Qualification Accredited

OCR
Oxford Cambridge and RSA

GCSE (9–1)

Exemplar Candidate Work

MATHEMATICS

J560
For first teaching in 2015

J560/04 Summer 2019 examination series

Version 1

Contents

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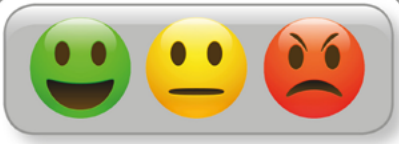

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Introduction

These exemplar answers have been chosen from the summer 2019 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 they 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 2019 Examiners' report or Report to Centres available from Interchange https://interchange.ocr.org.uk/.

The question paper, mark scheme and any resource booklet(s) will be available on the OCR website from summer 2020. 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

1 Calculate.

$$\sqrt[3]{\frac{210}{10^2+5^2}}$$

Give your answer correct to 3 significant figures.

..... [3]

Exemplar 1 3 marks

$\sqrt[3]{\frac{210}{10^2+5^2}} = \sqrt[3]{\frac{42}{25}} = 1.1887\ldots = 1.19$ (to 3sf)

Give your answer correct to 3 significant figures.

1.19 [3]

Examiner commentary

This response shows the working to simplify the fraction. The answer is then given to 5 significant figures and finally correctly rounded to 3 significant figures.

Exemplar 2 2 marks

Give your answer correct to 3 significant figures.

$\frac{210}{125} = \frac{42}{25}$ $\sqrt[3]{\frac{42}{25}} = 1.1887$

1.189 [3]

Examiner commentary

The answer has been correctly calculated as can be seen in the working. However, it has not been correctly rounded to 3 significant figures so it is awarded B2 for an acceptable figure given of 1.189.

Question 2

2 The ratio 50 grams to 1 kilogram can be written in the form 1 : n.

Find the value of n.

n = ... **[2]**

Exemplar 1 — 2 marks

Find the value of n.

50÷ (50 : 1000
1 : n) 50÷

1 : 20

n = 20 .... **[2]**

Examiner commentary

1 kilogram is converted into grams and written in the ratio, without units, as 50 : 1000. This is then simplified as much as possible and the value of n identified.

Exemplar 2 — 1 mark

÷50 (50g : 1kg
1 : n) ÷50

50g : 1000g
1 : 20g
1 : 0.02 kg

n = 0.02 .... **[2]**

Examiner commentary

The candidate starts correctly and writes 1 kilogram in grams and then in the ratio 50 g : 1000 g. Despite the units, they are awarded B1. The next line reveals the correct answer but they then convert it back to kilograms and do not give the correct answer.

Question 3 (a)

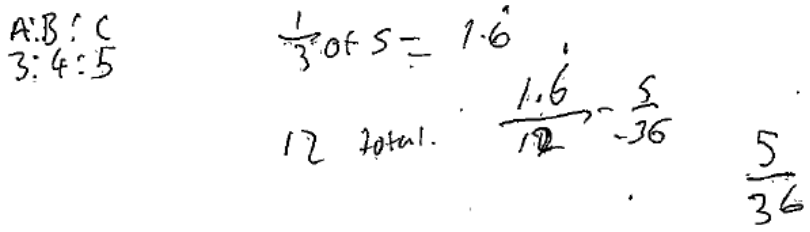
3 **(a)** Anne, Barry and Colin share a prize in the ratio 3 : 4 : 5.
Colin gives $\frac{1}{3}$ of his share to a charity.

What fraction of the whole prize does Colin give to the charity?

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

Exemplar 1

3 marks



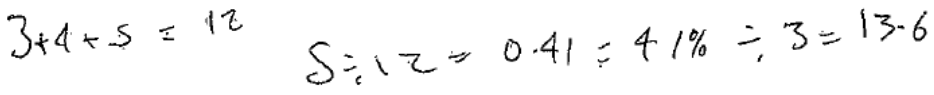
(a) ..... **[3]**

Examiner commentary

The candidate writes $\frac{1}{3}$ of 5 correctly as 1.6 and then forms the fraction $\frac{1.6}{12}$ which they simplify to $\frac{5}{36}$ which is the correct answer.

Exemplar 2

2 marks



(a) 13.6 ..... **[3]**

Examiner commentary

In this response M2 is awarded because the response shows 5 ÷ 12 and they then attempt to divide the result by 3. They do use percentages and the candidate has introduced an inaccurate result but the method is complete and correct.

Question 3 (b)

(b) Delia, Edwin and Freya share some money in the ratio 5 : 7 : 8.
Freya's share is £1600.

How much money did they share?

(b) £ ..... **[2]**

Exemplar 1

2 marks

5+7+8 = 20

(1600 ÷ 8) × 20 = 4000

(b) £ 4000 **[2]**

Examiner commentary

1600 ÷ 8 scores M1. Multiplying the result by 5 + 7 + 8 and getting the correct answer gains the second mark.

Question 4 (a)

4 A bus timetable shows the following information.

- A bus following route T leaves for the train station every 20 minutes.
- A bus following route A leaves for the airport every 18 minutes.
- A bus following route T and a bus following route A both leave at 8.37 am.

(a) When is the next time one of each bus is timetabled to leave at the same time?

(a) ..... **[4]**

Exemplar 1

4 marks

- A bus following route T leaves for the train station every 20 minutes.
- A bus following route A leaves for the airport every 18 minutes.
- A bus following route T and a bus following route A both leave at 8.37 am.

(a) When is the next time one of each bus is timetabled to leave at the same time?

Route T: 20 40 60 80 100 120 140 160 180

Route A: 18 36 54 72 90 108 126 144 162 180

180 minutes = 3 hours

8·37 + 3·00 = 11·37

(a) 11·37 AM. **[4]**

Examiner commentary

This candidate demonstrates a correct solution. This is not the most efficient method but the candidate correctly finds the lowest common multiple as 180 and then the correct next time. An alternative method was to write down the actual times but that often led to errors whereas this method was found to be easier and more reliable.

