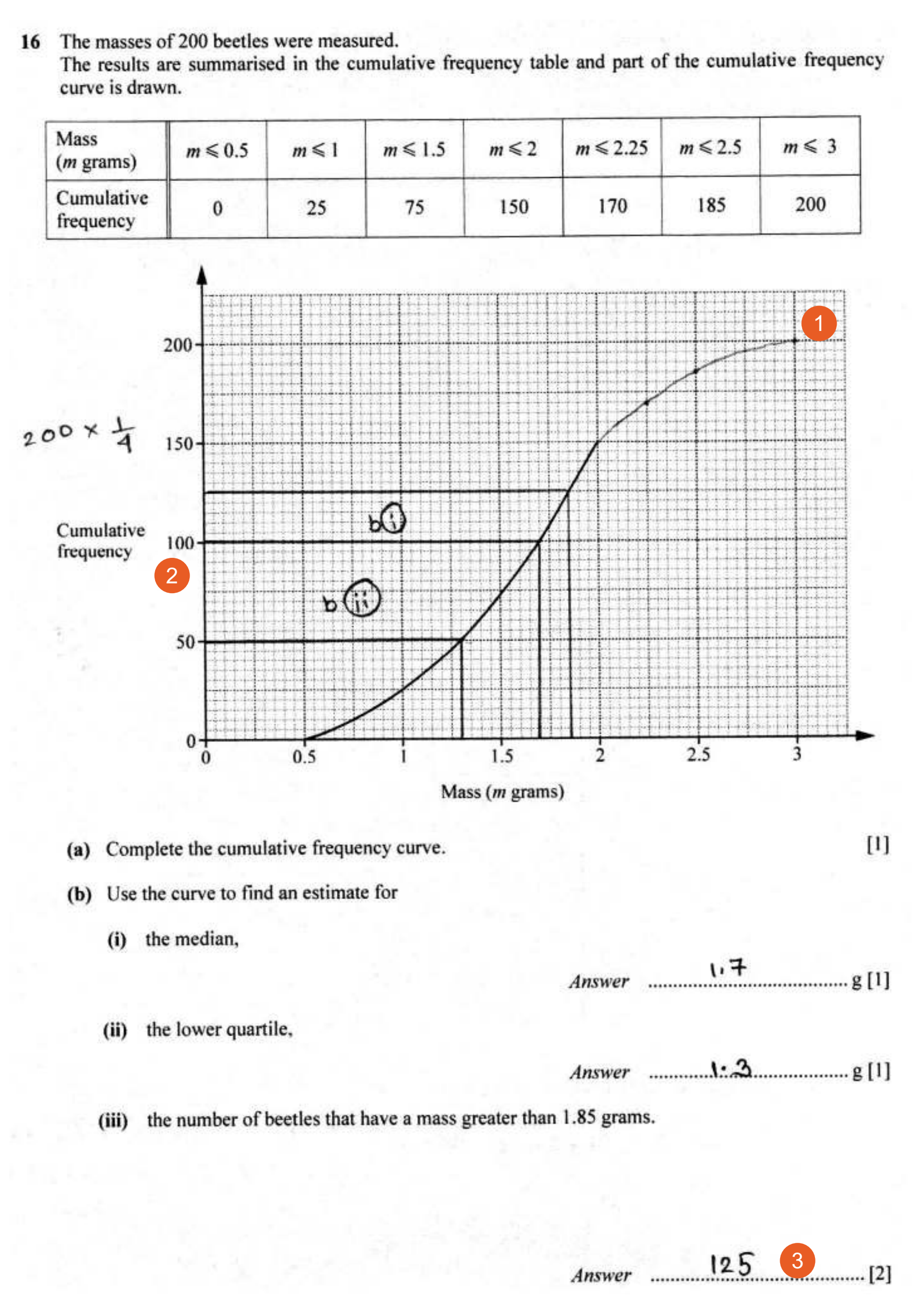
In part **(a)**, the candidate understood the correct process for multiplying these matrices and multiplied 40 by –0.5 correctly. If they had put a bracket around the result of the second product, (40 × –0.5 + 30 × 3) they would have evaluated this as 70 rather than 110. This would then have led to (76 – 70) and the correct answer of (6).

Common mistakes candidates made in this question

- **(a)**
  - Making errors when multiplying by a decimal or a negative value.
  - Multiplying the elements of the matrices incorrectly leading to the answer $\begin{pmatrix}56\\50\end{pmatrix}$ or $(56\quad 50)$ or a 2 by 2 matrix.
- **(b)**
  - Giving an explanation that was vague and did not include the key ideas of difference, profit and weeks.
  - Identifying it as a total rather than a difference.

Question 16

Example Candidate Response – high



16 The masses of 200 beetles were measured.
The results are summarised in the cumulative frequency table and part of the cumulative frequency curve is drawn.

Mass (m grams)	$m \leqslant 0.5$	$m \leqslant 1$	$m \leqslant 1.5$	$m \leqslant 2$	$m \leqslant 2.25$	$m \leqslant 2.5$	$m \leqslant 3$
Cumulative frequency	0	25	75	150	170	185	200

(a) Complete the cumulative frequency curve. [1]

(b) Use the curve to find an estimate for

(i) the median,

Answer 1.7 g [1]

(ii) the lower quartile,

Answer 1.3 g [1]

(iii) the number of beetles that have a mass greater than 1.85 grams.

