Qualification Accredited

OCR
Oxford Cambridge and RSA

GCSE (9–1)

Exemplar Candidate Work

MATHEMATICS

J560
For first teaching in 2015

J560/05 Summer 2018 examination series

Version 1

Contents

Introduction

These exemplar answers have been chosen from the summer 2018 examination series.

OCR is open to a wide variety of approaches and all answers are considered on their merits. These exemplars, therefore, should not be seen as the only way to answer questions but do illustrate how the mark scheme has been applied.

Please always refer to the specification https://www.ocr.org.uk/Images/168982-specification-gcse-mathematics-j560.pdf for full details of the assessment for this qualification. These exemplar answers should also be read in conjunction with the sample assessment materials and the June 2018 Examiners' report or Report to Centres available from Interchange https://interchange.ocr.org.uk/Home.mvc/Index

The question paper, mark scheme and any resource booklet(s) will be available on the OCR website from summer 2019. Until then, they are available on OCR Interchange (school exams officers will have a login for this and are able to set up teachers with specific logins – see the following link for further information http://www.ocr.org.uk/administration/support-and-tools/interchange/managing-user-accounts/).

It is important to note that approaches to question setting and marking will remain consistent. At the same time OCR reviews all its qualifications annually and may make small adjustments to improve the performance of its assessments. We will let you know of any substantive changes.

Question 1(a)

1 (a) Calculate.

$$\frac{3}{5}+\frac{5}{8}$$

Give your answer as a mixed number in its simplest form.

(a) ..... [3]

Exemplar 1

3 marks

(a) Calculate.

$\frac{3}{5}+\frac{5}{8}$

Give your answer as a mixed number in its simplest form.

$\frac{24}{40}+\frac{25}{40}=\frac{49}{40}=1\frac{9}{40}$

(a) $1\frac{9}{40}$ [3]

Examiner commentary

Correct answer, given as a mixed number as required with full supporting working shown.

Exemplar 2

2 marks

$\frac{3}{5}+\frac{5}{8}=\frac{24}{40}+\frac{25}{40}=\frac{51}{40}$ $1\frac{11}{40}$

(a) $1\frac{11}{40}$ [3]

Examiner commentary

Candidate shows correct working and converts both fractions to a common denominator correctly but then makes an arithmetic error when adding. M2 is credited for correct conversion to a common denominator.

Question 1(b)

(b) Work out.

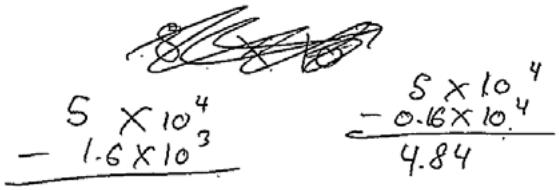
$$5 \times 10^4 - 1.6 \times 10^3$$

Give your answer in standard form.

(b) ..... **[3]**

Exemplar 1

3 marks



(b) 4.84 X 10 4 **[3]**

Examiner commentary

Candidate shows correct working and gives the correct answer in standard form.

Exemplar 2

2 marks

(b) Work out.

50000 1600

$5 \times 10^4 - 1.6 \times 10^3$

Give your answer in standard form. 48 400

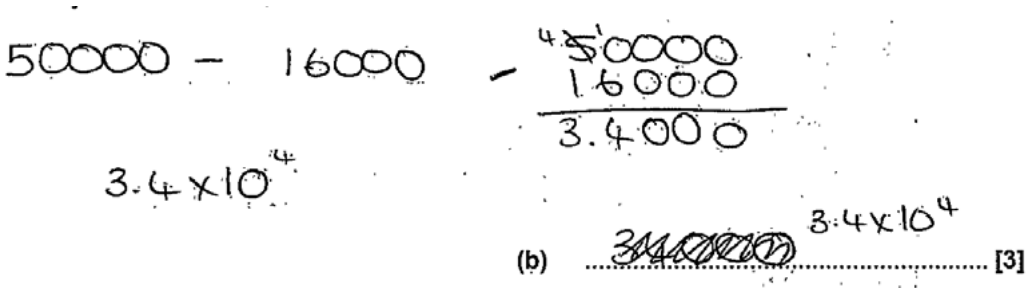
(b) 48400 **[3]**

Examiner commentary

Candidate shows correct working and arrives at a correct value but does not convert to standard form so M2 is credited.

Exemplar 3

1 mark

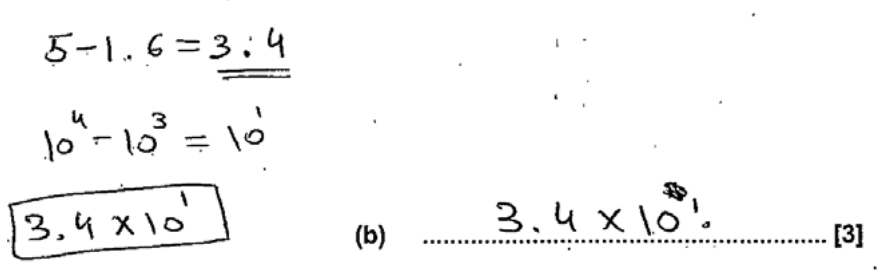


Examiner commentary

Incorrect answer but the candidate is credited 1 mark for converting 5×10^4 to 50 000 in working.

Exemplar 4

0 marks

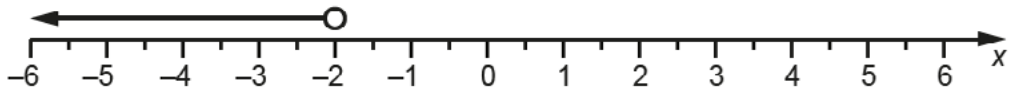


Examiner commentary

Incorrect processing with no correct working shown.

Question 2

2 Gemma's solution to the inequality $3x + 1 > -5$ is shown on the number line.



Is Gemma's solution correct?
Explain your reasoning.

..... **[3]**

Exemplar 1 — 3 marks

$3x+1>-5$
$3x>-6$
$x>-2$

No, x is ~~bigger than~~ -2, not ~~smaller than~~ -2. It should go the other way on the number line.

..... **[3]**

Examiner commentary

Clear working shown with the solution to the given inequality and then correct explanation of the error. Candidate earns M2 for solution to inequality and A1 for correct reasoning.

Exemplar 2 — 2 marks

Is Gemma's solution correct?
Explain your reasoning.

$3x>-1-5$
$3x>-6$
$x>\frac{-6}{3}$
$x>-2$

that the answer is x is smaller than -2.

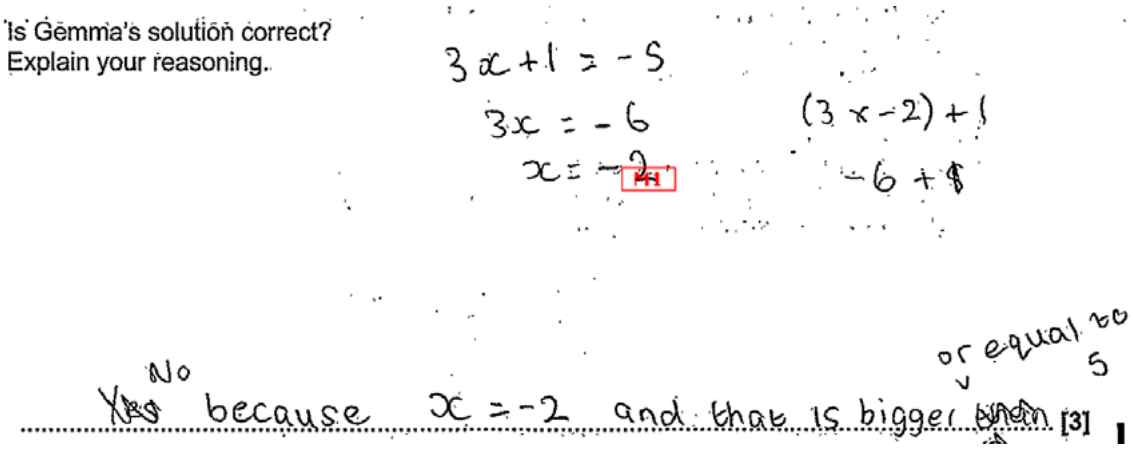
Yes, because the number line starts ... **[3]**

Examiner commentary

Candidate is credited M2 for correct solution to the given inequality shown but the conclusion is incorrect so A0.

Exemplar 3

1 mark

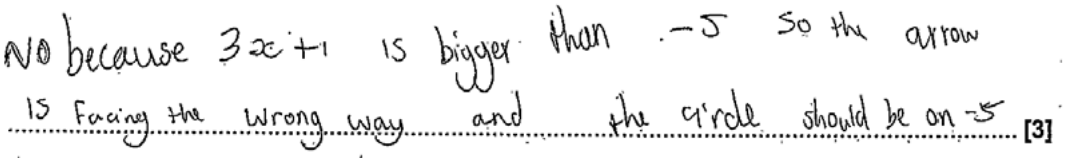


Examiner commentary

Candidate earns M1 for correct first step in solving the inequality. The use of the equals sign instead of the inequality sign is condoned for M1.

Exemplar 4

0 marks



Examiner commentary

No attempt to solve the inequality and an incorrect conclusion so no marks scored.

Question 3(b)

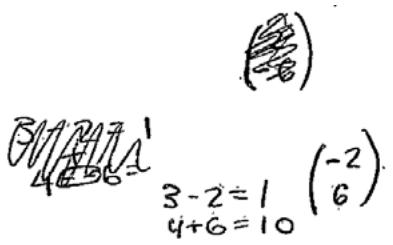
3 Work out.

(b) $\begin{pmatrix}3\\4\end{pmatrix} - 2\begin{pmatrix}1\\-3\end{pmatrix}$

(b) $\begin{pmatrix}\quad\\\quad\end{pmatrix}$ **[2]**

Exemplar 1

2 marks



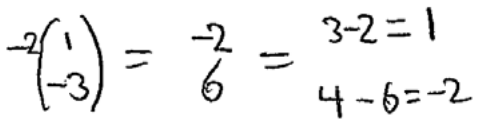
(b) $\begin{pmatrix}1\\10\end{pmatrix}$ **[2]**

Examiner commentary

Both components of the vector given correctly so full marks credited.

Exemplar 2

1 mark



(b) $\begin{pmatrix}1\\-2\end{pmatrix}$ **[2]**

Examiner commentary

Only one component of the vector given correctly so this earns 1 mark.

Question 4

4 Here is the nutritional information for a 110 g serving of cereal.

Carbohydrates	99.4 g
Proteins	9.5 g
Fats	1.1 g

Emily says that more than 90% of this serving is carbohydrates.

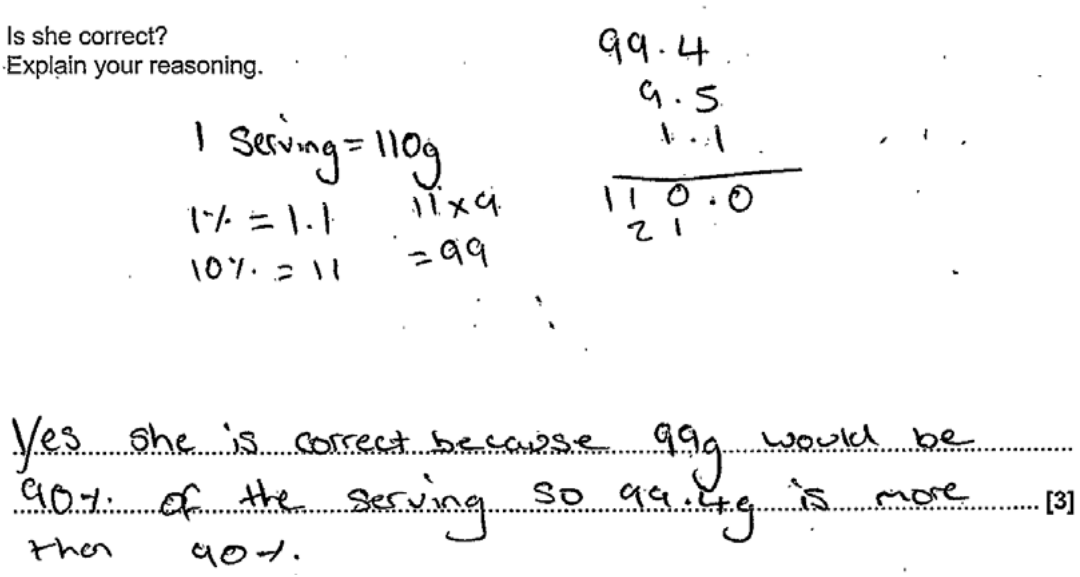
Is she correct?
Explain your reasoning.

.....

..... **[3]**

Exemplar 1

3 marks



Examiner commentary

Correct attempt to find 90% of 110 and a correct answer of 99 earns M1A1. A correct conclusion earns A1 meaning the candidate earns full marks for the question.

Exemplar 2

1 mark

Explain your reasoning.

.....

..... [3]

Examiner commentary

The candidate has written a correct fraction and although this is not processed and multiplied by 100 it is sufficient to earn M1.

Question 5(a)

5 The table shows the relative frequencies of the results for a football team after a number of games.

Result of game	won	lost	drew
Relative frequency	0.2	0.45	

(a) Complete the table. **[2]**

Exemplar 1

2 marks

Result of game	won	lost	drew
Relative frequency	0.2	0.45	0.35

(a) Complete the table. **[2]**

$1 - 0.2 - 0.45 = 0.35$.

Examiner commentary

Correct answer earns 2 marks.

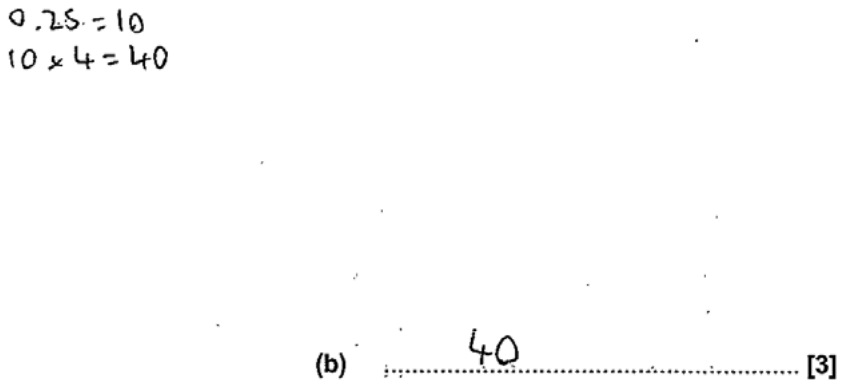
Question 5(b)

(b) The team lost 10 more games than they won.

How many games did the team play altogether?