Exemplar 2

2 marks

20 × 18 = 360

360 ÷ 60 = 6hrs

8:37.

14:37.

(a) 2:37 pm **[4]**

Examiner commentary

In this response the candidate works out the lowest common multiple as 360 instead of 180 and then correctly finds their time as 2.37 pm which is the time after the next time. This is awarded B2. This answer was seen quite often.

Question 5

5 Bennie is 7 years older than Ayesha.
Chloe is twice as old as Bennie.
The sum of their three ages is 57.

Work out the ages of Ayesha, Bennie and Chloe.

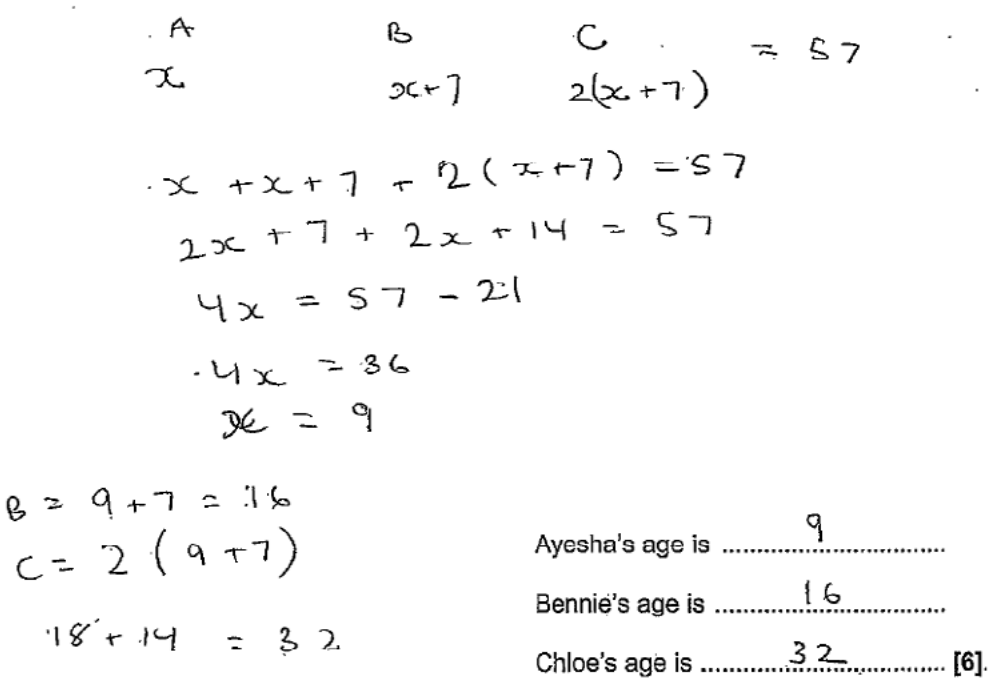
Ayesha's age is .....

Bennie's age is .....

Chloe's age is ..... **[6]**

Exemplar 1

6 marks



Ayesha's age is 9

Bennie's age is 16

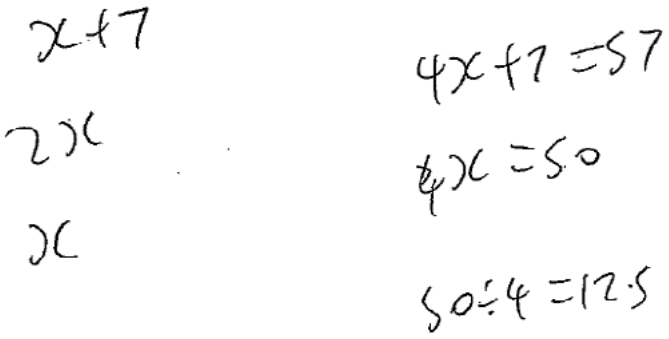
Chloe's age is 32 **[6]**.

Examiner commentary

In this response the variable *x* is clearly defined and the other expressions are written out. The equation is constructed and solved. The result is fed back into the other expressions to find all the ages.

Exemplar 2

3 marks



Ayesha's age is 12.5

Bennie's age is 19.5

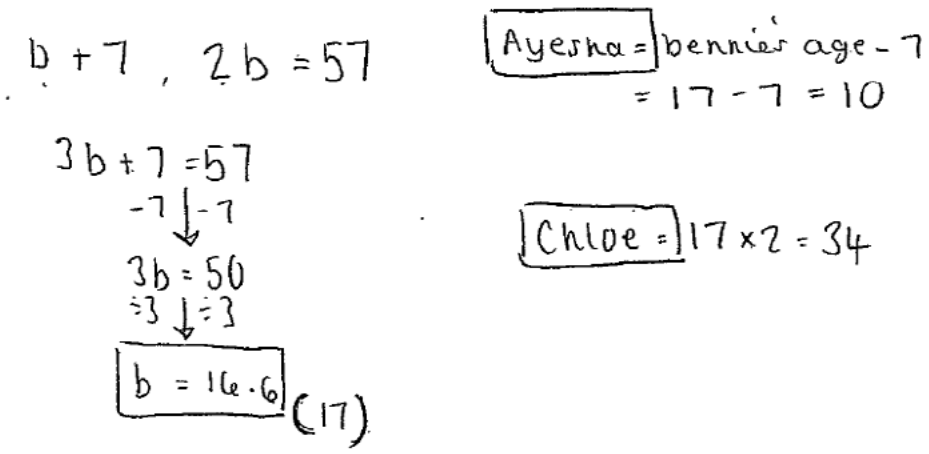
Chloe's age is ..... 25 ..... [6]

Examiner commentary

There is no indication what the *x* refers to so we have to assume it is Ayesha's age. The $x + 7$ is correct and scores B1 but $2x$ should be $2(x + 7)$ so scores B0. The candidate has constructed their equation to $4x + 7 = 57$ so gain B1 and correctly solve their equation so gain M1. They are awarded M0 for the substitution as Chloe's age should be twice Benny's age.