Answer 125 ③ [2]

Examiner comments

① The candidate has plotted the points correctly and joined with a smooth curve.
Mark for (a) = 1 out of 1

② They have indicated where they are reading the values for their answers to part (b).
Mark for (b)(i) = 1 out of 1
Mark for (b)(ii) = 1 out of 1

③ They have read the graph at the correct point for a mass of 1.85 grams so are awarded B1 for the reading of 125.
Mark for (b)(iii) = 1 out of 2

Total mark awarded =
4 out of 5

How the candidate could have improved their answer

- **(a)** The candidate showed accurate plots for the required points and joined them with a correct curve.
- **(b)(i)** and **(ii)** they read values off the graph correctly to find the median and lower quartile.
- **(b)(iii)** The candidate read the cumulative frequency for 1.85 grams correctly as 125. The question asked for the number of beetles with a mass greater than this, so they should have subtracted 125 from 200 to reach the answer of 75.

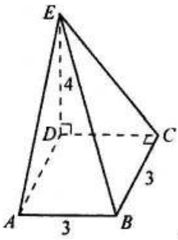
Common mistakes candidates made in this question

- **(a)**
  - Misinterpreting the scale and plotted points in the wrong vertical position.
  - Continuing the curve beyond $m = 3$.
- **(b)**
  - Having identified the correct cumulative frequencies, candidates misread the horizontal scale when finding the median and lower quartile.
  - Finding the number of beetles with a mass less than 1.85 grams rather than greater than 1.85 grams.
  - Misreading the vertical scale.

Question 17

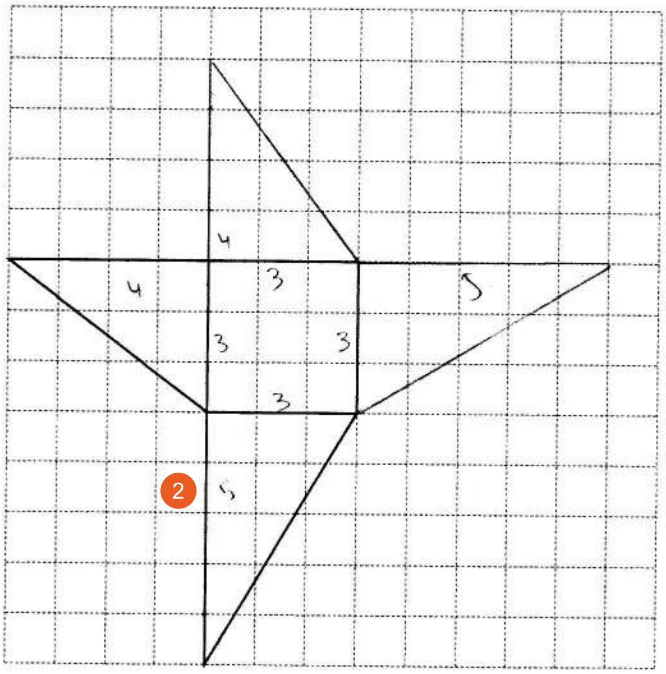
Example Candidate Response – high

17 The diagram shows a pyramid.
The square base, *ABCD*, has an edge of 3 cm.
The base is horizontal, and vertex *E* is vertically above *D*, where *ED* = 4 cm.



①

(a) On the grid below, complete the accurate drawing of a net of the pyramid.
Do **not** draw outside the grid.



[2]

(b) Calculate the **total** surface area of the pyramid.

$\frac{1}{2}\times b\times h$

$= \frac{1}{\cancel{2}}\times 3\times \overset{2}{\cancel{4}} = 6\times 2 = 12$

$\frac{1}{2}\times b\times h$

$= \frac{1}{2}\times 3\times 5 = \frac{15}{2} = 7.5\times 2 = 15$ ③

$$\begin{array}{r} 15\\ +\ 12\\ \hline 27\end{array}$$

Answer ....27........cm² [2]

Examiner comments

① The candidate has identified that a right-angled triangle with base 3 and height 4 will have a hypotenuse of 5.

② They use this hypotenuse to decide that the height of the other two triangles must be 5 to allow the edges of the net to join.
Mark for (a) = 2 out of 2

③ They show correct calculations for the total areas of the four triangles. They are awarded M1 for calculating a triangle area, but their surface area calculation is incomplete.
Mark for (b) = 1 out of 2

Total mark awarded =
3 out of 4

How the candidate could have improved their answer

- **(a)** The candidate used correct reasoning to identify the dimensions of the pyramid. They used these dimensions to construct an accurate net.
- **(b)** The candidate calculated the total area of the four triangular faces but did not include the area of the base of the pyramid. They should have added the area of the square, 3 × 3, to their answer of 27 to find the total surface area of 36 cm^2.

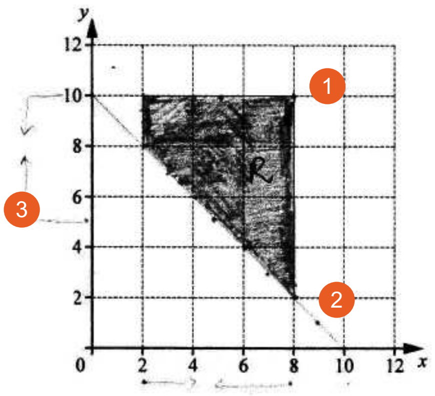
Common mistakes candidates made in this question

- **(a)**
    - Drawing a triangle of height 5 cm on the top of the net and height 4 cm on the right of the net.
    - Drawing the correct triangle at the top of the net, but an isosceles triangle on the right.
    - Not considering how the edges of the triangles would join when folded to make a pyramid.
- **(b)**
    - Omitting the area of the base from their surface area calculation.
    - Adding four triangles all of base 3 cm and height 4 cm to the area of the base.
    - Finding the volume of the pyramid rather than the surface area.