(b) ..... **[3]**

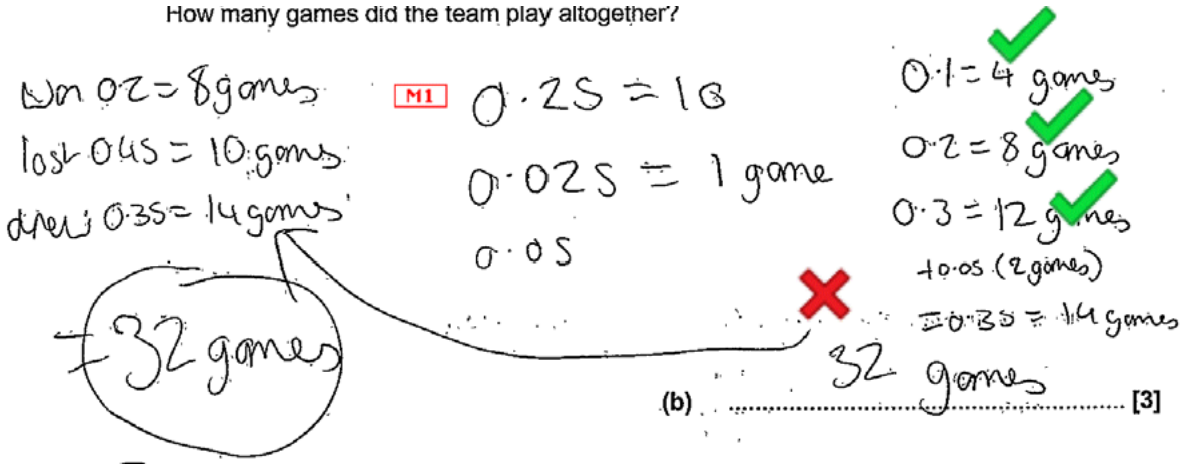
Exemplar 1 — 3 marks



Examiner commentary

Correct answer earns 3 marks.

Exemplar 2 — 1 mark

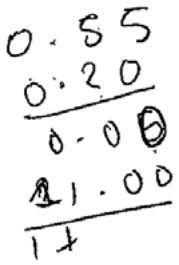


Examiner commentary

Candidate shows that 10 represents 0.25 and then cannot complete correctly with an error for the number of games for probability 0.45. This earns M1.

Exemplar 3

0 marks



(b) ..... [3]

Examiner commentary

Nothing of credit in working so M0.

Question 6

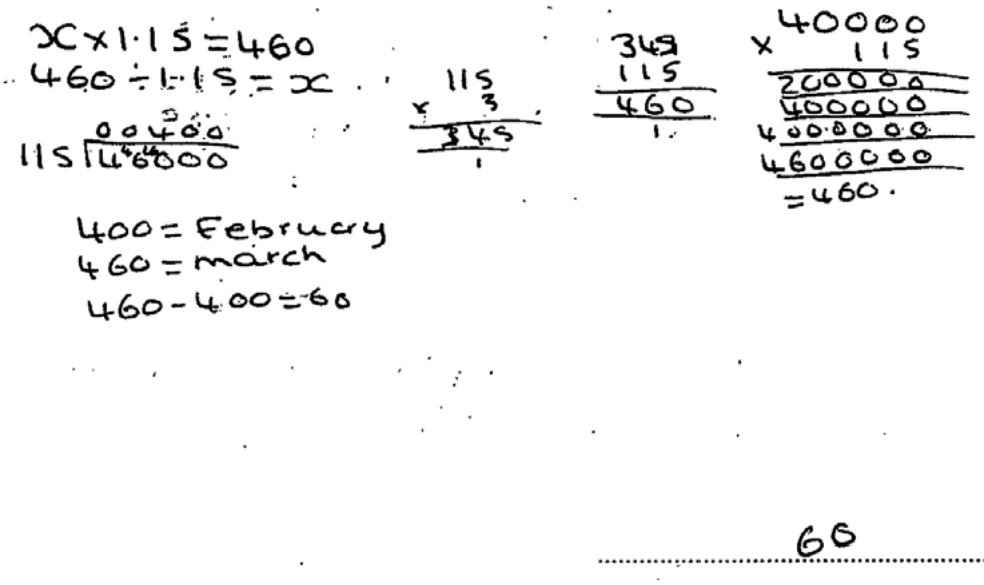
6 Jack sent 15% more text messages in March than in February.
Jack sent 460 text messages in March.

How many more texts did Jack send in March than in February?

..... [4]

Exemplar 1

4 marks



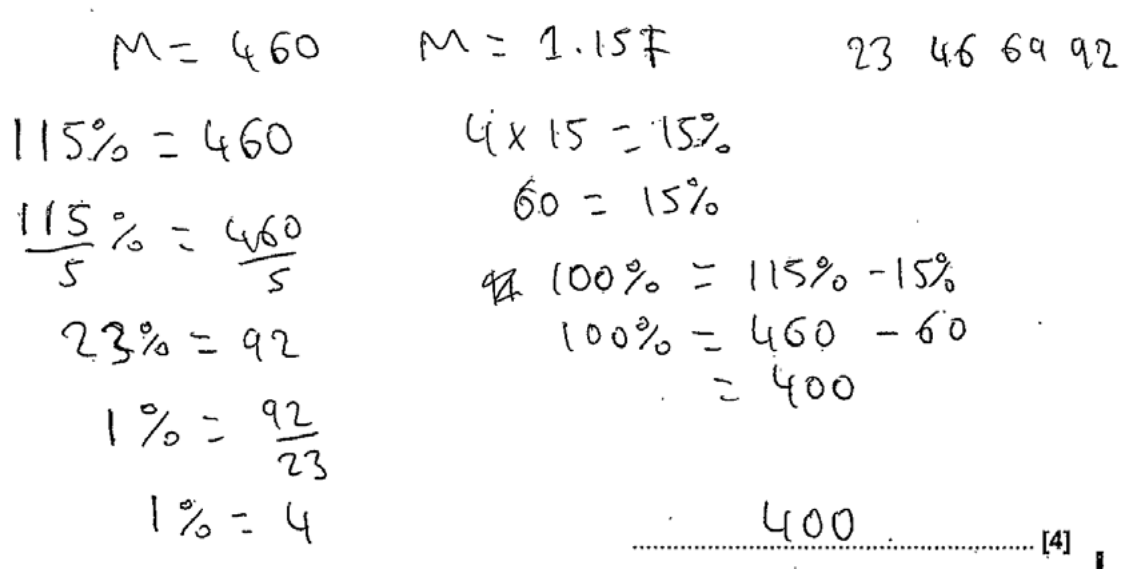
60 ..... [4]

Examiner commentary

Correct answer so full marks earned.

Exemplar 2

3 marks

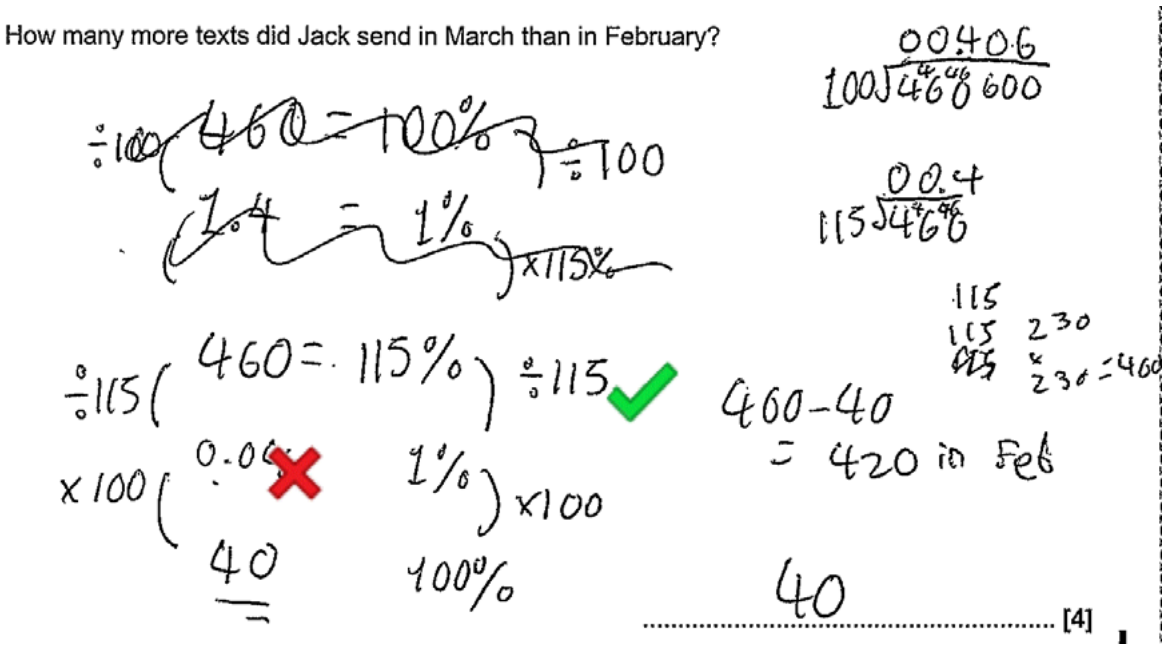


Examiner commentary

Candidate shows correct working in dividing 460 by 1.15 to reach 400. This earns B3 but then does not subtract the 400 from 460 to find how many more texts Jack sent in March than in February.

Exemplar 3

2 marks



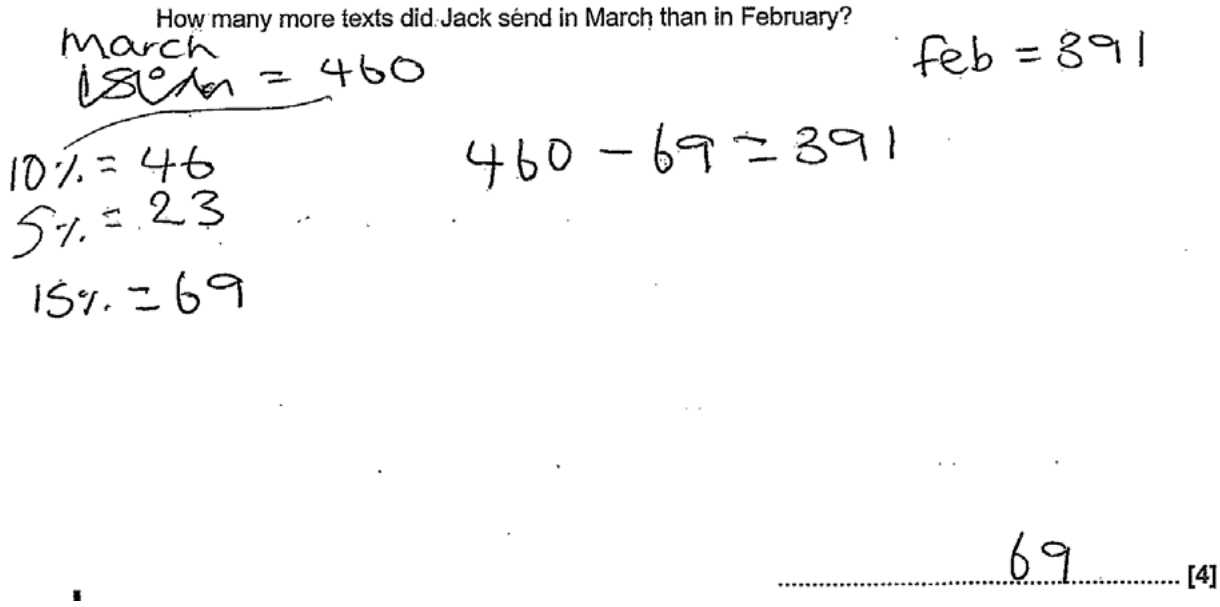
Examiner commentary

Candidate recognises this is a reverse percentage problem and attempts to divide by 115 and then multiply by 100 but makes an error in the processing. This earns M2.

Exemplar 4

0 marks

How many more texts did Jack send in March than in February?

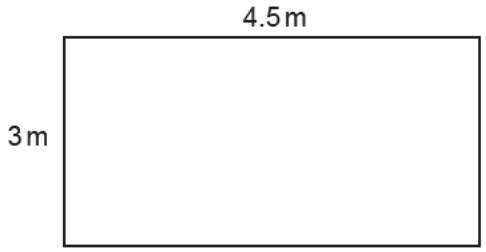


Examiner commentary

Candidate does not recognise this is a reverse percentage problem and reduces 460 by 15%. This earns no marks.

Question 7

7 Here is the floor plan of a rectangular room.



Not to scale

Tim buys carpet tiles for this room.

Each tile is a square measuring 50 cm by 50 cm.
The tiles are only sold in packs of ten.
Each pack costs £20.
Tim pays for fitting at a rate of £7.50 per square metre, with any fraction of a square metre rounded up.

Work out the **total** cost of the tiles and fitting.

£ ..... **[6]**

Exemplar 1

6 marks

Work out the **total** cost of the tiles and fitting.

Area of floor = 3 × 4.5 = 13.5 m² ↑ 14 × 7.5 = £105 ← total fitting cost

Tile area = 0.5 × 0.5 = 0.25 m²

13.5 ÷ 0.25 = 54 ← total tiles needed.

27
54

therefore 6 packs are needed.

6 × 20 = £120 ← total cost of tiles.

120 + 105 = 225

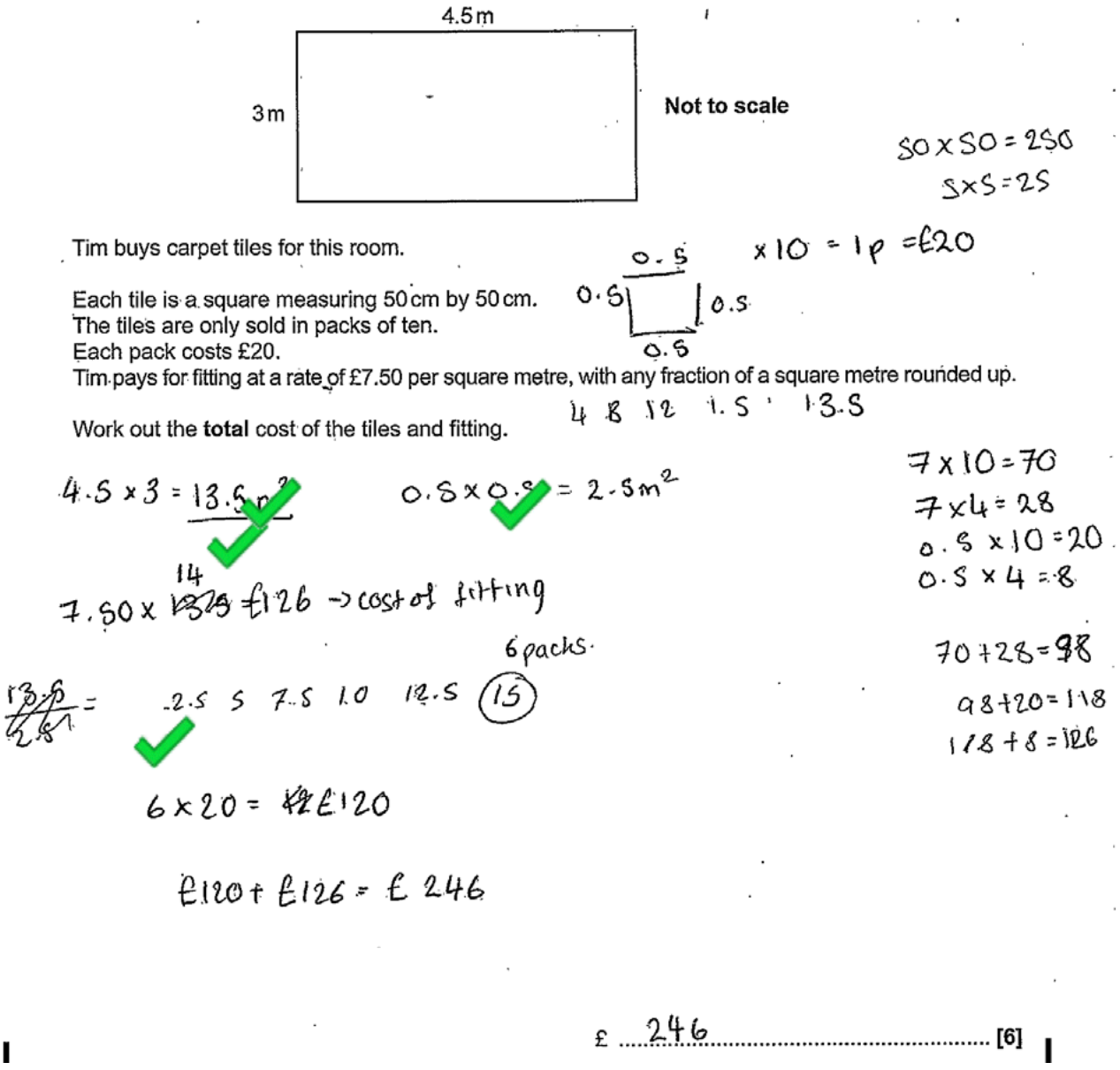
£ 225 **[6]**

Examiner commentary

Candidate gives a correct answer with fully correct supporting working and earns full marks.