Exemplar 3

3 marks



Ayesha's age is 10

Bennie's age is 17

Chloe's age is ..... 34 ..... [6]

Examiner commentary

There is little indication so we assume the *b* stands for Benny's age. The $b + 7$ should be $b - 7$ so gets B0. The $2b$ is correct and scores B1. The construction of their equation is incorrect because it does not contain the term *b* as well so scores B0. A correct follow through for this attempt would be $b + b + 7 + 2b = 57$. However they solve it correctly for M1. The evidence is in $50 \div 3$ with 16.6 (17) as further evidence. The three ages in the answer show that the correct substitution has taken place and is awarded M1.

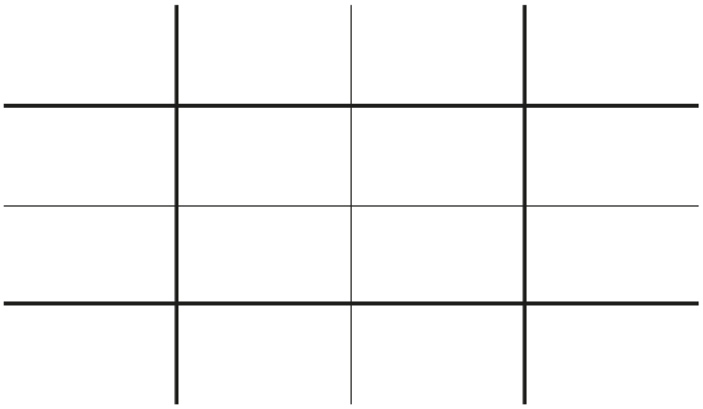
Question 6

6 120 students in Year 10 and Year 11 sit a test.

- 61 of the students are in Year 10.
- 83 of the students are right-handed.
- 20 of the students in Year 11 are left-handed.

One of the students in Year 10 and one of the students in Year 11 are chosen at random.

Which one is more likely to be left-handed?
Show your working. You may use the table if you wish.



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

Exemplar 1

6 marks

	Left	Right	Total
Yr 10	17	44	61
Yr 11	20	39	59
	37	83	120

$\frac{17}{61} = 0.2786$

$61 - 120 = 59$ $\frac{20}{59} = 0.33$

Year 11 has higher probability than Year 10 left handed.

Year 11 left handed has a higher probability than year [6]

Examiner commentary

In this response, the candidate uses the table and this was considered to be the most efficient method to find all the information required. The two proportions are written as fractions then converted to decimals so that they can be compared. The correct decision is then made.

Exemplar 2

4 marks

	Year 10	Year 11	total
right hand	44	39	83
left hand	17	20	37
total	61	59	120

120 - 61 = 59
59 - 20 = 39
120 - 83 = 37
37 - 20 = 17
83 - 39 = 44

year 10 $\frac{17}{44}$ are left handed
year 11 $\frac{20}{59}$ are left handed

$\frac{17}{44} = 0.3863$

$\frac{20}{59} = 0.33898...$

The year 10 student is more likely to be left handed because 0.386 is more than 0.339

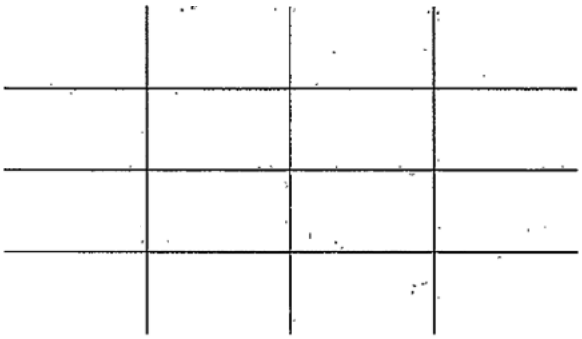
..... [6]

Examiner commentary

This response shows a correct table and 17 is with 61 and 20 with 59. This satisfies the B4 criteria. However they select one incorrect denominator and so they are not comparing the correct proportions. To be awarded 5 marks the candidate should have used 61 in place of 44 in the first fraction.

Exemplar 3

3 marks



120 − 83
= 37
students are LH

120 students

Year 11	Year 10
59	61

11.8 of 37
100
= 4.366

① 61 of student in Year 10
120 − 61 = 59

② 83 of student RH

83 of 120 = $\frac{83}{100} \times \frac{6}{120}$ = 99.6
Right handed

③ 20 of student in Year 11 are left handed.

20 of 59
$\frac{20}{100} \times 59$ = 11.8%
↳ Year 11 left handed

Year 10 is more likely to be left handed because there are more children than Year 11 who are left handed [6]

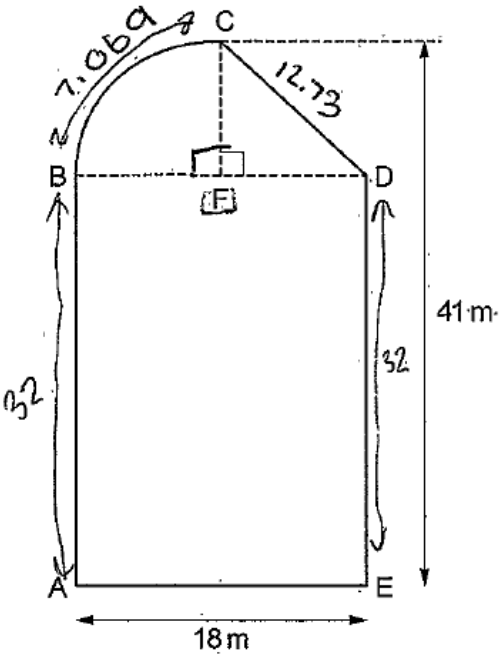
Examiner commentary

The candidate does not find the value 17 but they have worked out both 37 and 59 which is sufficient for 2 marks. However, they then link 20 with 59 towards the bottom which is sufficient for B3, so three marks are scored overall.