Question 18

Example Candidate Response – high

18



The region R is defined by the inequalities

$$2 \leqslant x \leqslant 8$$

$$5 \leqslant y \leqslant 10$$

$$x + y \geqslant 10.$$

On the diagram, shade and label the region R. [3]

Examiner comments

① Their region is outlined by the lines $x = 2$, $x = 8$ and $y = 10$. They have not shown the line $y = 5$. They are awarded B1 because they have three of these lines correct.

② They have drawn the line $x + y = 10$ accurately and are awarded B1.

③ The annotation on the side of the graph indicates that they have considered $y = 5$, however, they have not drawn this line to provide the final border of the region.

Total mark awarded =
2 out of 3

How the candidate could have improved their answer

The only line that the candidate drew completely across the grid was $x + y = 10$. Although they identified the positions of the other four required lines on the axes, they did not draw these lines across the grid, but just used these points as a guide to complete the outline of their region. Their final answer did not satisfy $5 \leqslant y$, because that line was not included as one of the borders of their region.

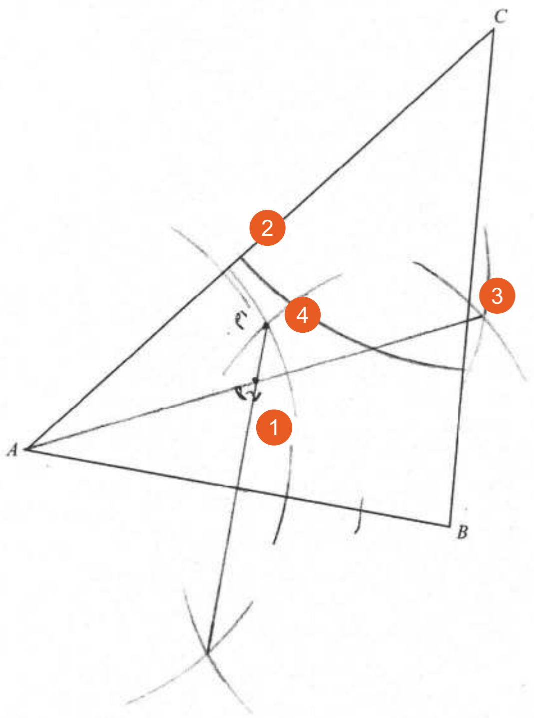
Common mistakes candidates made in this question

- Identifying the wrong side of the line $x + y = 10$.
- Mixing up x and y values when drawing the horizontal and vertical lines.
- Interpreting the double inequalities wrongly, for example, $x = 5$ was drawn for $2 \leqslant x \leqslant 8$.
- Some lines were drawn inaccurately.

Question 19

Example Candidate Response – middle

19



(a) On the diagram, construct the perpendicular bisector of AB. [1]

(b) On the diagram, construct the locus of points inside triangle ABC, that are

(i) 7 cm from C, [1]

(ii) equidistant from AB and AC. [1]

(c) P is any point which is

equidistant from A and B
and more than 7 cm from C
and nearer to AC than AB.

Find the extremes of the possible positions of P and label them P_1 and P_2. [1]

Examiner comments

① Although the candidate has drawn the correct perpendicular bisector, it is too short.
Mark for (a) = 0 out of 1

② They have drawn an accurate arc that meets both sides of the triangle.
Mark for (b)(i) = 1 out of 1

③ They have drawn an accurate bisector that crosses the whole triangle.
Mark for (b)(ii) = 1 out of 1

④ They are not able to identify the correct positions of *P* as their perpendicular bisector does not intersect with the arc.
Mark for (c) = 0 out of 1

Total mark awarded =
2 out of 4

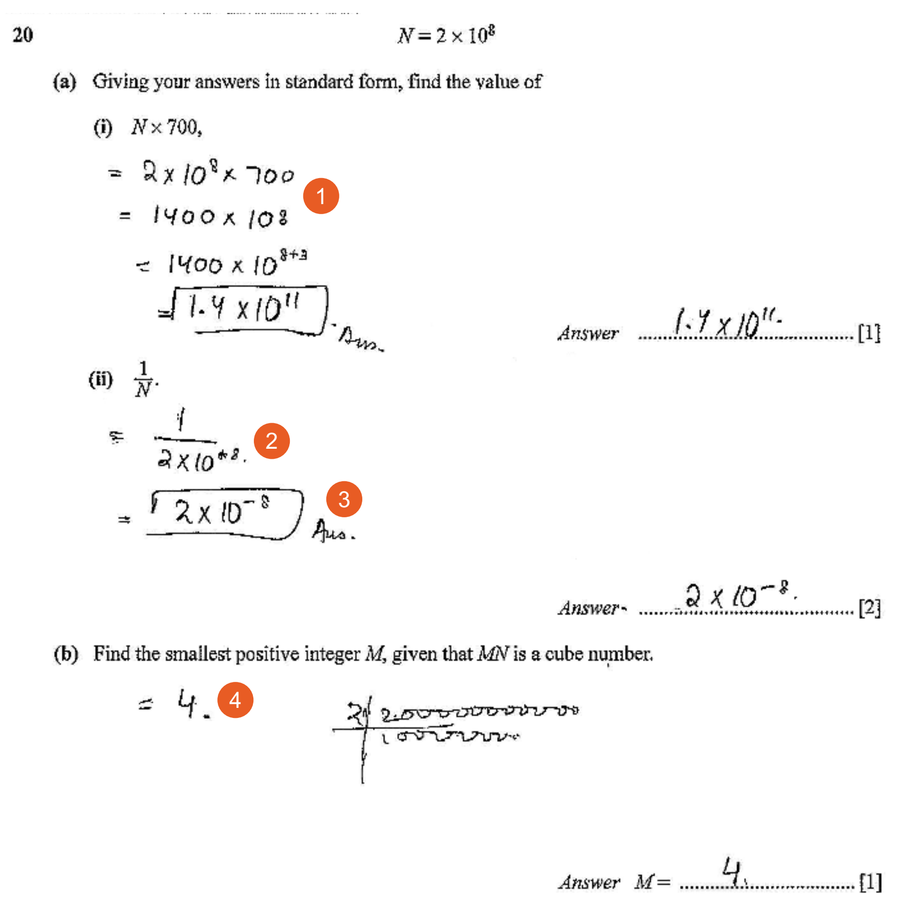
How the candidate could have improved their answer