Exemplar 2

4 marks

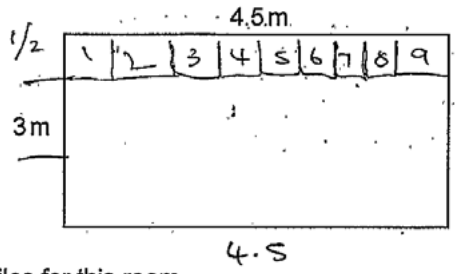


Examiner commentary

Candidate earns 2 method marks for 3 × 4.5 and 0.5 × 0.5 shown in working. They do not show the number of tiles needed for the room but correctly give the number of packs needed and then multiply this by the cost which earns a further method mark. One more method mark is earned for rounding the area of the room 13.5 up to the next integer (14) and then multiplying this by 7.5 even though they make an error in processing when doing this. This earns 4 marks in total.

Exemplar 3

3 marks



Tim buys carpet tiles for this room.

Each tile is a square measuring 50 cm by 50 cm.
The tiles are only sold in packs of ten.
Each pack costs £20.
Tim pays for fitting at a rate of £7.50 per square metre, with any fraction of a square metre rounded up.

Work out the **total** cost of the tiles and fitting.

£20
Pack of 10 = £~~200~~
+£7.50

100cm = 1m

50cm
50cm □ = tile

1/2m
1/2m Tile

4.5 x 3 = 13.5 ✓

1/2 1/2 = 1 1/2 + 1/2 = ~~2~~1 1/2 + 1 1/2 = ~~3~~1
1/2 + 1/2 = 1 1/2 = .5

4.5 = 9 tiles ✓

9
18
27
36
45
54
63
72 ←

~~3x9=27~~ = ~~27~~ tiles
6x9 = 54 tiles ✓

60packs = £1200 + fitting rate ✗

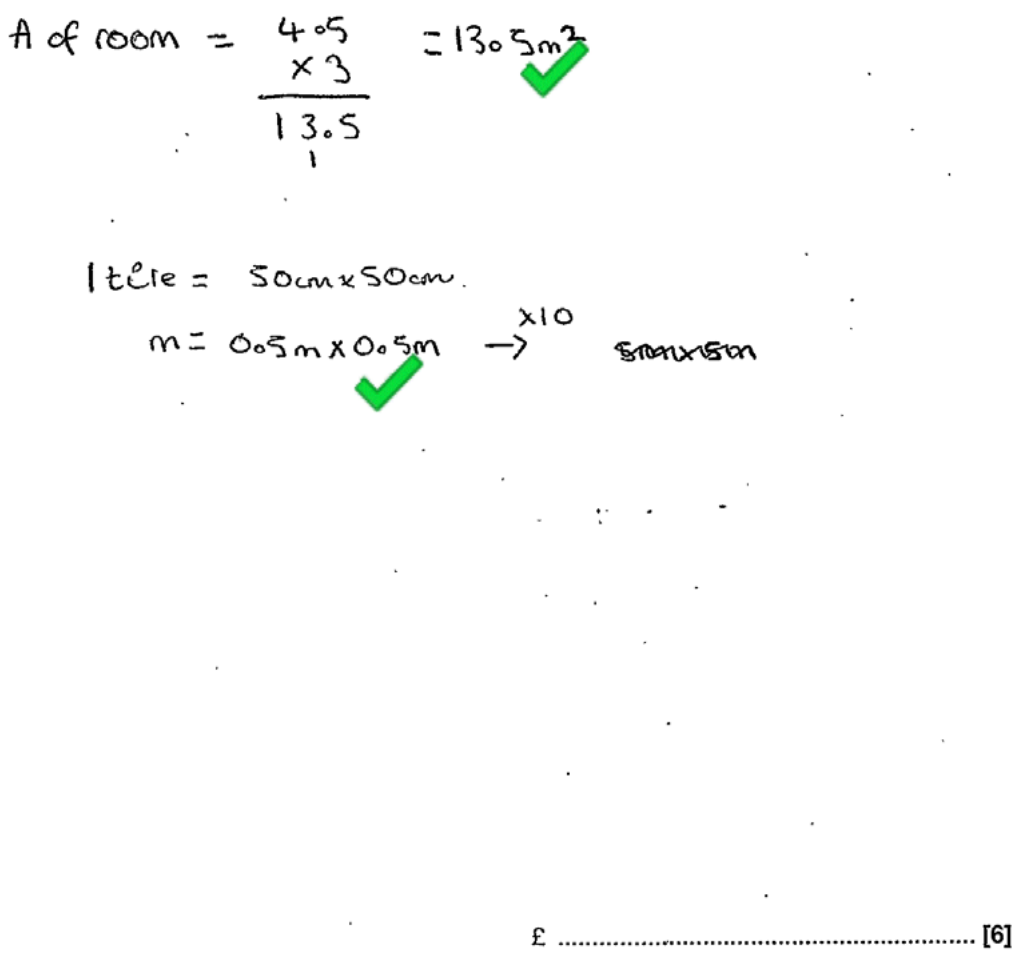
£ ..... [6]

Examiner commentary

The candidate gives the correct number of tiles needed (54) but then makes no further progress so B3 is earned.

Exemplar 4

2 marks



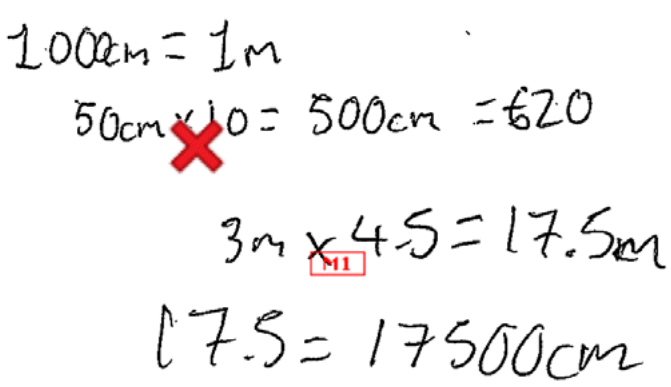
£ ..... **[6]**

Examiner commentary

Candidate earns M1 for attempting to find the area of the room and a further M1 for attempting to find the area of one tile.

Exemplar 5

1 mark



£ ..... [6]

Examiner commentary

Candidate earns M1 for 3 × 4.5 even though this is incorrectly processed.

Question 8(b)(i) and (ii)

8 Hannah wants to display all the possible outcomes when rolling two fair 6-sided dice.

(b) (i) Draw a sample space to display all the possible outcomes. **[2]**

(ii) Show that the probability of the scores on the two dice adding to 11 is $\frac{1}{18}$.

..... **[2]**

Exemplar 1 — 3 marks

(b) (i) Draw a sample space to display all the possible outcomes. **[2]**

x	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

=36 outcomes

(ii) Show that the probability of the scores on the two dice adding to 11 is $\frac{1}{18}$.

adding = 11 = 5+6 = 6+5 $= \frac{2}{36} = \frac{1}{18}$ (÷2)

5+6, 6+5 $= \frac{1}{18}$ ..... **[2]**

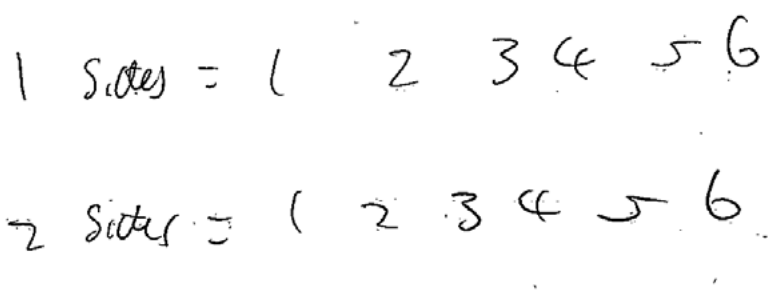
Examiner commentary

The candidate has used a table to show the sample space. They have worked out the products rather than listing the pairs or calculating the totals so M1 is earned for the attempt. The second part is completely correct and earns 2 marks.

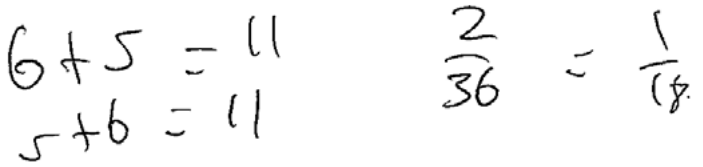
Exemplar 2

2 marks

(b) (i) Draw a sample space to display all the possible outcomes. **[2]**



(ii) Show that the probability of the scores on the two dice adding to 11 is $\frac{1}{18}$.



..... **[2]**

Examiner commentary

In the first part, the sample space shows no ordered pairs or combinations and earns no marks. The second part shows both pairs that give a total of 11 and then the correct probability so earns 2 marks.

Question 9(b)

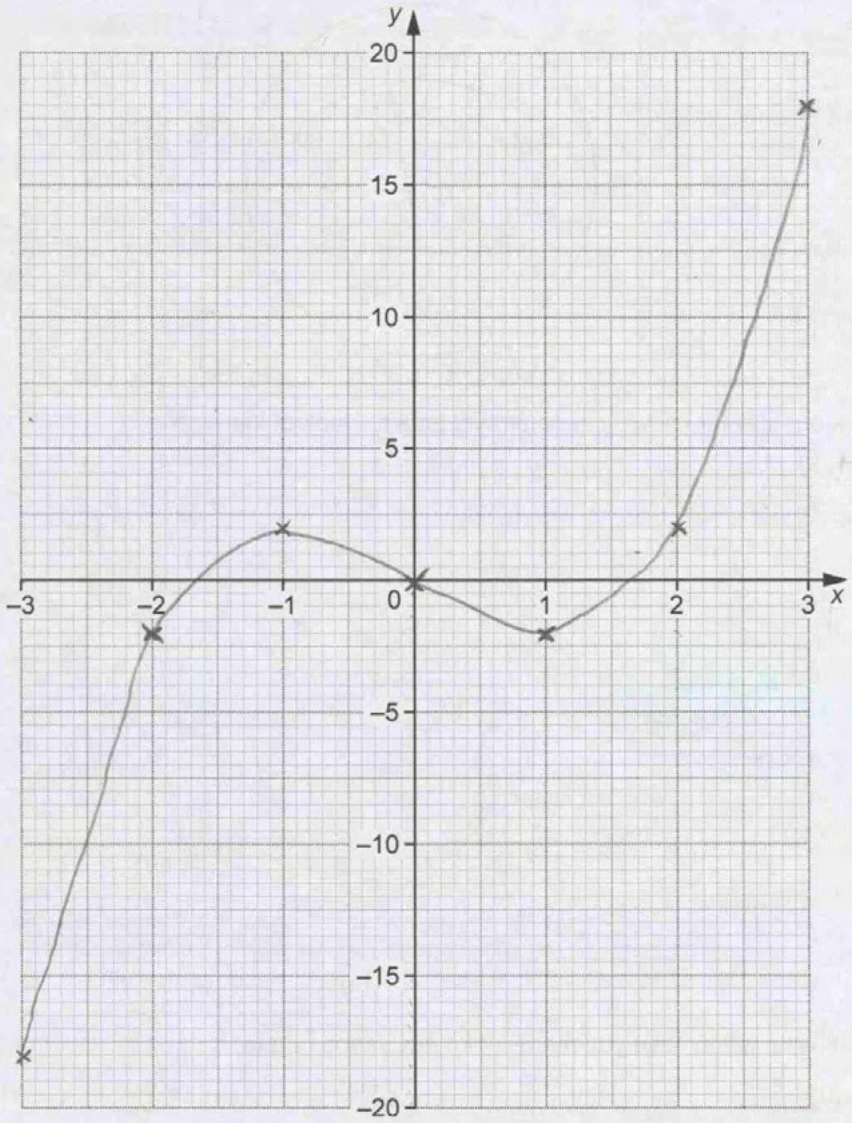
Exemplar 1

3 marks

x	-3	-2	-1	0	1	2	3
y	-18	-2	~~+2~~	0	-2	2	18

[1]

(b) Draw the graph of $y = x^3 - 3x$ for $-3 \leqslant x \leqslant 3$.



[3]

Examiner commentary

A correct well drawn graph earning full marks.

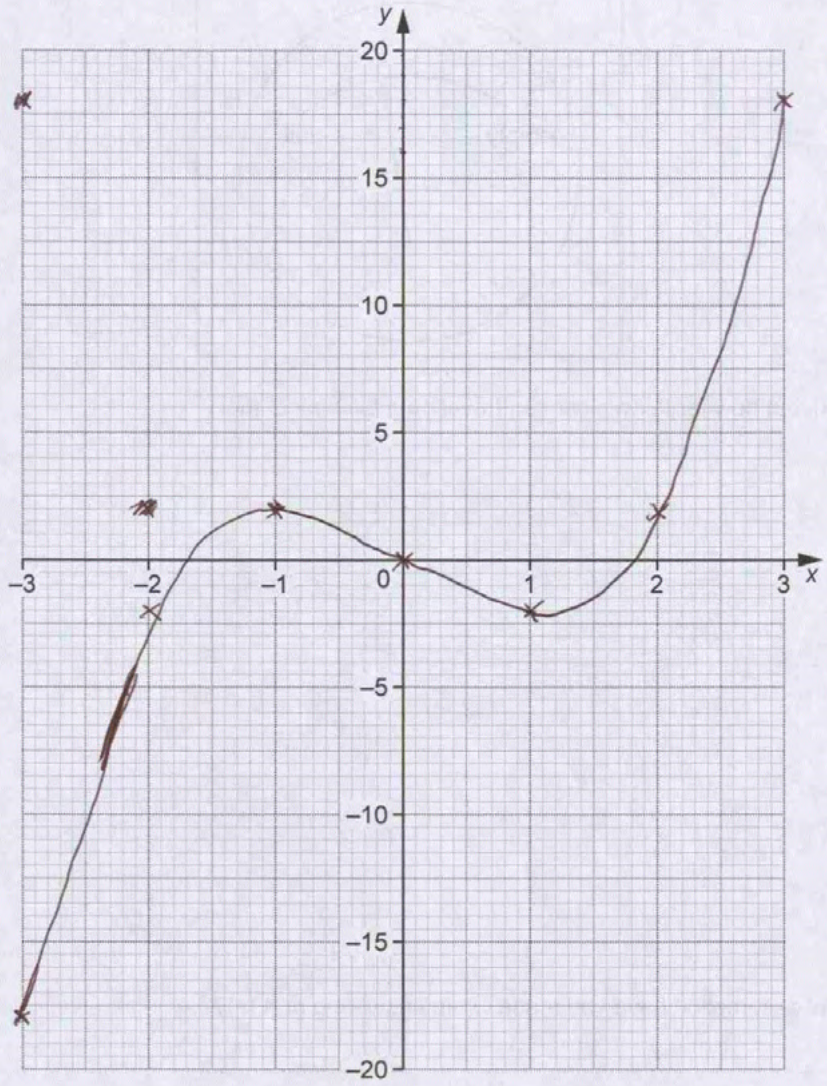
Exemplar 2

2 marks

x	-3	-2	-1	0	1	2	3
y	-18	-2	2	0	-2	2	18

[1]

(b) Draw the graph of $y = x^3 - 3x$ for $-3 \leqslant x \leqslant 3$.