Question 7

Exemplar 1 5 marks

7 The diagram shows a shape ABCDE.
The shape is made from a rectangle, a right-angled triangle and a quarter of a circle.



Not to scale

E is the mid-point of BD.
AE = 18 m and the perpendicular distance from C to AE is 41 m.

Work out the **perimeter** of the shape ABCDE.

AE = 18
BD = 18 FD = 9
BF = 9
CF = 9

$9^2 + 9^2 = \sqrt{ans} = 12.73$

CD = 12.73

ectangle

ngth of an arc = $\frac{\theta}{360} \times \pi d$

$\frac{90}{360} \times \pi \times 9 = 7.069$

41 − 9 = 32
ED = 32 BA = 32

BC BA AE ED CD
7.069 + 32 + 18 + 32 + 12.73 = 101.7985

101.81 m [6]

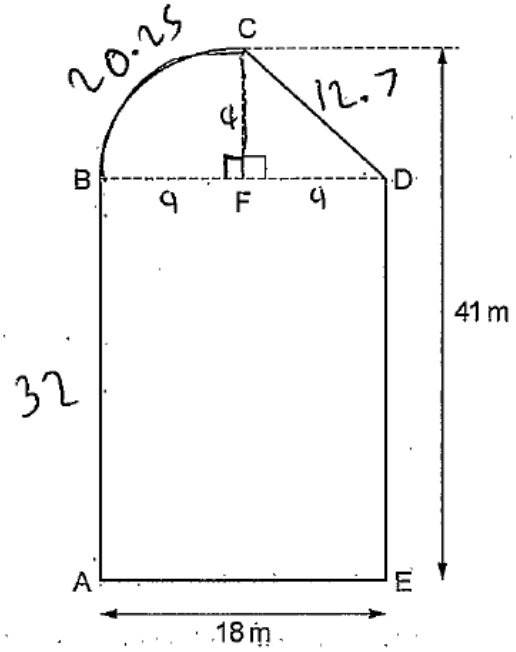
Examiner commentary

Showing the radius of the circle as 9 gains B1, AB (or DE) as 32 gains another B1 and CD as 12.73 gains M2. Most of these results have supporting working. The candidate uses the incorrect value for the diameter of the circle to find the arc length. They have a total perimeter and the working is correct using their figures so this is awarded M1.

Exemplar 2

4 marks

7 The diagram shows a shape ABCDE.
The shape is made from a rectangle, a right-angled triangle and a quarter of a circle.



Not to scale

F is the mid-point of BD.
AE = 18 m and the perpendicular distance from C to AE is 41 m.

Work out the **perimeter** of the shape ABCDE.

$\frac{90}{360} \times \pi 9^2 =$ 20.25

94.7

114.95

..... m **[6]**

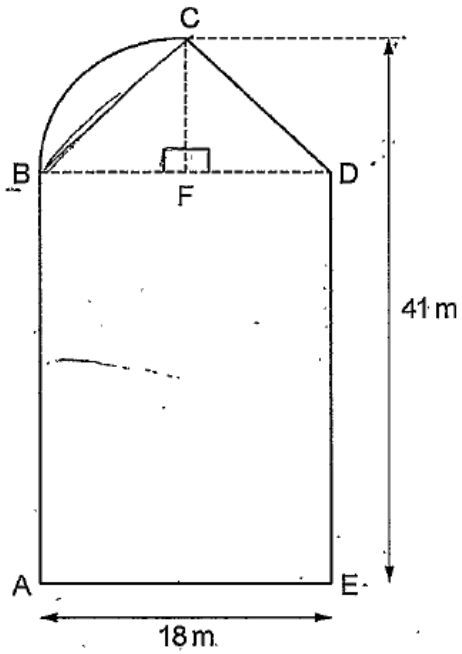
Examiner commentary

Showing the radius of the circle as 9 gains B1, AB as 32 gains another B1 and CD as 12.7 gains M2. None of these results have any supporting working but the figures are sufficient for the credit to be awarded. The candidate uses the incorrect formula to find the arc length. They have a total perimeter but there is no supporting working so M0 is awarded for this.

Exemplar 3

2 marks

7 The diagram shows a shape ABCDE.
The shape is made from a rectangle, a right-angled triangle and a quarter of a circle.



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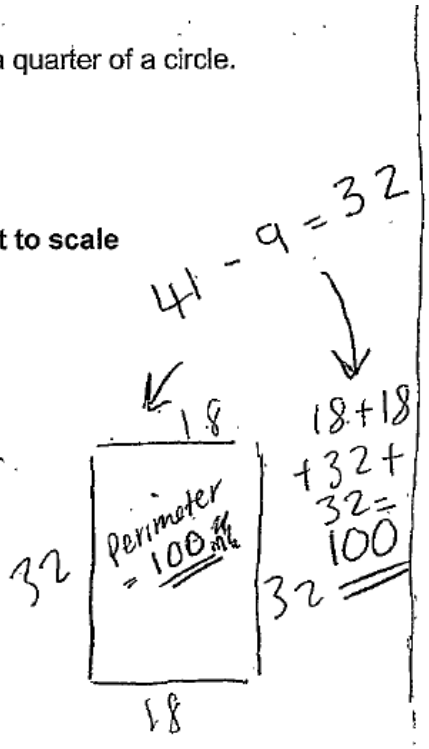
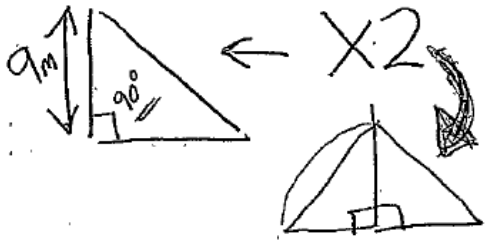


F is the mid-point of BD.
AE = 18 m and the perpendicular distance from C to AE is 41 m.