- **(a)** The candidate drew an accurate perpendicular bisector. They should have extended it beyond the intersection of their arcs so that it reached across the whole triangle.
- **(b)** The candidate drew both the arc and the angle bisector to reach across the whole triangle.
- **(c)** The candidate identified that the extremes of the position of *P* would be on the perpendicular bisector. However, because their bisector did not intersect the arc centred on *C*, they were only able to identify one of these positions correctly.

Common mistakes candidates made in this question

- **(a)** Drawing a perpendicular bisector that was too short.
- **(b)** Drawing an angle bisector from vertex *B* or *C* rather than from *A*.
- **(c)**
  - Identifying points just inside the arc and just inside the angle bisector rather than on the intersections.
  - Identifying the intersections of their construction arcs rather than the correct points.
  - Identifying regions rather than points.

Question 20

Example Candidate Response –low	Examiner comments
 20 $N = 2 \times 10^8$ (a) Giving your answers in standard form, find the value of (i) $N \times 700$, $= 2 \times 10^8 \times 700$ ① $= 1400 \times 10^8$ $= 1400 \times 10^{8+3}$ $= \boxed{1.4 \times 10^{11}}$ Ans. Answer 1.4×10^{11} [1] (ii) $\frac{1}{N}$. $= \frac{1}{2 \times 10^{+8}}$ ② $= \boxed{2 \times 10^{-8}}$ Ans. ③ Answer 2×10^{-8} [2] (b) Find the smallest positive integer M, given that MN is a cube number. $= 4.$ ④ $2 \,|\, 200000000$ 100000000 Answer $M =$ 4 [1]	① The candidate shows a correct result which they then convert correctly to standard form. Mark for (a)(i) = 1 out of 1 ② They show a first correct step. ③ They have tried to remove the fraction by changing the power of 10 but they have not considered the 2. Mark for (a)(ii) = 0 out of 2 ④ They have identified that 8 is a cube number, but have not considered the power of 10. Mark for (b) = 0 out of 1 **Total mark awarded =** **1 out of 4**

How the candidate could have improved their answer

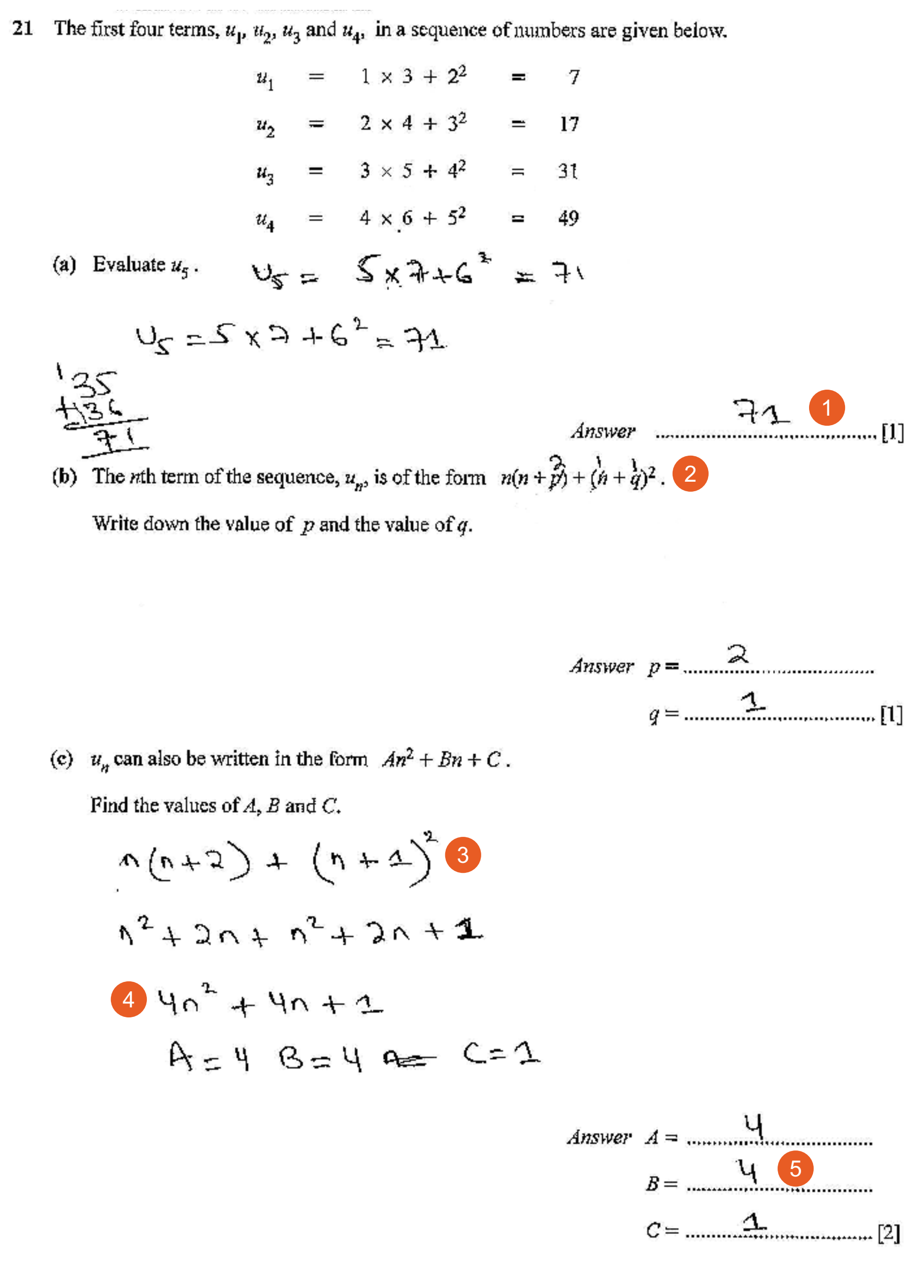
- **(a)(i)** The candidate carried out the calculation correctly and then adjusted the result correctly to give an answer in standard form.
- **(a)(ii)** When the candidate eliminated the fraction, they should have found the reciprocal of 2 to give 0.5×10^{-8}. They could then have adjusted this to give the answer in standard form as 5×10^{-9}.
- **(b)** The candidate needed to consider the complete number including the power of 10 rather than just the 2. Their value of $M = 4$ gave MN as 8×10^8, which is not a cube number. They could have identified that the next cube number would be 1×10^9 so $M = 5$.