[3]

Examiner commentary

Graph is not fully correct as the curve does not pass through all of the plots. The plots are all correct however so this earns B2.

Exemplar 3

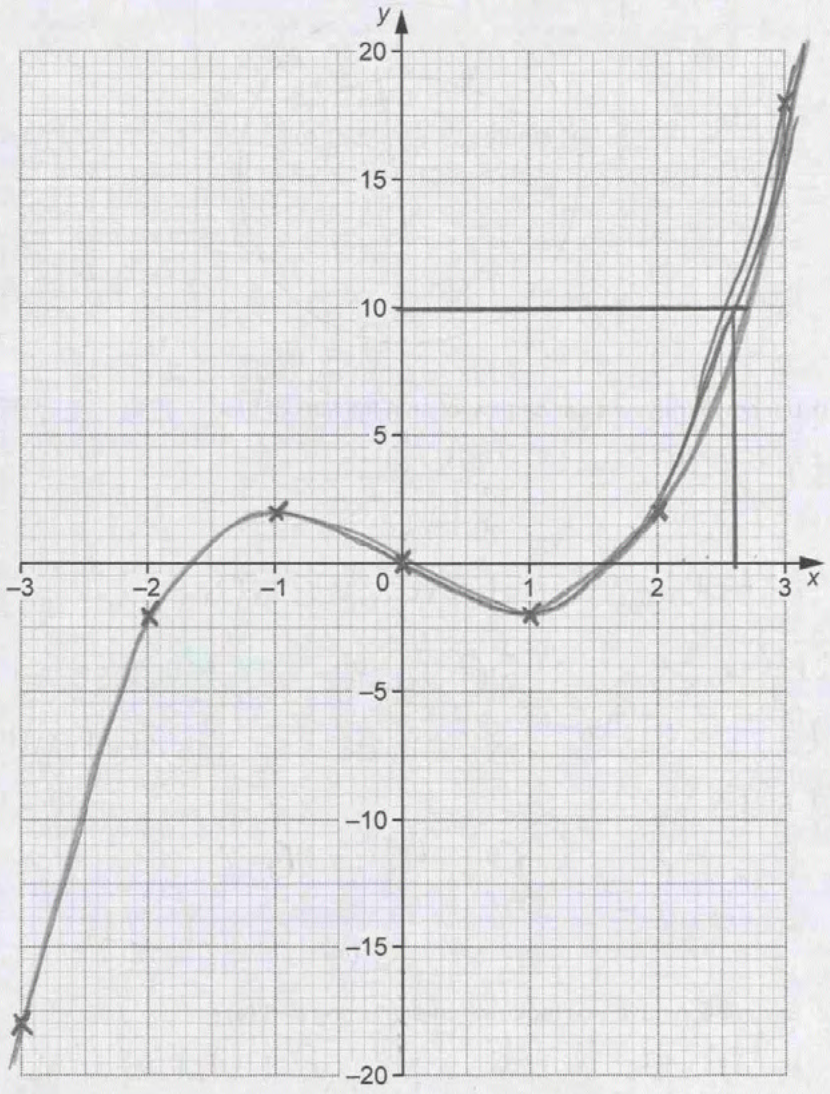
2 marks

x	-3	-2	-1	0	1	2	3
y	-18	-2	2	0	-2	2	18

$-1 \times -1 \times -1 \quad -1 \quad -3 \times -1 = 3 \quad -1 + 3 = +2$

$-3 \times -3 = 9 \times -3 = -27 \quad -3 \times -3 = +9$ [1]

(b) Draw the graph of $y = x^3 - 3x$ for $-3 \leqslant x \leqslant 3$.



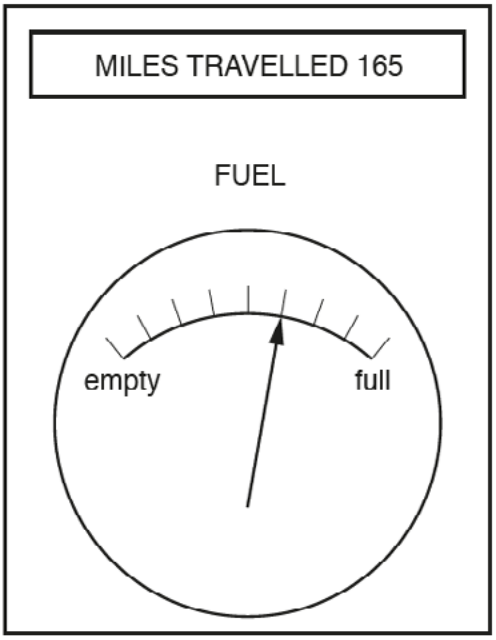
[3]

Examiner commentary

Graph is not fully correct as the curve has excessive feathering and is of poor quality. The plots are all correct however so this earns B2.

Question 10

10 Ifsaw noticed this information on her car's dashboard at the end of her journey.
She started her journey with a full tank of fuel and her miles travelled set to zero.



(a) Work out how far Ifsaw's car can travel on a full tank of fuel.

(a) ..... miles **[3]**

Exemplar 1

3 marks

165 ÷ 3 = ~~55~~ 55

55 x 8 =

50 x 8 = 400
5 x 8 = 40
440

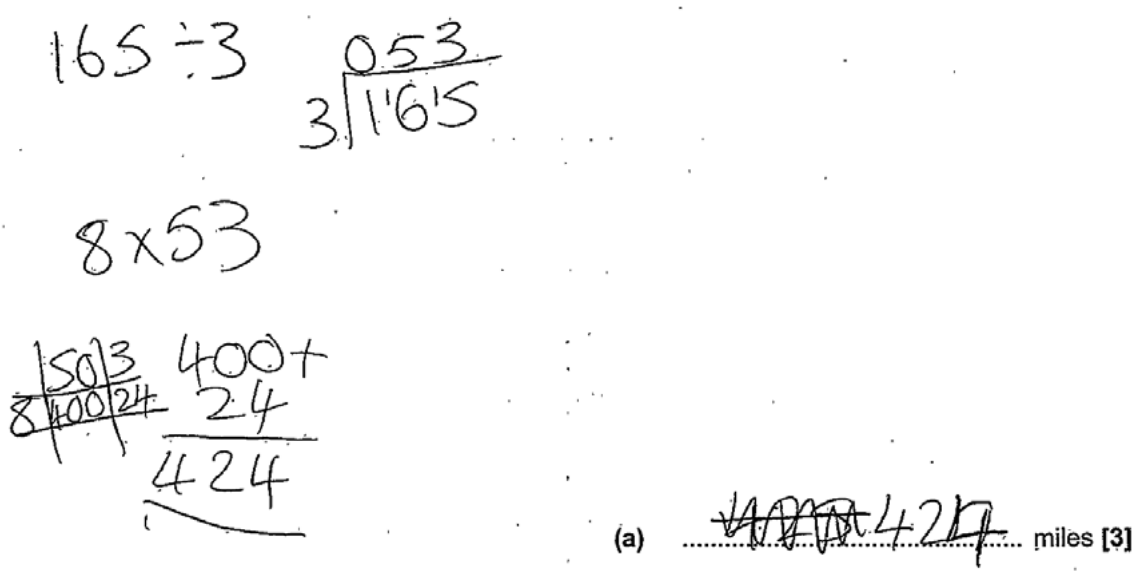
(a) 440 miles **[3]**

Examiner commentary

Correct answer with supporting working earns 3 marks.

Exemplar 2

2 marks

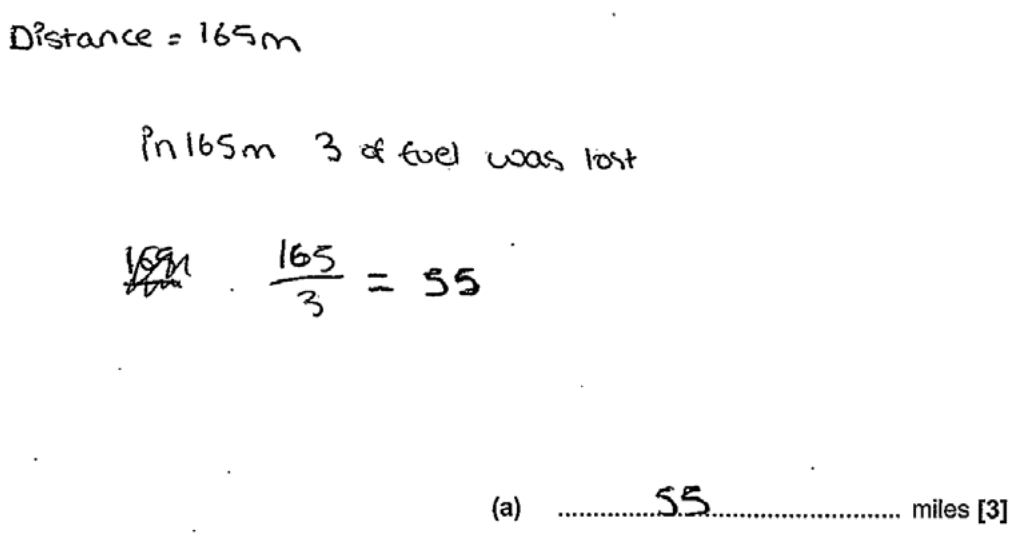


Examiner commentary

Candidate shows a complete correct method but makes a processing error when dividing 165 by 3 so M2 is earned.

Exemplar 3

1 mark



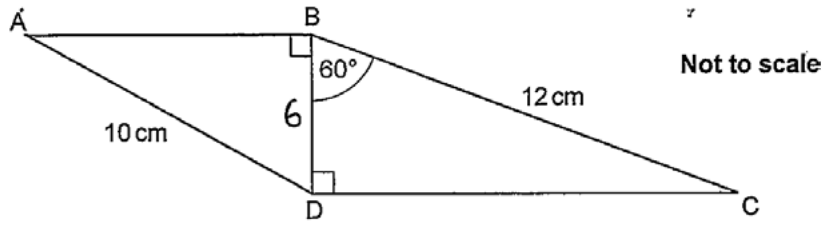
Examiner commentary

The candidate shows a partial method when dividing 165 by 3 but then does not complete. M1 is earned.

Question 11

Exemplar 1 6 marks

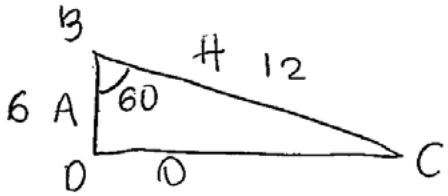
11 The diagram shows two right-angled triangles ABD and BCD, sharing a common side BD.
AD = 10 cm, BC = 12 cm and angle DBC = 60°.



Not to scale

Work out the length of AB.

	sin	cos	tan
30	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$
45	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1
60	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
90	1	0	/



COS

SOH CAH TOA

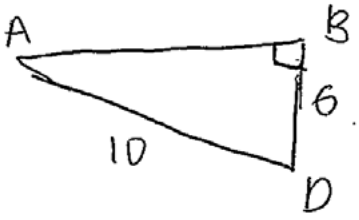
$\cos 60 = \frac{a}{12}$ ✓

$\frac{1}{2} \times 12 = a$

$\frac{1}{2} = \frac{a}{12}$ ✓

$\frac{12}{2} = a$

$6 = a$ ✓



$AD^2 = BD^2 - BA^2$

$BA^2 = AD^2 - BD^2$

$BA^2 = 100 - 36$ ✓

$BA^2 = 64$

$BA = \sqrt{64} = 8$

100 − 36 = 64

8 ✓ cm [6]

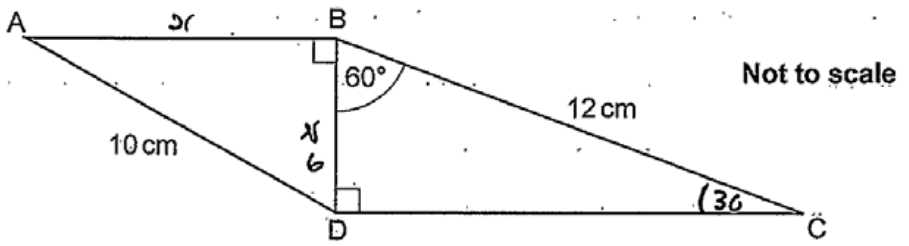
Turn over

Examiner commentary

Candidate shows a fully correct method with no errors and gives a correct solution.

Exemplar 2

3 marks



Work out the length of AB.

SOH CAH TOA

180 - 90 - 60 = 30

Sin 30 = $\frac{1}{2}$ ✓

Sin 30 × 12 = 6 ✓

BD = 6 ✓

Cos 90 = 0

Tan 90 = 1

Tan 90 × 6 = 6

AB = 6

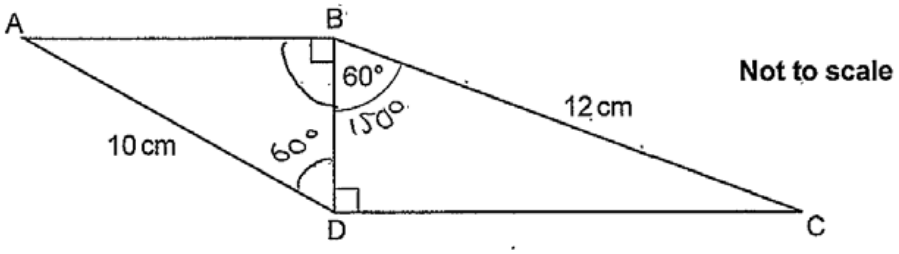
..... cm **[6]**

Examiner commentary

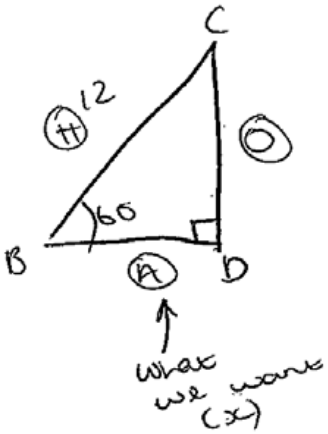
Candidate correctly finds BD and shows the method leading to this to earn B1 for sin30 = $\frac{1}{2}$, M1 for 12 × sin30 and A1 for BD = 6. They cannot complete correctly to find AB so no further marks earned.