Work out the **perimeter** of the shape ABCDE.



..... m **[6]**

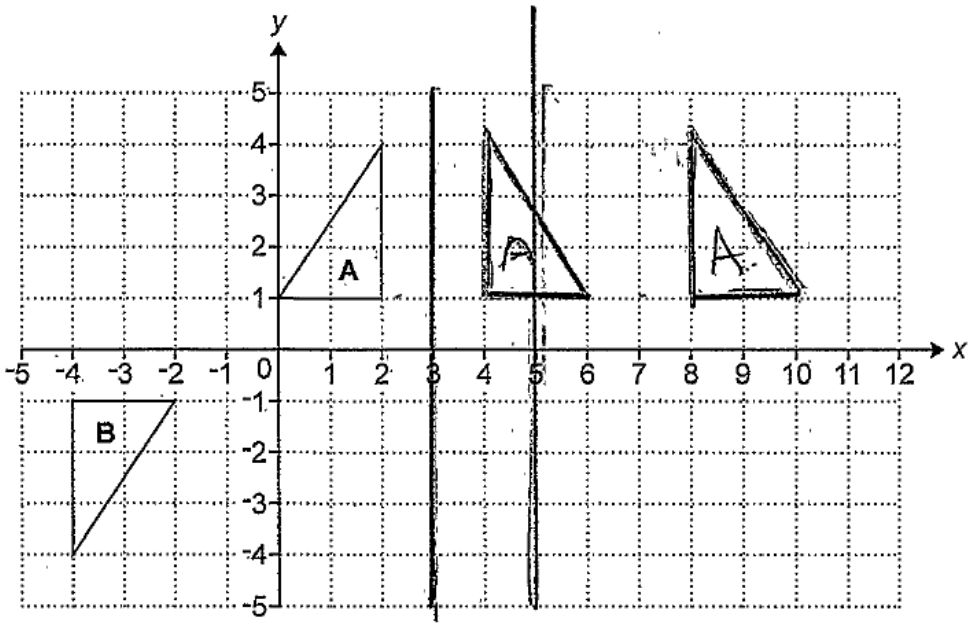
Examiner commentary

The candidate shows the figure 9 so they gain B1 and it is confirmed later as the radius of the circle. They show 32 and they gain another B1, later confirming it is one side of the rectangle.

Question 8 (a)

Exemplar 1 2 marks

8 Triangle **A** and triangle **B** are drawn on the coordinate grid.



(a) Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.

Rotation of 180° about centre (0, -1)

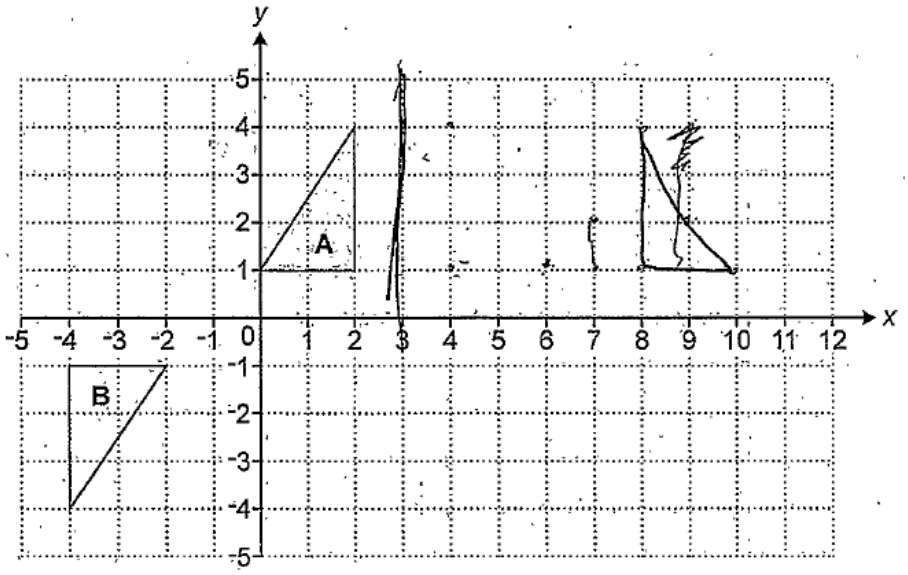
..... **[3]**

Examiner commentary

Rotation scores 1 mark, 180° scores 1 mark but the centre has the coordinates the wrong way round so the third mark is not earned.

Exemplar 2

1 mark



(a) Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.

an anticlockwise 180°c turn around the point -1, 0 [3]

Examiner commentary

'Turn' is insufficient for 1 mark as we need the word 'rotation', 180° scores 1 mark and the centre has the coordinates without brackets so 0 scored.

Question 8 (b)

(b) Describe fully the **single** transformation that is equivalent to:

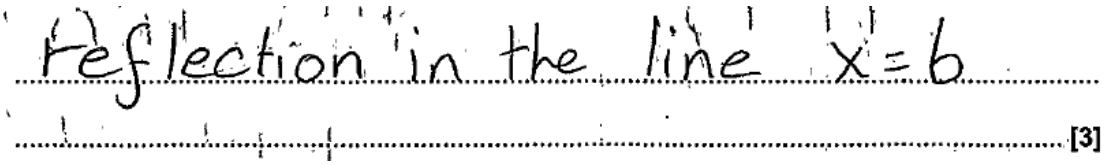
- a reflection in the line $x = 3$, followed by
- a translation by $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$.

You may use the grid above to help you.

.....