Common mistakes candidates made in this question

- **(a)(i)** They calculated the correct result but gave an answer such as 14×10^{10}, which was not in standard form.
- **(a)(ii)**
  - When they attempted to remove the fraction from $\frac{1}{2 \times 10^8}$, they commonly wrote 2×10^{-8} or 0.5×10^8.
  - Not being able to write 0.5×10^{-8} in standard form.
- **(b)** Not considering the 10^8 term when they were trying to find a product that had a power of 3.

Question 21

Example Candidate Response – high



21 The first four terms, u_1, u_2, u_3 and u_4, in a sequence of numbers are given below.

$$u_1 = 1 \times 3 + 2^2 = 7$$
$$u_2 = 2 \times 4 + 3^2 = 17$$
$$u_3 = 3 \times 5 + 4^2 = 31$$
$$u_4 = 4 \times 6 + 5^2 = 49$$

(a) Evaluate u_5. $U_5 = 5 \times 7 + 6^2 = 71$

$U_5 = 5 \times 7 + 6^2 = 71$

${}^{1}35$
$+36$
71

Answer 71 ① [1]

(b) The nth term of the sequence, u_n, is of the form $\overset{1}{n}(n+\overset{2}{p}) + (\overset{1}{n}+\overset{1}{q})^2$. ②

Write down the value of p and the value of q.

Answer $p = 2$

$q = 1$ [1]

(c) u_n can also be written in the form $An^2 + Bn + C$.

Find the values of A, B and C.

$n(n+2) + (n+1)^2$ ③

$n^2 + 2n + n^2 + 2n + 1$

④ $4n^2 + 4n + 1$

$A = 4$ $B = 4$ ~~A=~~ $C = 1$

Answer $A = 4$

$B = 4$ ⑤

$C = 1$ [2]

Examiner comments

① The candidate shows full working leading to the correct answer.
Mark for (a) = 1 out of 1

② They show some evidence of working here, which is not clear. However, they give the correct answer.
Mark for (b) = 1 out of 1

③ They substitute their values of *p* and *q* into the given expression and expand the brackets correctly.

④ They make an error when collecting the *n* squared terms.

⑤ They compare coefficients in their expression with the given expression. Their values of B and C are correct, so B1 is awarded.
Mark for (c) = 1 out of 2

Total mark awarded = 3 out of 4

How the candidate could have improved their answer

- **(a)** and **(b)** The candidate interpreted the given sequence correctly and gave correct answers.
- The candidate used a correct method in part **(c)**, relating the expression from part **(b)** to the one given in part **(c)**. They showed clear working and the only error was in collecting the n^2 terms from their expanded expression. This error could have been corrected if the working had been checked.

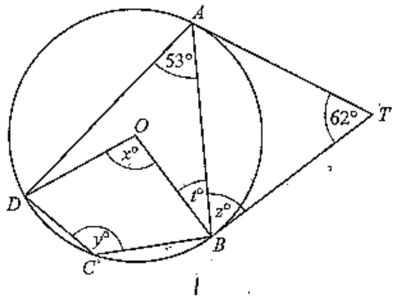
Common mistakes candidates made in this question

- **(b)**
  - Reversing the two values.
  - Giving algebraic answers in terms of p and q rather than numeric answers.
- **(c)**
  - Making errors in expanding $n(n + 2) + (n + 1)^2$.
  - Not substituting their values of p and q into the expression from part **(b)**.
  - Attempting to find a general term from the sequence 7, 17, 31, 49 which was rarely successful.

Question 22

Example Candidate Response – high

22



The diagram shows a circle, centre O, that passes through A, B, C and D.
The tangents at A and B meet at T.
$A\hat{T}B = 62°$ and $D\hat{A}B = 53°$.

(a) Find x.