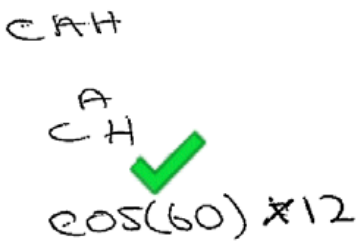
Exemplar 3

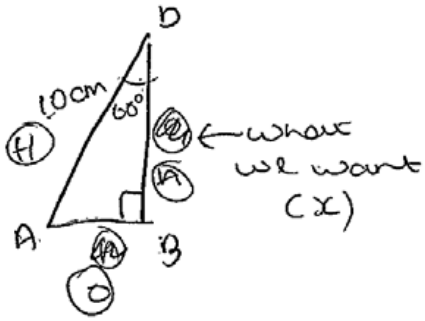
1 mark

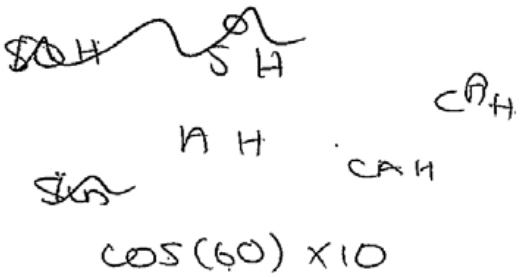


Work out the length of AB.









..... cm **[6]**

Examiner commentary

Candidate earns M1 for showing BD = 12 × cos60 but then makes no further progress.

Question 12

12 Carol says that $64^{-\frac{1}{2}} = \frac{1}{32}$.

Explain her error and give the correct value of $64^{-\frac{1}{2}}$ in the form $\frac{p}{q}$.

.....

.....

.....

..... **[3]**

Exemplar 1

3 marks

She need to square root 64 and not half it. The correct value of $64^{-\frac{1}{2}} = \frac{1}{\sqrt{64}}$ which is $\frac{1}{8}$

[3]

Examiner commentary

Candidate gives the correct answer of $\frac{1}{8}$ and also correctly explains the error made and the correct step needed. Full marks earned.

Exemplar 2

2 marks

$64^{\frac{1}{2}}$ gives 8 because $8 \times 8 = 64$ and 32×32 gives a number bigger than 64 so it would be $\frac{1}{8}$ because negative power makes it a fraction.

[3]

Examiner commentary

Candidate gives the correct answer of $\frac{1}{8}$ but is unable to explain the error made so this earns 2 marks only.

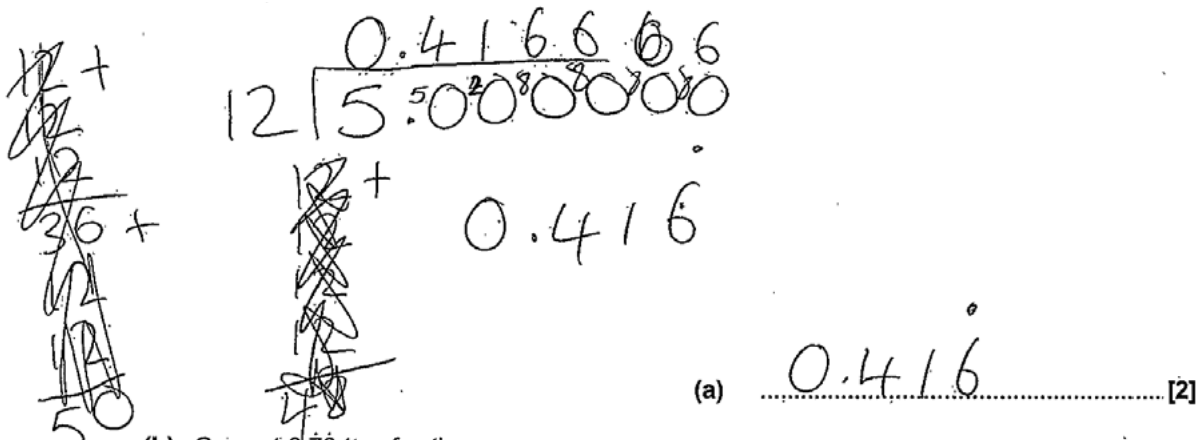
Question 13(a)

13 (a) Write $\frac{5}{12}$ as a recurring decimal.

(a) ..... **[2]**

Exemplar 1

2 marks

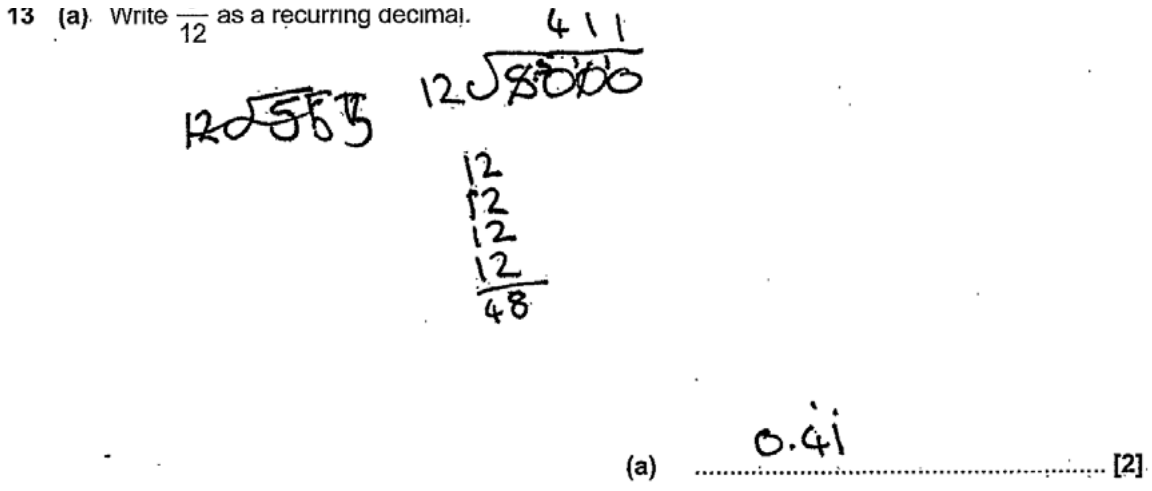


Examiner commentary

Correct answer with correct recurring decimal notation used so full marks earned.

Exemplar 2

1 mark



Examiner commentary

Candidate reaches answer 0.41… which earns B1.

Question 13(b)

(b) Convert $0.\dot{7}\dot{6}$ to a fraction.

(b) ..... **[2]**

Exemplar 1

2 marks

$x = 0.767676$

$10x = 7.67676$

$100x = 76.7676$

$100x - x = 99x$

$76.7676 - 0.7676$

$= 76$

$99x = 76$ $\quad \frac{76}{99}$

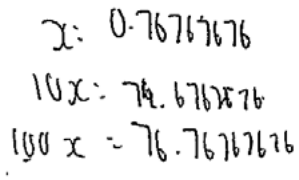
(b) $\frac{76}{99}$ **[2]**

Examiner commentary

Candidate gives correct answer with supporting working and earns 2 marks.

Exemplar 2

1 mark



(b) $\frac{76}{100}$ ..... [2]

Examiner commentary

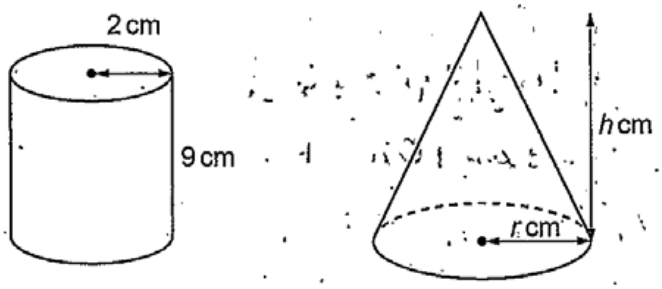
Incorrect answer but candidate earns M1 for showing 76.76… in working.

Question 14

Exemplar 1

5 marks

14 The diagram shows a cylinder and a cone.



The cylinder has radius 2 cm and height 9 cm.
The cone has radius r cm and height h cm.

The ratio $r : h$ is 1 : 4.
The volume of the cone is **equal to** the volume of the cylinder.

Work out the value of r.

[The volume V of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

volume of cylinder = $\pi r^2 h = 2^2 \times \pi \times 9 = 4 \times 9\pi = 36\pi$ ✓

so $36\pi = \frac{1}{3}\pi r^2 h$

$108 = r^2 h$ ✓ & $r : h$ is $1 : 4$

so $h = 4r$

so $108 = r^2 \times 4r$

$108 = 4r^3$

$27 = r^3$

$r = 3$ ✓

$4\pi \times 9 = 36\pi$

$h = 4r$

$4r \times r^2 = 4r^3$

$\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \times 4r^3$

$\frac{1}{3} \times r^3$

$27 = r^3$

$r = 3$

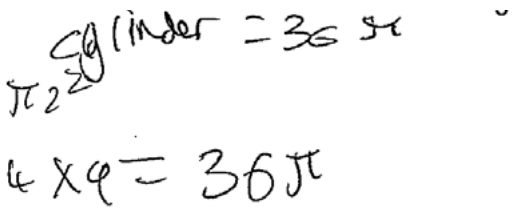
3 ..... [5]

Examiner commentary

Candidate shows fully correct step by step working and gives a correct answer so 5 marks earned.

Exemplar 2

2 marks



..... [5]

Examiner commentary

Candidate finds the volume of the cylinder correctly in terms of π to earn 2 marks but then makes no further progress.

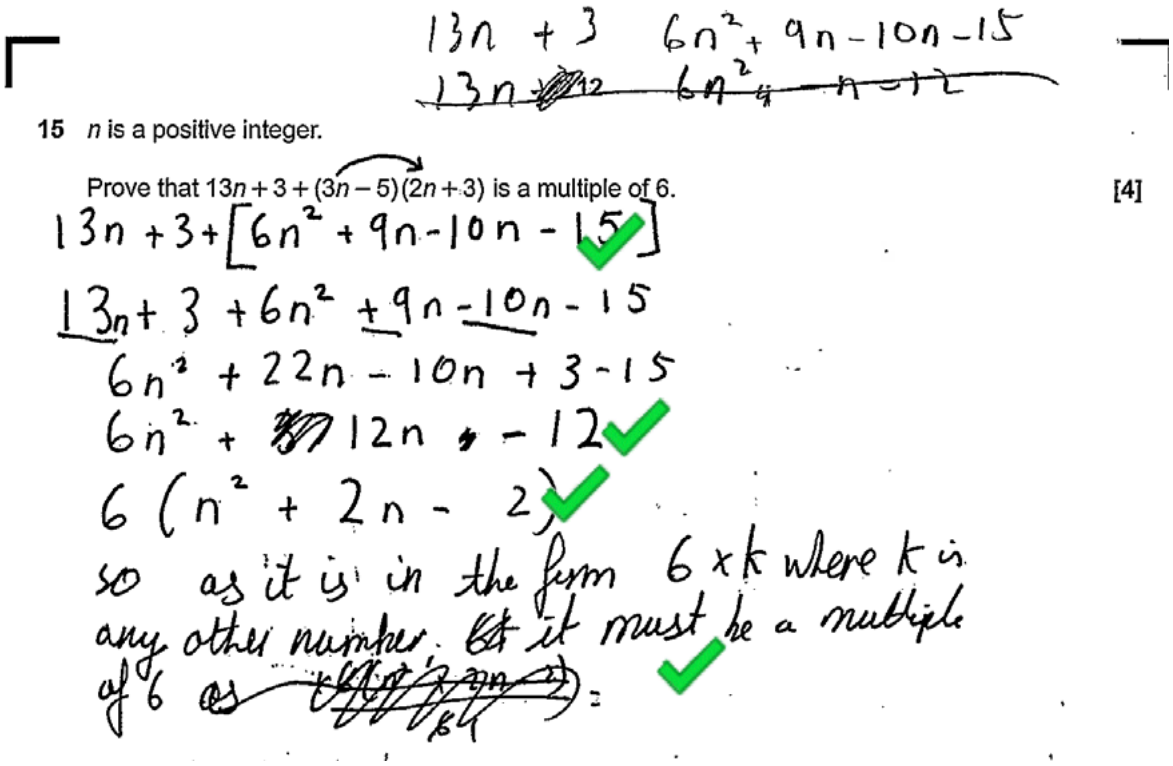
Question 15

15 n is a positive integer.

Prove that $13n + 3 + (3n - 5)(2n + 3)$ is a multiple of 6. **[4]**

Exemplar 1

4 marks

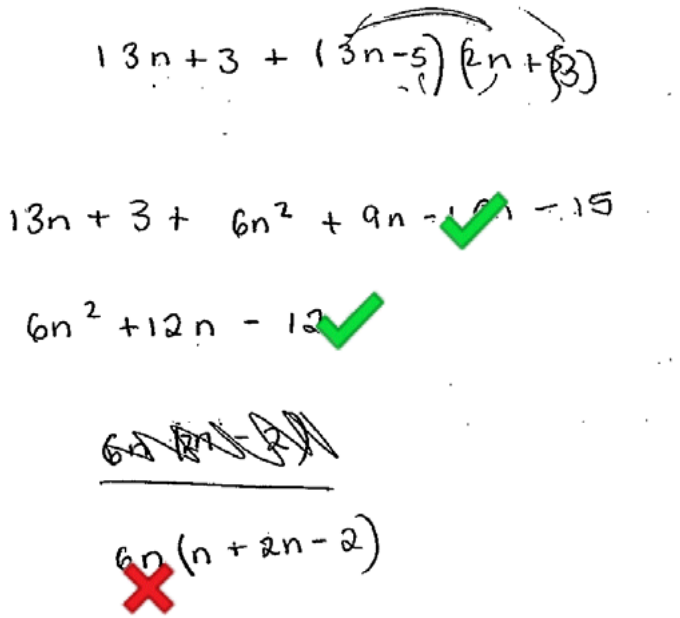


Examiner commentary

Candidate shows a correct step by step method and completes all algebraic manipulation correctly with no omissions. They correctly remove a common factor of 6 from the expression, showing the factorised expression and then conclude correctly reflecting on the demand of the question.

Exemplar 2

3 marks

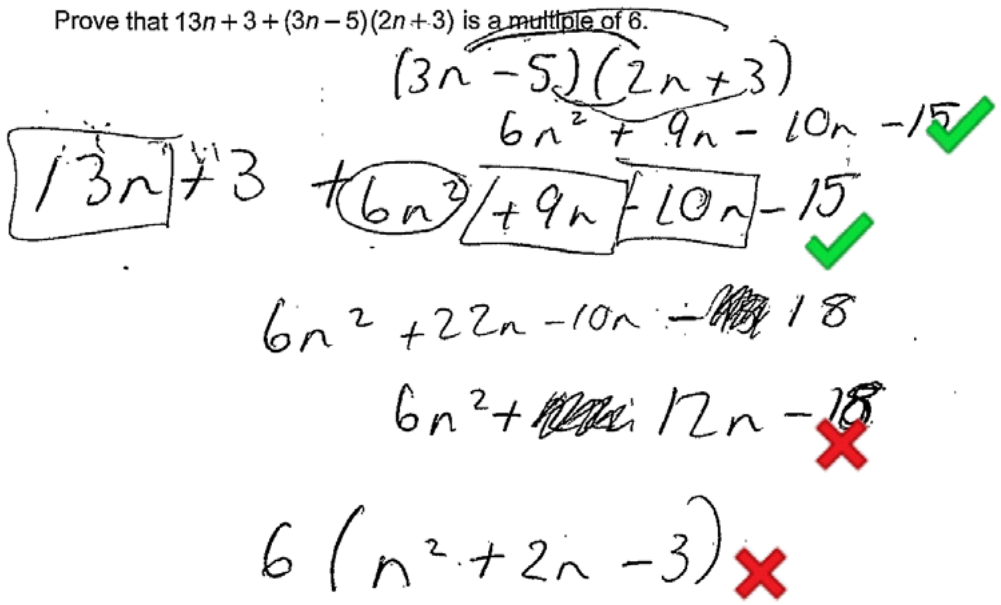


Examiner commentary

Candidate correctly expands brackets and simplifies the resulting expression to earn M2 A1. They make an error when factorising the expression and omit their conclusion so the final A1 is not earned.