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

Exemplar 1 2 marks



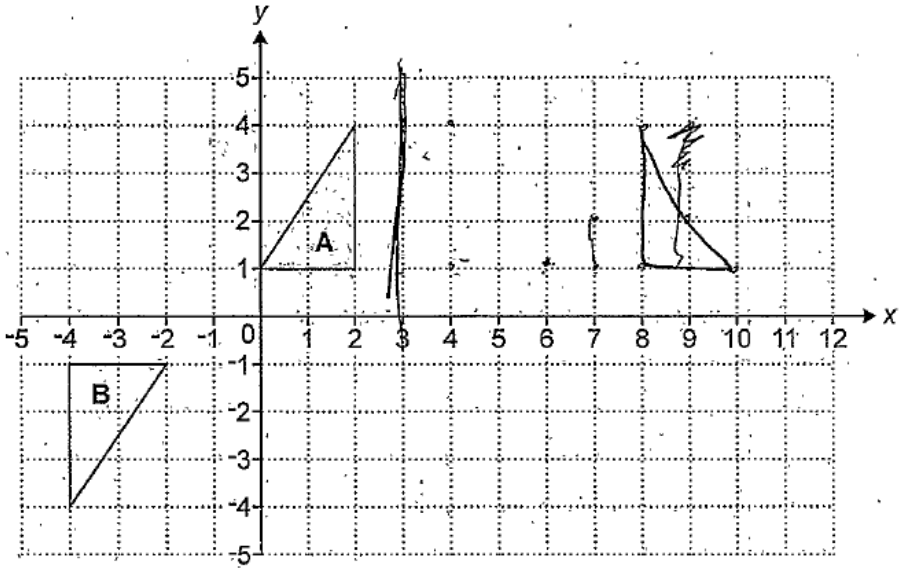
..... **[3]**

Examiner commentary

The answer contains 'reflection' so they are awarded B1 and given the candidate has done both transformations on A they gain another B1.

Exemplar 2

1 mark



(b) Describe fully the **single** transformation that is equivalent to:

- a reflection in the line $x = 3$, followed by
- a translation by $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$.

You may use the grid above to help you.

I don't know

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

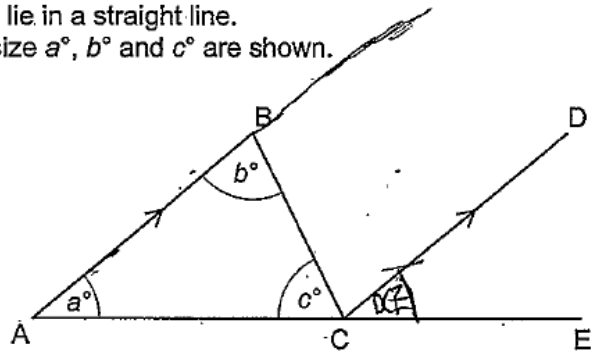
Examiner commentary

Despite the answer given the candidate has done both transformations on A so they gain B1.

Question 9 (a)

Exemplar 1 1 mark

9 The diagram shows triangle ABC.
CD is parallel to AB.
A, C and E lie in a straight line.
Angles of size $a°$, $b°$ and $c°$ are shown.



Not to scale

(a) Insert $a°$, $b°$ or $c°$ to make this statement true.
Give a reason for your answer.

Angle DCE = a because alternating angles are equal they are both on a straight line and from parallel lines [2]

Examiner commentary

The angle *a* is awarded 1 mark but the reason which involves parallel lines is not sufficient because we need the term 'corresponding'.

Question 9 (b)

(b) Use the diagram and the answer to part **(a)** to show that the angles of a triangle add up to 180°.
Give a reason for each statement you make. **[3]**

Exemplar 1 3 marks

$a + b + c = 180$.

$D\hat{C}E + B\hat{C}D + c° = 180°$ (angles on a straight line sum to 180°).

$D\hat{C}E = a°$ (because corresponding angles are equal)

$b°$

$A\hat{B}C = B\hat{C}D$ (alternate angles are equal).

$\therefore b° + a° + c° = 180°$

as $D\hat{C}E + B\hat{C}D + c° = 180°$ (as on a straight line).

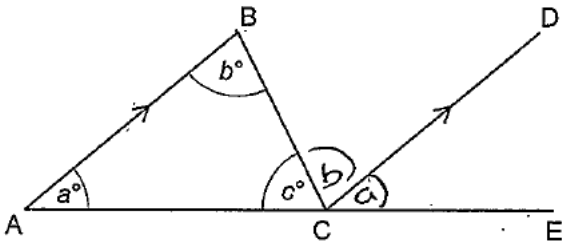
Examiner commentary

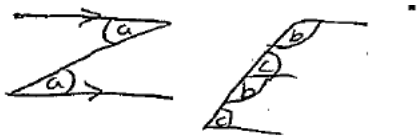
The working is not in the expected order however 'angles on a straight line …' gains 1 mark and, two lines below that, the candidate states angle BCD = *b* with the correct reason and term so 2 marks for that line.

Exemplar 2

2 marks

9 The diagram shows triangle ABC.
CD is parallel to AB.
A, C and E lie in a straight line.
Angles of size $a°$, $b°$ and $c°$ are shown.





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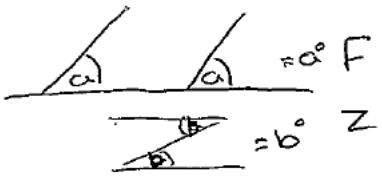
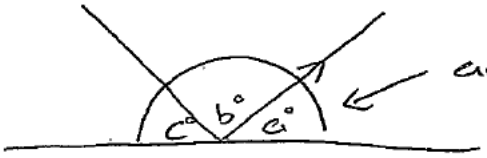
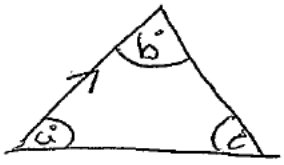


(b) Use the diagram and the answer to part **(a)** to show that the angles of a triangle add up to 180°.
Give a reason for each statement you make. **[3]**