53 × 2 $\begin{array}{r} 53 \\ \times 2 \\ \hline 106 \end{array}$ (angle in centre is twice as angle in circumference)
= 106°

Answer x = 106° ① [1]

(b) Find y.

~~106° − 180° = y (cyclic quad~~ $\begin{array}{r} 180 \\ -53 \\ \hline 127 \end{array}$
180° − ~~56~~ 53° = y (cyclic quadrilateral)
2 127° = y

Answer y = 127° ② [1]

(c) Find z.

$\begin{array}{r} 180 \\ -62 \\ \hline 118 \end{array}$
~~2z + 62° = 180° (sum of △)~~ ③
~~2z = 180° − 62~~
~~z = $\frac{180 - 62}{2}$~~ ~~z = 118°~~

Answer z = 53° ~~118°~~ ~~118°~~ [1]

(d) Find t.

z + t = 90° (~~angle~~ tangent passes ; 90°)
~~118°~~ 90 − 53 = 37°
$\begin{array}{r} 90 \\ -53 \\ \hline 37 \end{array}$

Answer t = 37° ④ [1]

Examiner comments

① The candidate shows correct reasoning and gives the correct answer.
Mark for (a) = 1 out of 1

② Again, they show correct reasoning and a correct answer.
Mark for (b) = 1 out of 1

③ They identify that *ABT* is an isosceles triangle, but do not use this in their answer.
Mark for (c) = 0 out of 1

④ They use the fact that the tangent is perpendicular to the radius together with their incorrect value for *z* to find the value of *t*. They are given credit for using their value of *z* correctly to find *t*.
Mark for (d) = 1 out of 1

Total mark awarded = 3 out of 4

How the candidate could have improved their answer

- The candidate showed clear working and stated the geometrical reasons for their answers in each part. The question did not ask for geometrical reasons, so it was not necessary for them to write these.
- **(c)** The candidate started with a correct method of using the angle sum of an isosceles triangle. They then deleted this work and gave an incorrect answer which resulted from their assumption that angle *z* was equal to angle *DAB*.
- Their reasoning in part **(d)** was correct, so despite the incorrect answer to part **(c)**, they could be given credit here for evaluating 90 – 53 = 37 correctly.

Common mistakes candidates made in this question

- **(b)**
    - ○ Treating *OBCD* rather than *ABCD* as a cyclic quadrilateral and subtracted their value of *x* from 180 to find *y*.
    - ○ Thinking that angle *x* was equal to angle *y*.
- **(c)**
    - ○ Not knowing that tangents from an external point are equal and hence the triangle is isosceles.
    - ○ Assuming that angle *z* was an alternate angle with angle *DAB*.
    - ○ Assuming that angle *z* was equal to angle *ATB*.
- **(d)** Not using the fact that the tangent is perpendicular to the radius.

Question 23

Example Candidate Response – high

23 $\quad \mathbf{A} = \begin{pmatrix} 4 & -1 \\ 2 & 0 \end{pmatrix} \qquad \mathbf{B} = \begin{pmatrix} 6 & -3 \\ 0 & -2 \end{pmatrix}$

(a) Find the matrix $\mathbf{X}$, such that $2\mathbf{A} + \mathbf{X} = \mathbf{B}$.

$$2\begin{bmatrix} 4 & -1 \\ 2 & 0 \end{bmatrix} + X = \begin{bmatrix} 6 & -3 \\ 0 & -2 \end{bmatrix}$$

$$\begin{bmatrix} 8 & -2 \\ 4 & 0 \end{bmatrix} + x = \begin{bmatrix} 6 & -3 \\ 0 & -2 \end{bmatrix}$$

$$x = \begin{bmatrix} 6 & -3 \\ 0 & -2 \end{bmatrix} - \begin{bmatrix} 8 & -2 \\ 4 & 0 \end{bmatrix}$$ ①

$$= \begin{bmatrix} -2 & -1 \\ -4 & -2 \end{bmatrix}$$

Answer $\begin{pmatrix} -2 & -1 \\ -4 & -2 \end{pmatrix}$ [2]

(b) Find the matrix $\mathbf{Y}$, such that $\mathbf{AY} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$.

$$A^{-1}\cancel{A}Y = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \times A^{-1}$$ ②

$$Y = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \times A^{-1}$$

$$\text{Det} A: 0 - (-2)$$
$$= 0 + 2$$
$$= 2$$

$$= \frac{1}{2}\begin{bmatrix} 0 & 1 \\ -2 & 4 \end{bmatrix}$$

$$= \begin{bmatrix} 0 & \frac{1}{2} \\ -1 & 2 \end{bmatrix}$$ ③

$$\Rightarrow \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 0 & \frac{1}{2} \\ -1 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} 0+0 & \frac{1}{2}+0 \\ 0-1 & \frac{1}{2}+2 \end{bmatrix}$$ ④

$$= \begin{bmatrix} 0 & \frac{1}{2} \\ -1 & \frac{5}{2} \end{bmatrix}$$

Answer $\begin{bmatrix} 0 & \frac{1}{2} \\ -1 & \frac{5}{2} \end{bmatrix}$ [3]

Examiner comments

① The candidate shows every stage of the method clearly leading to the correct answer.
Mark for (a) = 2 out of 2

② They identify that they need to use the inverse of matrix A.

③ They find the inverse of matrix A correctly. They are awarded B2 at this point.