Exemplar 3

2 marks



Examiner commentary

Candidate correctly expands the brackets to 4 terms to earn M2 but then makes an error when simplifying the expression and earns no further marks.

Exemplar 4

1 mark

15 n is a positive integer.

Prove that $13n + 3 + (3n - 5)(2n + 3)$ is a multiple of 6. **[4]**

$13n+3+6n-15$

$19n+3-15=0$

$+15 \quad 19n+3=15 \quad -3$

$-3 \quad 19n=12$

$18n=12$

$\div 6$

$\div 6 \quad 3n=2$

$n=\frac{2}{3}$

	$3n$	-5
$2n$	$6n$	$-10n$
$+3$	$9n$	-15 M1

$6n+9n-10n-15$

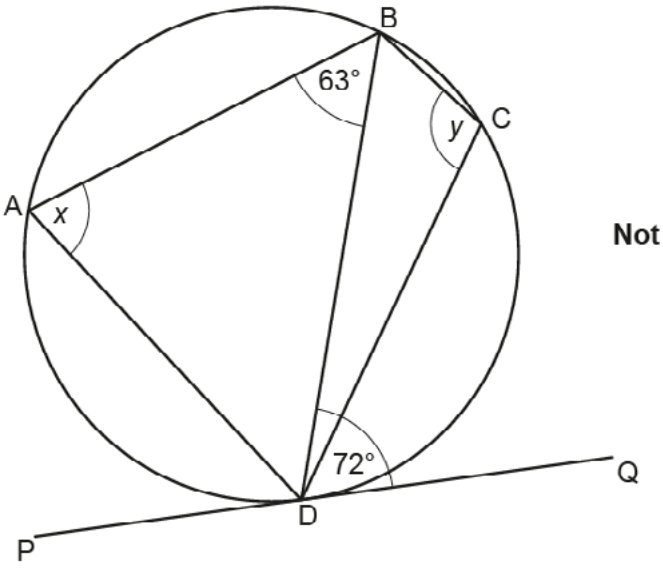
$=6n-4n-15$

Examiner commentary

Candidate attempts to expand brackets and makes an error with one term. They earn M1 for three correct terms out of four shown.

Question 16(a)

16 A, B, C and D are points on the circumference of a circle.



Not to scale

PQ is a tangent to the circle at D.
Angle BDQ = 72° and angle ABD = 63°.

(a) Work out angle *x*.
Give a reason for your answer.

Angle *x* = ...° because .....

..... **[2]**

Exemplar 1

2 marks

Angle *x* = 72 ° because alternate segment theorem

..... **[2]**

Examiner commentary

Angle *x* is given correctly and the correct terminology is given in the reasoning so both marks are earned.

Exemplar 2

1 mark

Angle x = 72 ° because the angles opposite are equal. [2]

Examiner commentary

Angle x is given correctly but the reasoning is not correct and does not use the required terminology of 'alternate segment'.

Question 16(b)

(b) Work out angle *y*.
Give a reason for your answer.

Angle *y* = ...° because .....

..... [2]

Exemplar 1 2 marks

Angle *y* = 108 ° because angles opposite in a cyclic quadrilateral add to 180° [2]

Examiner commentary

Angle *y* is given correctly and the correct terminology is given in the reasoning so both marks are earned.

Exemplar 21 1 mark

180
− 72
108

Angle *y* = 108 ° because opposite angles in a quadrilateral in a circle add up to 180° [2]

Examiner commentary

Angle *y* is given correctly but the correct terminology is not given in the reasoning with the term 'cyclic' omitted so one mark only.

Question 17

Exemplar 1

4 marks

17 $(x+a)(x+3)(2x+1) = bx^3 + cx^2 + dx - 12$

Find the value of a, b, c and d.

$(x+a)(x+3)$

$x^2 + 3x + ax + 3a$

$(x+3)(2x+1)$

$2x^2 + 1x + 6x + 3$

$2x^2 + 7x + 3$

	$2x^2$	$+7x$	$+3$
x	$2x^3$	$+7x^2$	$+3x$
$+a$ (-4)	$-8x^2$	$-28x$	-12

$2x^3 - x^2 - 25x - 12$

$-12 \div 3 = -4$

$a = -4$ ✓

$b = 2$ ✓

$c = -1$ ✓

$d = -25$ ✓ [4]

Examiner commentary

All values correctly given and correct working showing expansion of the three brackets.

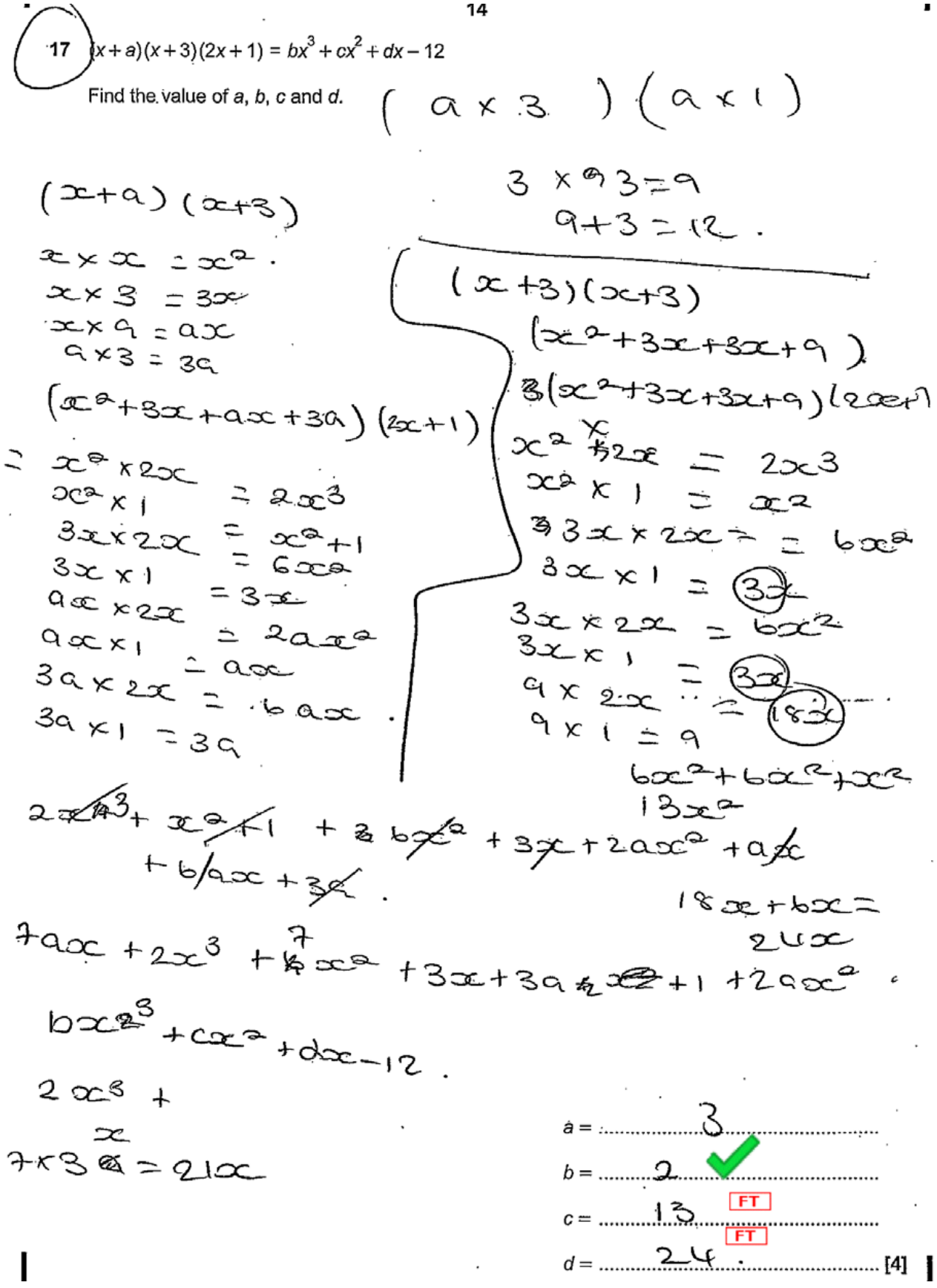
Exemplar 2

3 marks

14

17 $(x+a)(x+3)(2x+1) = bx^3 + cx^2 + dx - 12$

Find the value of a, b, c and d.



Examiner commentary

Looking at the answer line first, the value of *b* is correctly given but the value of a is incorrect. The candidate's answers for *c* and *d* correctly follow through from their incorrect value of *a* so 3 marks are earned.

Exemplar 3

2 marks

17 $(x+a)(x+3)(2x+1) = bx^3 + cx^2 + dx - 12$

Find the value of a, b, c and d.

$(x+a)(x+3)(2x+1)$

$(x+a)(2x^2+x+6x+3)$

$(2x^3+x^2+6x^2+3x+2ax^2+ax+6ax+3a)$

$2x^3+8x^2+3x+(2ax^2+7ax+3a)$

$= 12$

$= 2x^3+8x^2+3x$

$2ax^2+7ax+3a = 12$

$12 = 2ax^2+7ax+3a$

$3a$ $\frac{12}{3} = a = 4$

$a =$ 4

$b =$ 2

$c =$ 8

$d =$ 3 **[4]**

Examiner commentary

The candidate gives one correct value on the answer line with the others all incorrect. In the working on the third line, the candidate has shown a correct unsimplified expression for the three bracket expansion and this earns B2.

Exemplar 4

1 mark

17 $(x+a)(x+3)(2x+1) = bx^3 + cx^2 + dx - 12$

Find the value of a, b, c and d.

$(x+a)(2x^2+6x+x+3 = bx^3+cx^2+dx-12$

$(x+a)\ 2x^2+7x+3 = bx^3+cx^2+dx-12$

$(+a)\ 2x^3+7x^2+3x = bx^3+cx^2+dx-12$

(12)

$-24x^3+84x^2-36x$

$a = -12$

$b = 2$

$c = 7$

$d = 3$ [4]

Examiner commentary

The candidate scores 1 mark for giving a correct value for b. In the working there is evidence of a correct two bracket expansion but not for a correct 3 bracket expansion so 1 mark overall.

Question 18(a)

18 (a) A straight line passes through the point (0, 6) and is perpendicular to $y = 4x - 5$.

Find the equation of this line, giving your answer in the form $y = mx + c$.

(a) ..... [3]

Exemplar 1

3 marks

15

18 (a) A straight line passes through the point (0, 6) and is perpendicular to $y = 4x - 5$.

Find the equation of this line, giving your answer in the form $y = mx + c$.

$-1/x$.

$y = 4x - 5$.

$6 = (-1/4 \times 0) - c$.

$(-1/4 \times 0) = 0$.

$b = -c$

$c = -b$

$y = -1/4x + c$

$y = -1/4x + b$

$b = 0 + b$

$b = +b$

(a) $y = -1/4x + b$ [3]

Examiner commentary

A correct answer is given. The candidate shows understanding of the relationship between gradients of perpendicular lines and uses the given coordinate to find the constant value in the equation correctly.

Exemplar 2

1 mark

$y = 4x - 5$

y	-1	3	7	-9	-13
x	1	2	3	-1	-2

(a) $y = -4x + 6$ [3]

Examiner commentary

The candidate does not recall the relationship between gradients of perpendicular lines by giving -4 as the gradient but correctly finds the constant value 6 in the equation to score M1.

Question 18(b)

Exemplar 1

6 marks

(b) Work out the coordinates of the intersection of the graphs of $y = 4x - 5$ and $y = x^2 - 17$.

$y = 4x - 5$

$y = x^2 - 17 \Rightarrow x^2 - y = 17$

$x^2 - (4x - 5) = 17$

$x^2 - 4x + 5 = 17$

$x^2 - 4x = 17 - 5$

$x^2 - 4x = 12$

~~$x(x - 4) = 12$~~

~~$x - 4x$~~

$x^2 - 4x - 12 = 0$

1 12
2 6

$(x + 2)(x - 6) = 0$

$x = -2$
$x = 6$

$x = -2$

$y = 4 \times -2 - 5$

$y = -8 - 5$

$y = -13$

$x = 6$

$y = 4 \times 6 - 5$

$y = 24 - 5$

$y = 19$

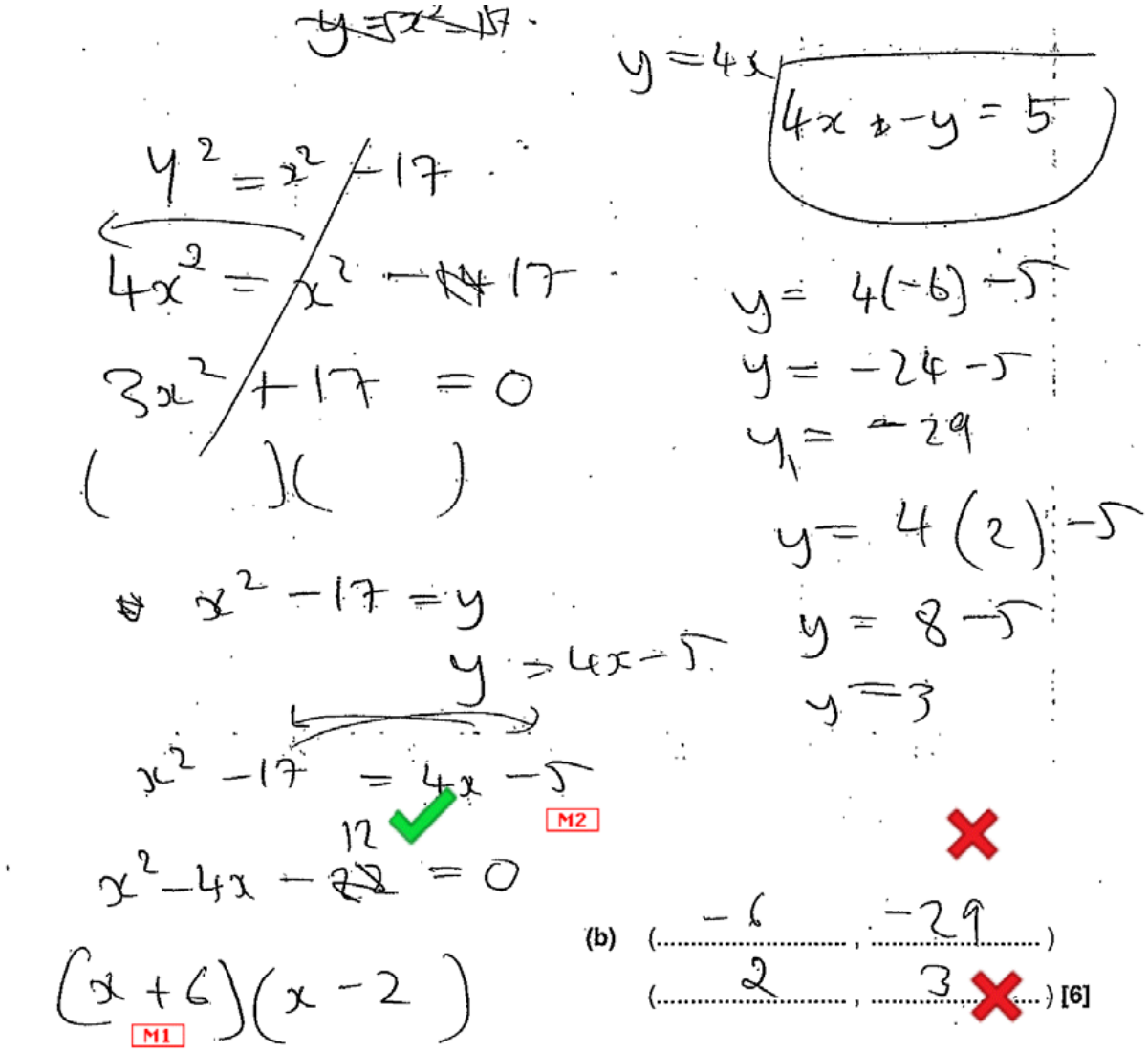
(b) (−2, −13)
(6, 19) [6]

Examiner commentary

Candidate gives a correct solution supported by a correct algebraic method and scores full marks.