$a° + b° + c° = 180$



angles on a straight line = 180°
a°, b°, c°



angles in triangle = 180°
a°, b°, c°

Examiner commentary

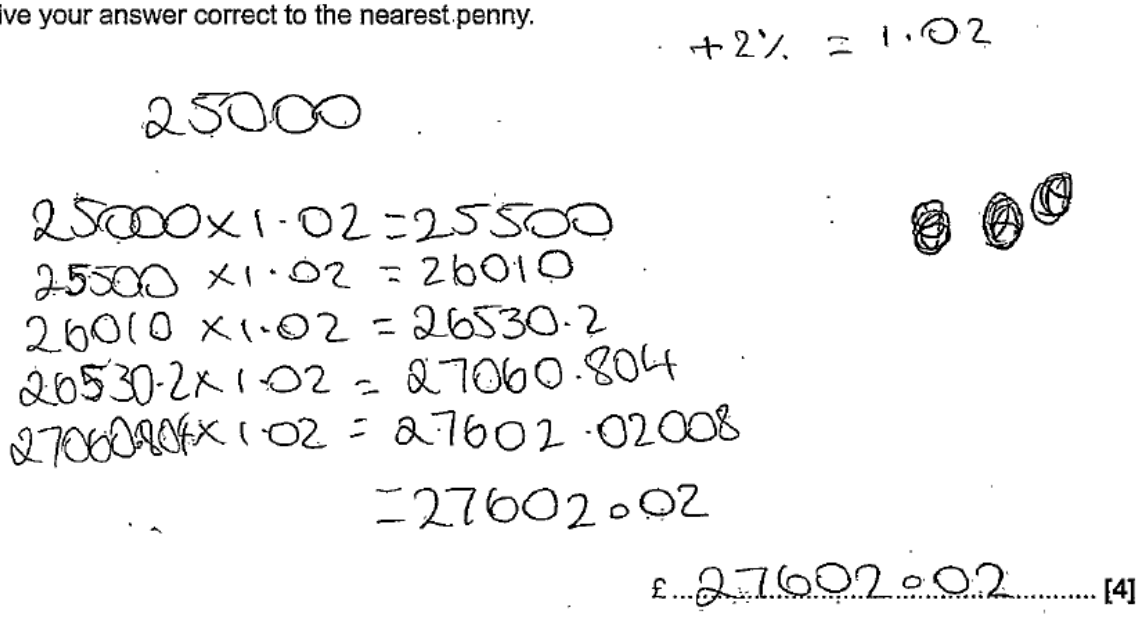
On the diagram, angle BCD has *b* written on it so 1 mark is awarded and 'angles on a straight line …' is awarded 1 mark. The reason for angle BCD is given as Z which is not sufficient, we need the term 'alternate'.

Question 10

Exemplar 1 3 marks

10 Claudia invests £25 000 at a rate of 2% per year compound interest.

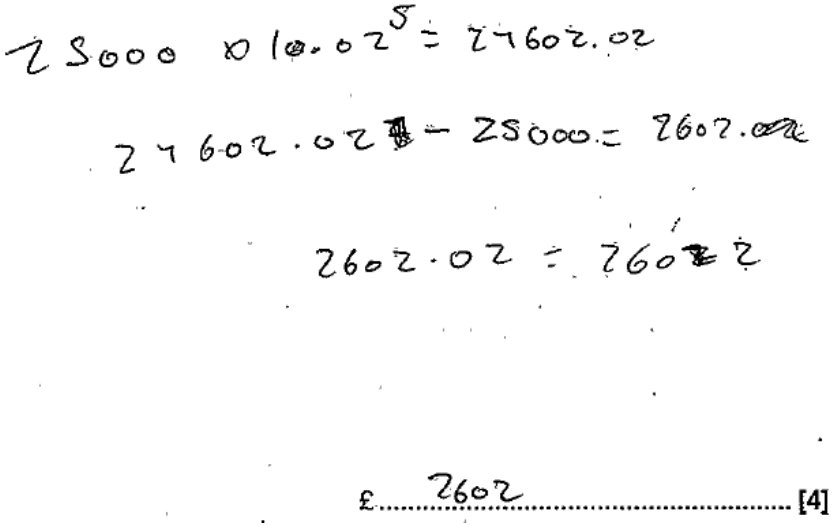
Calculate the total amount of **interest** she will have earned after 5 years.
Give your answer correct to the nearest penny.



Examiner commentary

Here the candidate uses a correct, but inefficient, method to find the total investment which is shown to the required accuracy so we award 3 marks. They need to subtract the initial investment to find the interest.

Exemplar 2 3 marks



Examiner commentary

The candidate uses the most efficient method and they find the correct total investment. They go on to work out the interest but they do not give the answer to the accuracy demanded. They are awarded 3 marks.

Question 11

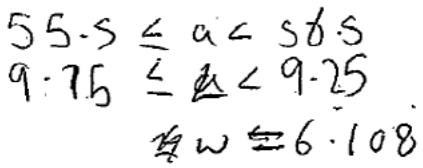
11 The area of a rectangle is 56 m^2, correct to the nearest m^2.
The length of the rectangle is 9.2 m, correct to the nearest 0.1 m.

Calculate the smallest possible width of the rectangle.

..... m **[4]**

Exemplar 1

2 marks



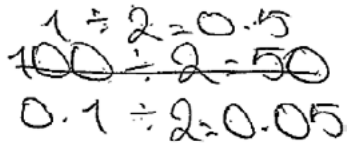
6.108 m **[4]**

Examiner commentary

The candidate shows the correct bounds for both values, so 55.5 scores B1 and 9.25 scores B1. They do not show which values they use or the operation to give their answer so we award M0.