④ They attempt to multiply the two matrices but make an arithmetic error.
Mark for (b) = 2 out of 3

Total mark awarded = 4 out of 5

How the candidate could have improved their answer

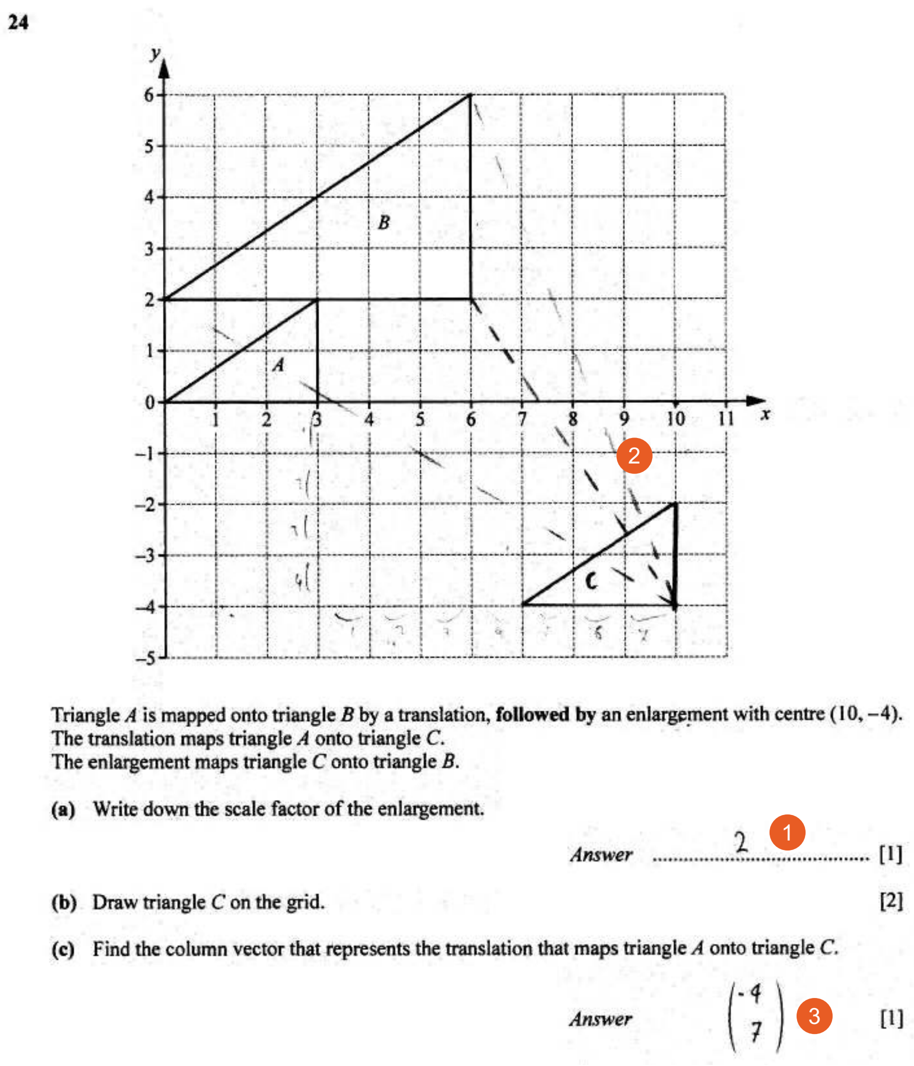
- **(a)** The candidate showed all the stages of their working which helped them to reach the correct answer.
- **(b)** The candidate understood that they were required to find matrix A^{-1}. If they had used the fact that $AA^{-1} = I$, they could have identified that $Y = A^{-1}$ and their matrix multiplication where the arithmetic slip occurred would have been unnecessary.

Common mistakes candidates made in this question

- **(a)**
  - Making arithmetic errors, particularly in the subtraction of negative values.
  - Calculating 2A – B rather than B – 2A.
- **(b)**
  - Not realising that the answer was matrix A^{-1} and carried out further incorrect calculations after finding this correctly.
  - Making errors in calculating the determinant, often giving –2 or 6.
  - Attempting to divide each element in the identity matrix by the corresponding element in matrix A.

Question 24

Example Candidate Response – middle



24

Triangle *A* is mapped onto triangle *B* by a translation, **followed by** an enlargement with centre (10, –4).
The translation maps triangle *A* onto triangle *C*.
The enlargement maps triangle *C* onto triangle *B*.

(a) Write down the scale factor of the enlargement.

Answer ....2........ [1] ①

(b) Draw triangle *C* on the grid. [2]

(c) Find the column vector that represents the translation that maps triangle *A* onto triangle *C*.

Answer $\begin{pmatrix}-4\\7\end{pmatrix}$ ③ [1]

Examiner comments

① The candidate identifies the scale factor of the enlargement correctly.

② The candidate draws construction lines from the centre (10, –4) to the vertices of triangle B. This is a correct method and is awarded M1.
Mark for (a) = 1 out of 1
Mark for (b) = 1 out of 2

③ They have not positioned triangle C correctly, so their translation vector is not correct.
Mark for (c) = 0 out of 1