Exemplar 2

3 marks

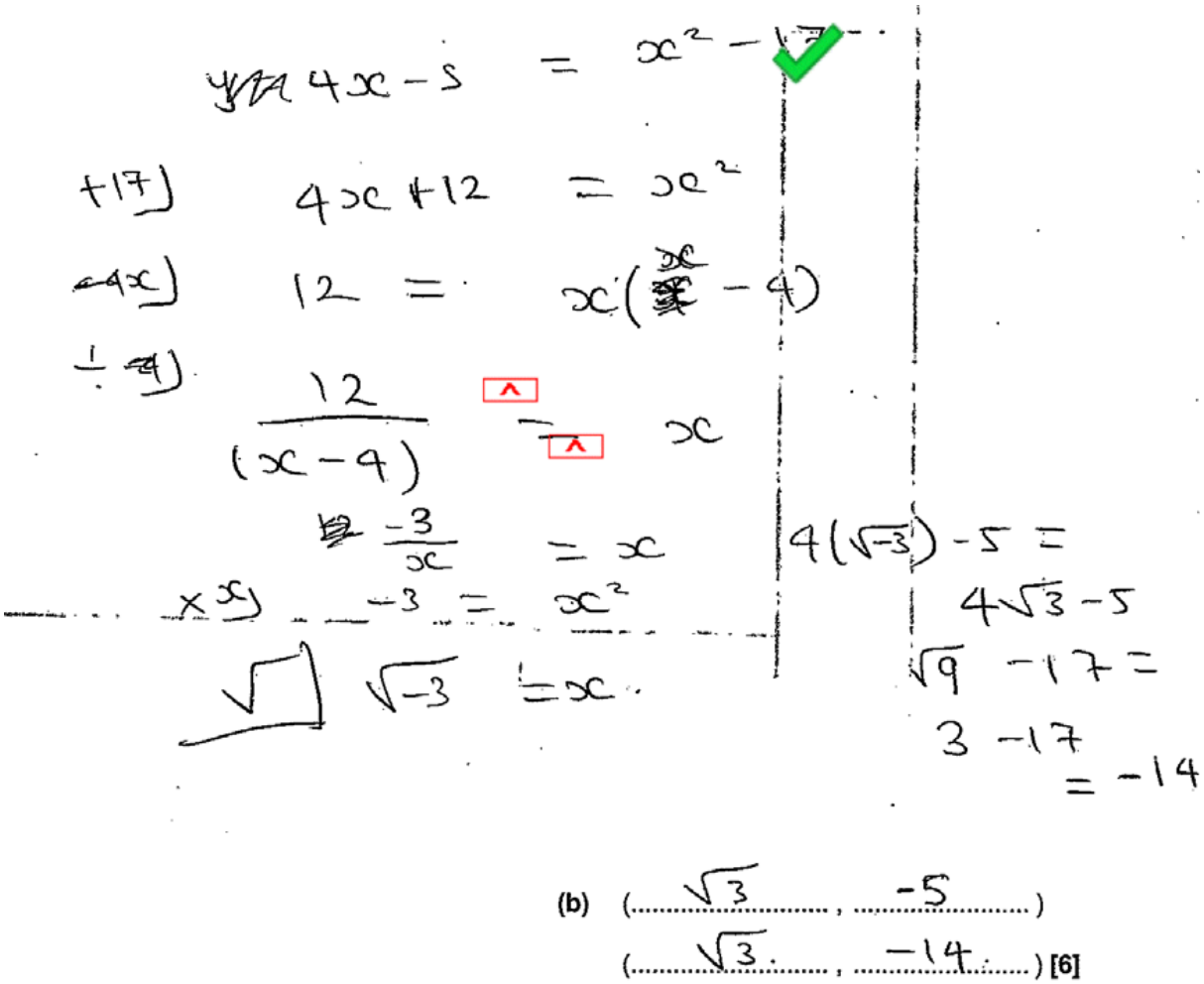


Examiner commentary

Candidate shows a correct first step in forming an equation in *x* from the two given equations. They simplify the equation to a 3 term quadratic and then attempt to factorise but make an error with the factors. They earn M2 for the quadratic equation and M1 for a pair of factors in brackets which, when expanded, will give 2 correct terms in the quadratic equation.

Exemplar 3

1 mark



(b) (..... √3 ....., ... −5 .....)

(..... √3 ....., ... −14 .....) **[6]**

Examiner commentary

Candidate shows a correct first step in forming an equation in *x* from the two given equations but does not simplify it to a 3 term quadratic. M1 only is earned for the first step.

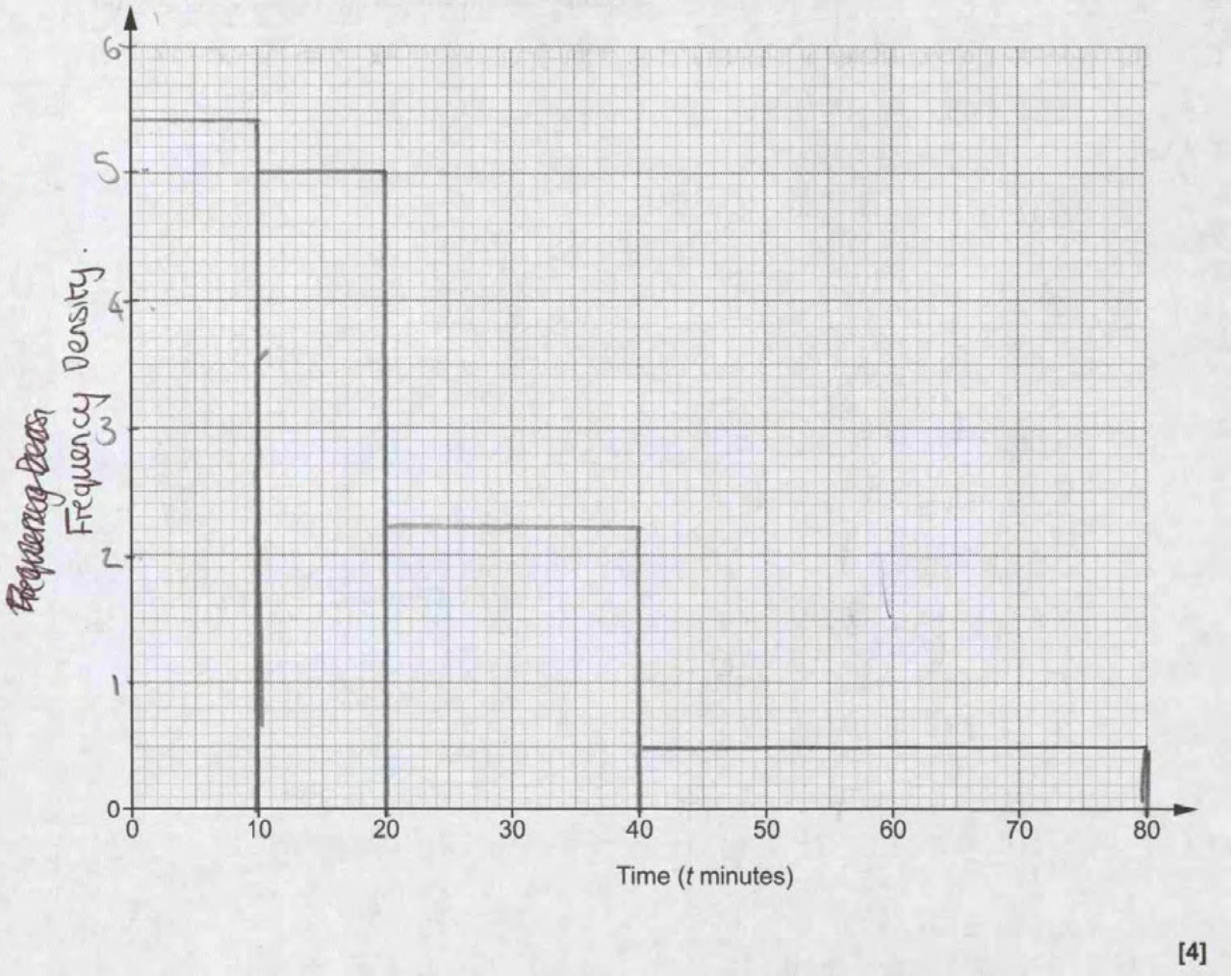
Question 19(a)

Exemplar 1 4 marks

19 Ceri records the time taken, t minutes, to travel to school for a sample of 168 students at her Academy.

Time taken (t minutes)	Frequency	F.d
$0 < t \leqslant 10$	54	5.4.
$10 < t \leqslant 20$	50	5.
$20 < t \leqslant 40$	44	2.2.
$40 < t \leqslant 80$	20	0.5

(a) Draw a histogram to represent this information.



[4]

Examiner commentary

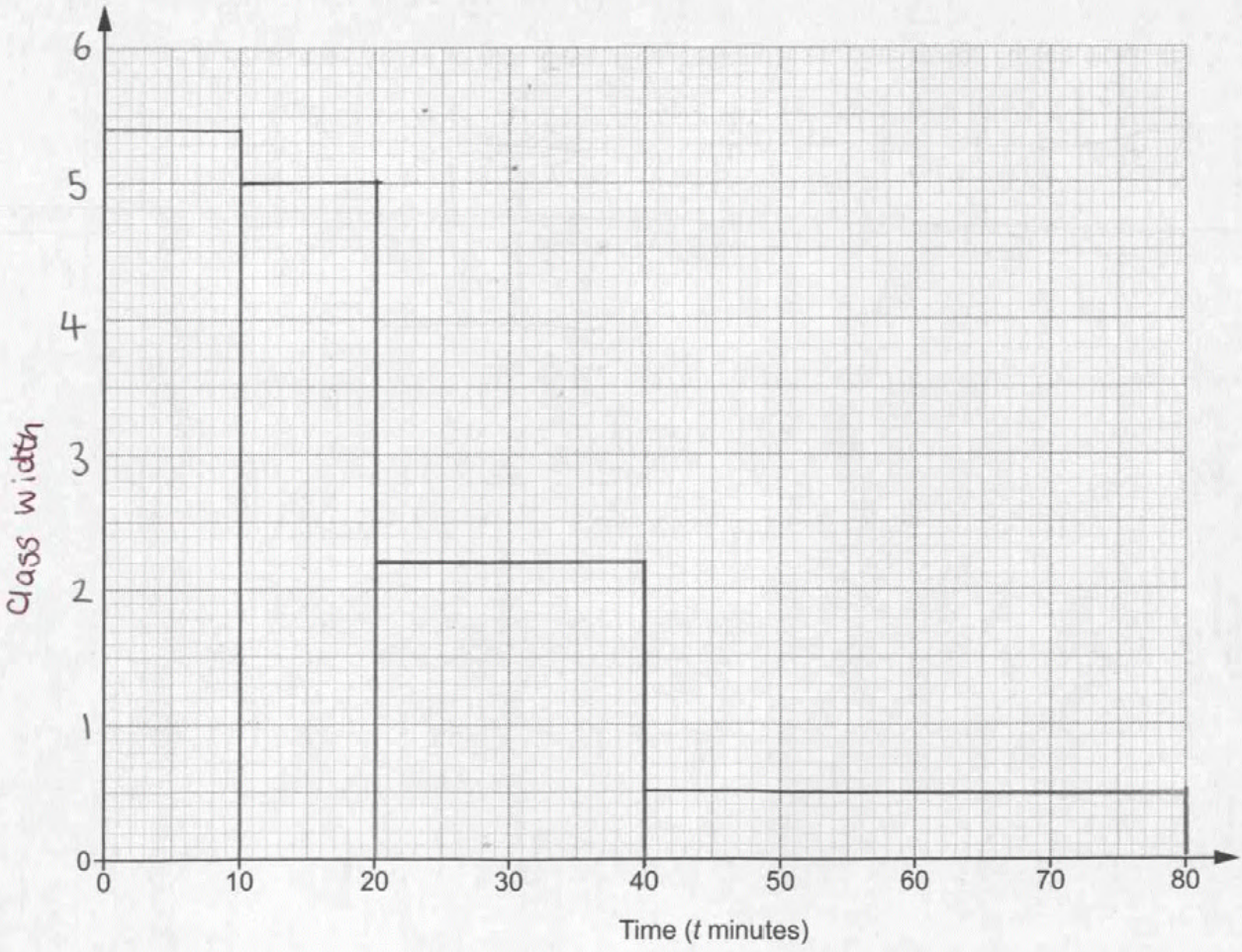
A correct histogram with all blocks correctly drawn and vertical axis correctly scaled and labelled 'frequency density'.

Exemplar 2

3 marks

Time taken (t minutes)	Frequency	
$0 < t \leqslant 10$ 10	54	54 ÷ 10 = 5.4
$10 < t \leqslant 20$ 10	50	50 ÷ 10 = 5
$20 < t \leqslant 40$ 20	44	44 ÷ 20 = 2.2
$40 < t \leqslant 80$ 40	20	20 ÷ 40 = 0.5

(a) Draw a histogram to represent this information.



[4]

Examiner commentary

The bars on the histogram are all correct heights and widths and the vertical axis is correctly scaled but incorrectly labelled as class width. Candidate earns 3 marks for the correct blocks.