Total mark awarded =
2 out of 4

How the candidate could have improved their answer

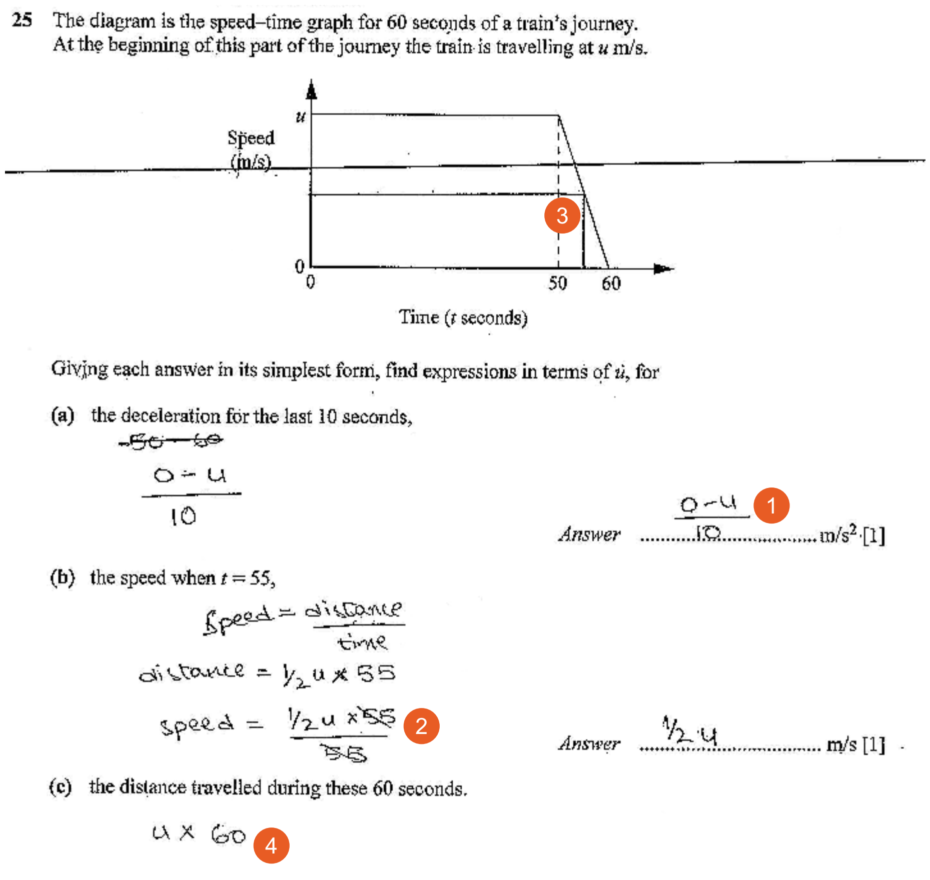
- **(b)** The candidate started by drawing the correct construction lines. Although they drew triangle *C* the correct size, they did not use their construction lines to position it correctly on the grid. They should have positioned the vertices of *C* halfway along their lines to give a correct position.
- **(c)** They showed the correct vector for the translation of triangle *A* to their triangle *C*. However, as *C* was not in the correct position, their vector was incorrect.

Common mistakes candidates made in this question

- **(a)** Giving the ratio 2:1 or 1:2 which is not acceptable as a scale factor.
- **(b)**
  - Not knowing how to use the centre of enlargement and triangle *B* to find the position of triangle *C*.
  - Positioning triangle *C* inside triangle *B*.
- **(c)** Making sign errors in the vector, for example $\begin{pmatrix}-5\\1\end{pmatrix}$ rather than $\begin{pmatrix}5\\-1\end{pmatrix}$.

Question 25

Example Candidate Response – high



25 The diagram is the speed–time graph for 60 seconds of a train's journey.
At the beginning of this part of the journey the train is travelling at u m/s.

Giving each answer in its simplest form, find expressions in terms of u, for

(a) the deceleration for the last 10 seconds,

~~50 — 60~~

$\frac{0-u}{10}$

Answer $\frac{0-u}{10}$ ① m/s² [1]

(b) the speed when $t = 55$,

Speed = $\frac{\text{distance}}{\text{time}}$

distance = $\frac{1}{2}u \times 55$

speed = $\frac{\frac{1}{2}u \times \cancel{55}}{\cancel{55}}$ ②

Answer $\frac{1}{2}u$ m/s [1]

(c) the distance travelled during these 60 seconds.

$u \times 60$ ④

Examiner comments

① The candidate understands that the deceleration is related to the gradient of the line between $t = 50$ and $t = 60$.
Mark for (a) = 0 out of 1

② Their reasoning is not clear, but they reach the correct answer.

③ Their annotation of the graph supports their answer of $\frac{u}{2}$ in part (b).
Mark for (b) = 1 out of 1

④ They have calculated a relevant area which can be used to calculate the distance travelled. This partial method is awarded M1.
Mark for (c) = 1 out of 2

**Total mark awarded =
2 out of 4**

How the candidate could have improved their answer

- **(a)** The candidate has found an expression for the gradient of the line. They did not write their answer in its simplest form as required by the question. Their simplified answer would have been $-\frac{u}{10}$, which is the acceleration. As the question asked for deceleration, the correct answer should be $\frac{u}{10}$.
- **(b)** The candidate used the graph to help find the correct answer and gave a simplified expression. To avoid confusion about the position of u, it is preferable to write $\frac{u}{2}$ rather than $\frac{1}{2}u$.
- They identified that the distance related to the area under the graph in part **(d)**, but they did not calculate the area of the trapezium. They should have subtracted the area of the triangle from their rectangle area to get the correct answer.

Common mistakes candidates made in this question

- **(a)**
  - Giving acceleration rather than deceleration.
  - Not simplifying their expression which was required by the question.
- **(b)** Candidates attempted to use 55 in their calculation and gave answers such as $\frac{55u}{10}$, $\frac{55u}{50}$ or $\frac{u}{55}$.
- **(c)**
  - Showing a correct expression for the area of the trapezium or the sum of the area of a rectangle and a triangle but made errors in simplifying the expression.
  - Substituting a value for u as they thought a numerical answer was required.

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