Exemplar 3

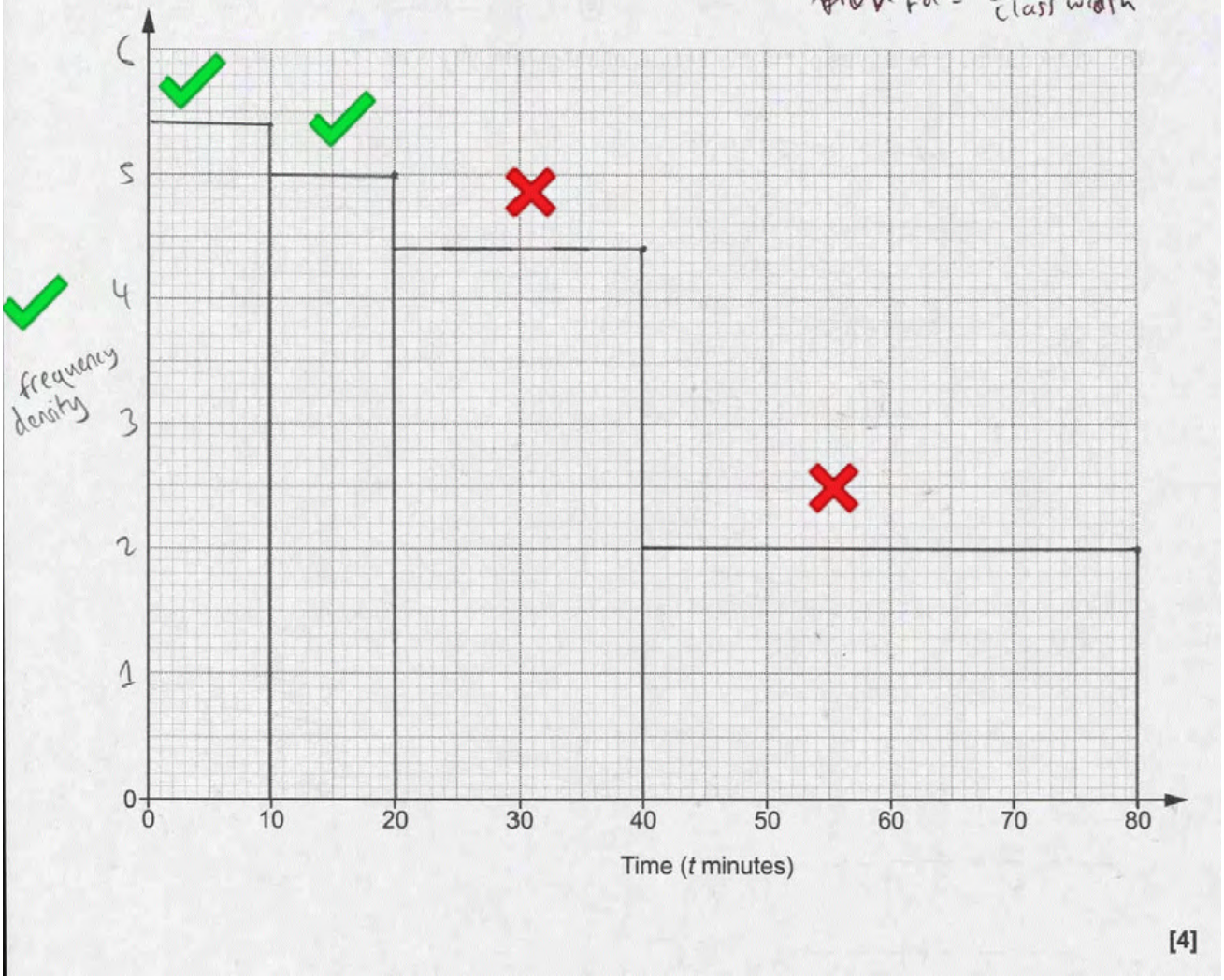
1 mark

Time taken (t minutes)	Frequency
$0 < t \leqslant 10$	54
$10 < t \leqslant 20$	50
$20 < t \leqslant 40$	44
$40 < t \leqslant 80$	20

freq density
5.4
5
4.
2

(a) Draw a histogram to represent this information.

fd × class width = freq
~~freq~~ fd = freq / class width



[4]

Examiner commentary

Only two of the blocks have been drawn correctly and by the table the candidate shows two correct frequency densities so no mark earned at this stage. The vertical axis is correctly scaled and labelled and this earns one mark.

Question 19(b)

(b) Ceri says

The longest time that any of these students took to travel to school was 80 minutes.

Is she correct?
Give a reason for your answer.

.....

..... [1]

Exemplar 1 — 1 mark

NO the longest was between 40 and 80
but might not be 80 [1]

Examiner commentary

An example of a correct reason which gives an acceptable decision 'No' and refers to the data being anywhere in the interval but not necessarily 80 minutes.

Exemplar 2 — 0 marks

Give a reason for your answer.

Yes because but it is less likely because of the range. [1]

Examiner commentary

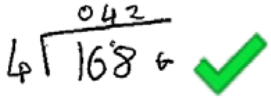
The candidate makes an incorrect decision 'Yes' and so this scores no marks.

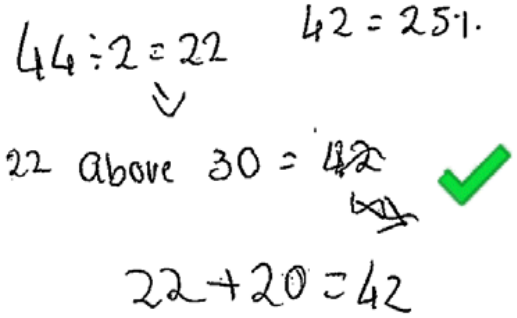
Question 19(c)(i)

(c) Ceri also claims that 25% of all of the students at this Academy took more than 30 minutes to travel to school.

(i) Show how Ceri might have worked out her claim. **[2]**

Exemplar 1 — 2 marks

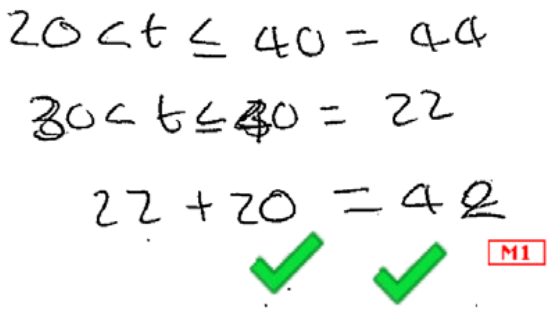


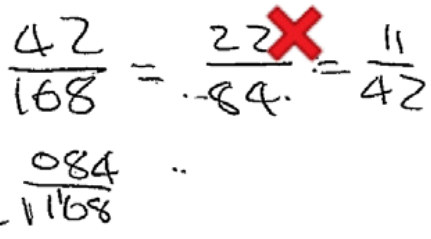


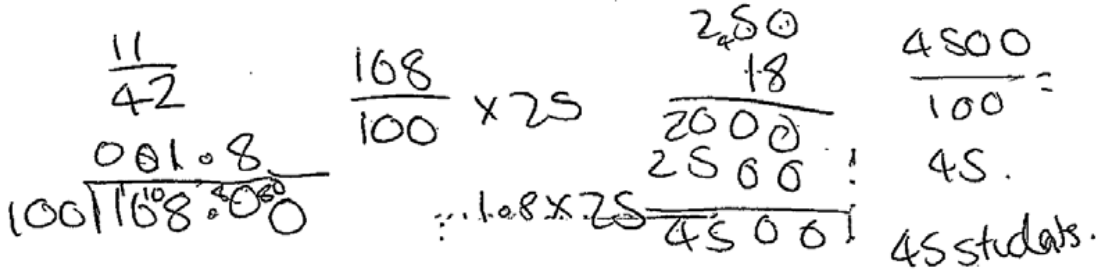
Examiner commentary

Candidate shows how 42 is established from 20 + 44 ÷ 2 and then shows that this is 25% of 168. Full marks are earned.

Exemplar 2 — 1 mark







Examiner commentary

Candidate shows how 42 is established from 20 + 44 ÷ 2 to earn M1 but does not earn the A mark as there is an error in finding 25% of 168.

Question 19(c)(ii)

(ii) State one assumption that Ceri has made in making her claim.

.....

..... [1]

Exemplar 1 — 1 mark

That the frequency within the $20 < t \leq 40$ range are evenly distributed. ie there are the same amount of people taking $20 < t \leq 30$ as $30 < t \leq 40$. [1]

Examiner commentary

An example of an acceptable reason that refers to the even frequency distribution in the relevant interval.

Exemplar 2 — 0 marks

That there is no traffic or congestions [1]

Examiner commentary

An incorrect reason that does not address the issue.

Question 20(a)(i)

20 In the following equation, n is an integer greater than 1.

$$(\sqrt{2})^n = k\sqrt{2}$$

(a) (i) Find k when $n = 7$.

(a)(i) $k =$ ..... **[2]**

Exemplar 1

2 marks

(a) (i) Find k when $n = 7$.

$(\sqrt{2})^7 = \sqrt{2} \times \sqrt{2} \times \sqrt{2} \times \sqrt{2} \times \sqrt{2} \times \sqrt{2} \times \sqrt{2}$

$2 \times 2 \times 2 \times \sqrt{2}$

$8\sqrt{2}$

(a)(i) $k =$ 8 **[2]**

Examiner commentary

A correct answer supported by correct working.

Exemplar 2

1 mark

$(\sqrt{2})^7 = k\sqrt{2}$

$\sqrt{2} \times \sqrt{2} \times \sqrt{2} \times \sqrt{2} \times \sqrt{2} \times \sqrt{2} \times \sqrt{2}$

$2 \times 2 \times 2 \times \sqrt{2}$

$8\sqrt{2}$

(a)(i) $k =$ $8\sqrt{2}$ **[2]**

Examiner commentary

The candidate has shown correct working in reaching $8\sqrt{2}$ to earn M1 but has not given the k value as 8 in the answer.

Question 20(a)(ii)

(ii) Find n when $k = 64$.

(ii) $n =$ ..... **[2]**

Exemplar 1

2 marks

$64\sqrt{2} = 2^{6.5}$

$= \sqrt{2}^{13}$

(ii) $n =$ 13 **[2]**

Examiner commentary

An unusual method to use an index of 6.5 in the working but the candidate correctly associates $2^{6.5}$ with $\left(\sqrt{2}\right)^{13}$ and gives the correct answer.

Exemplar 2

1 mark

$n = 8, 9, 10, 11, 12$

$16, 16\sqrt{2}, 32, 32\sqrt{2}, 64$

(ii) $n =$ 12 **[2]**

Examiner commentary

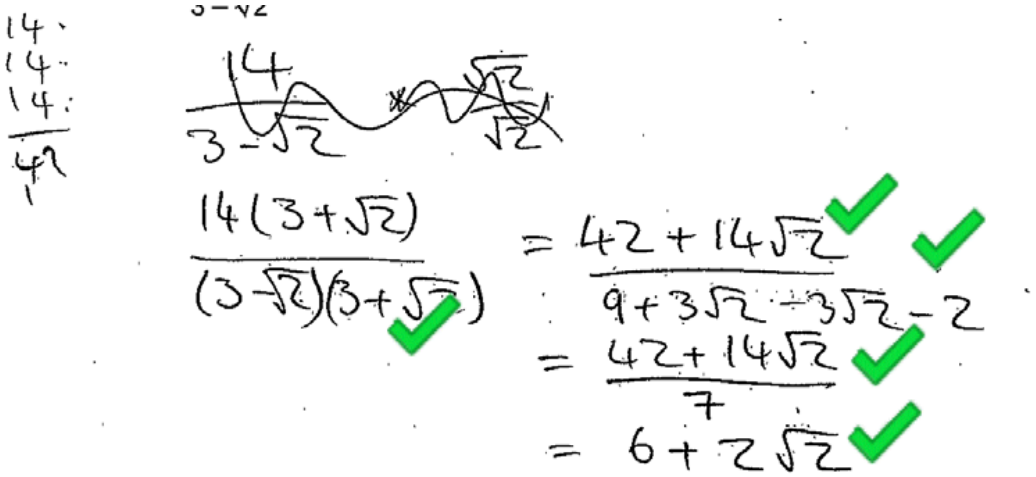
An incorrect answer, but in the working the candidate has given the correct figures for at least 2 different values of n to earn B1.

Question 20(b)

(b) Show that $\frac{14}{3-\sqrt{2}}$ can be written in the form $a+b\sqrt{2}$. **[5]**

Exemplar 1

5 marks

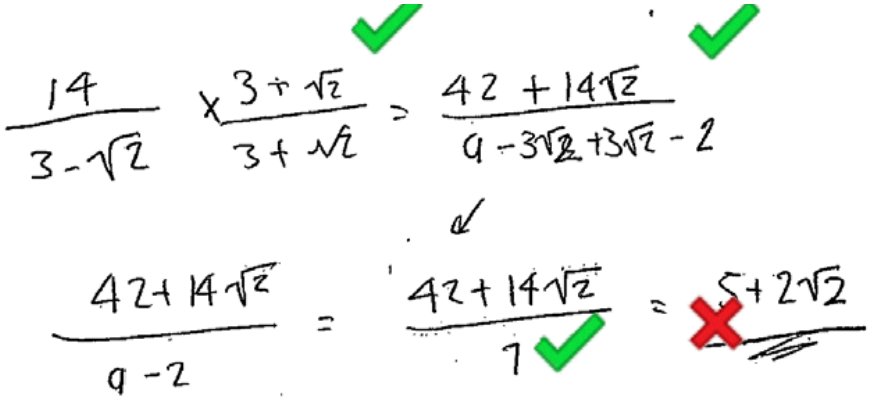


Examiner commentary

In 'Show that' questions, it is important that the candidate shows each step of working to reach the answer. Here all steps are shown clearly and there are no errors in reaching the correct answer.

Exemplar 2

4 marks

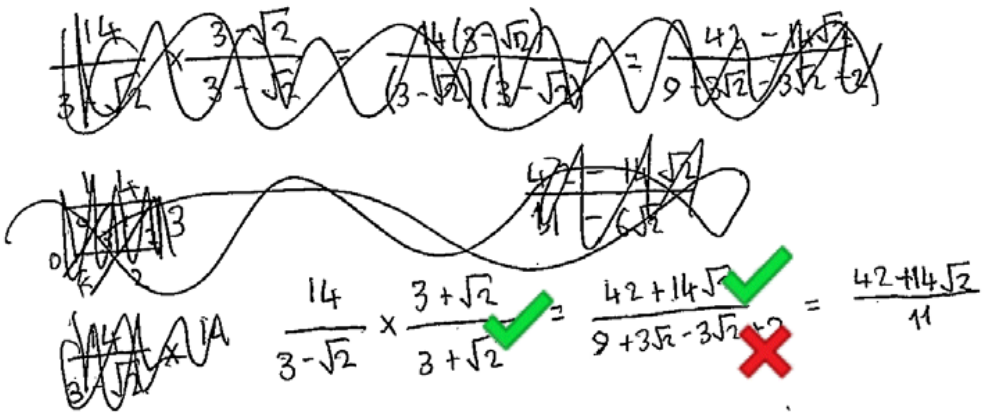


Examiner commentary

The candidate shows the correct working to rationalise the surd expression and then correctly deals with the brackets in the numerator and denominator but then there is an error when dividing by 7 resulting in an incorrect answer. The working shown scores M1 and B3.

Exemplar 3

2 marks

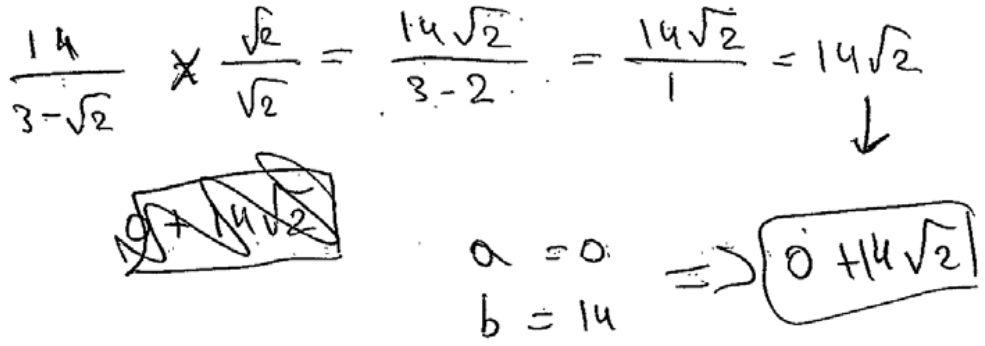


Examiner commentary

The candidate shows the correct working to rationalise the surd expression and then correctly deals with the brackets in the numerator but makes an error when expanding the denominator. The working shown scores M1M1.

Exemplar 4

0 marks



Examiner commentary

The candidate realises that the surd expression needs to be rationalised but cannot recall how to correctly do this and makes an error at the first stage. No marks were earned.

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