Exemplar 2

2 marks



11 The area of a rectangle is 56 m^2, correct to the nearest m^2.
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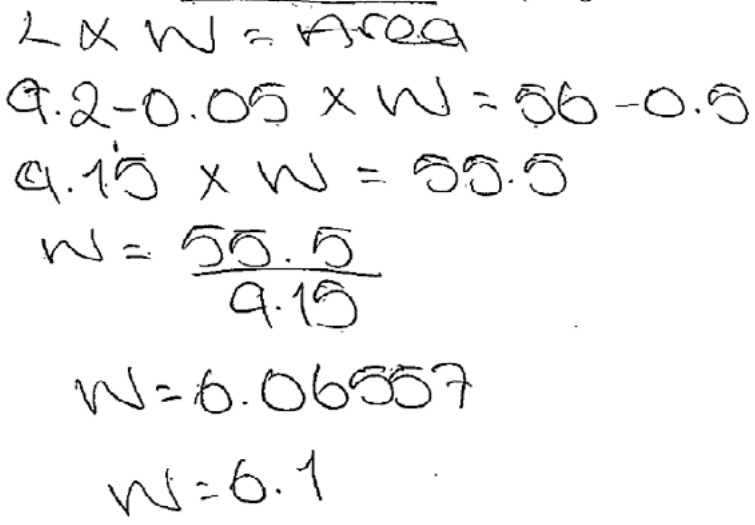


6.1 m **[4]**

Examiner commentary

The candidate shows 55.5 so score B1 but they do not show 9.25. In the division, which we can see, they use two values which are within the given ranges so we award M1.

Question 12 (a)

Exemplar 1 1 mark

12 (a) Here are the first four terms of a sequence.

-1 +5 4 +5 9 +5 14

Write an expression for the *n*th term of this sequence.

(a) 5n - 1 **[2]**

Examiner commentary

It looks like the candidate has used the second term to find the value of *c*. The 5*n* scores B1.

Question 12 (b)

(b) The *n*th term of another sequence is given by

$an^2 + bn$

The third term is 9 and the sixth term is 126.

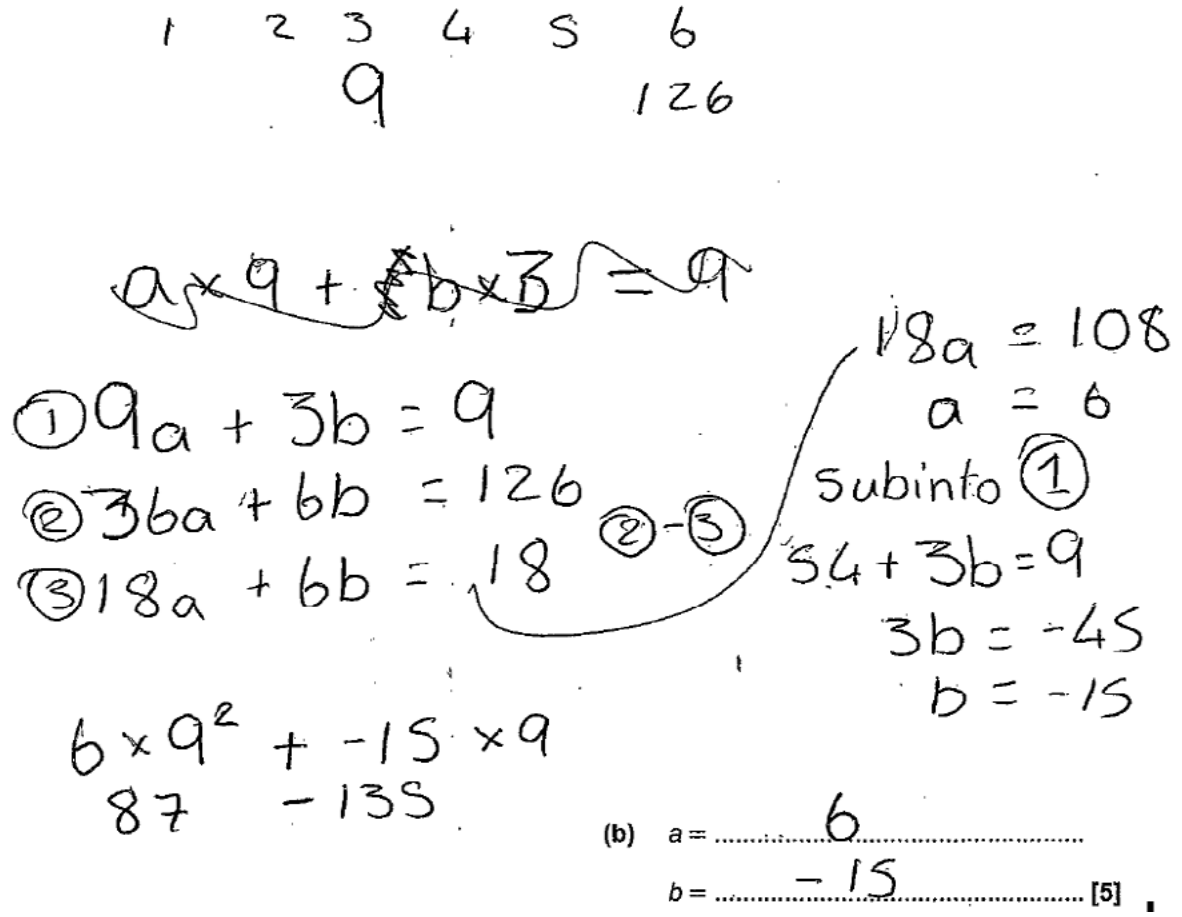
Find the value of *a* and the value of *b*.

(b) *a* = ...

b = ... **[5]**

Exemplar 1

5 marks



Examiner commentary

Here the two equations are clearly written down and solved and the correct values of *a* and *b* have been found. The candidate is awarded full marks.

Exemplar 2

3 marks

$an^2 + bn$

The third term is 9 and the sixth term is 126.

Find the value of a and the value of b.

$a(2^2) + b(2) = 9$

$a(6^2) + b(6) = 126$

$4.125(2^2) + b(2) = 9$

$16.5 + 2b = 9$

$2b = -7.5$

$b = -3.75$

14

$a(4) + b(2) = 9 \times 3$

$a(36) + b(6) = 126$

$a(12) + b(6) = 27$

$a(36) - a(12) = 126 - 27$

$24a = 99$

$a = 4.125$.

(b) $a =$ 4.125

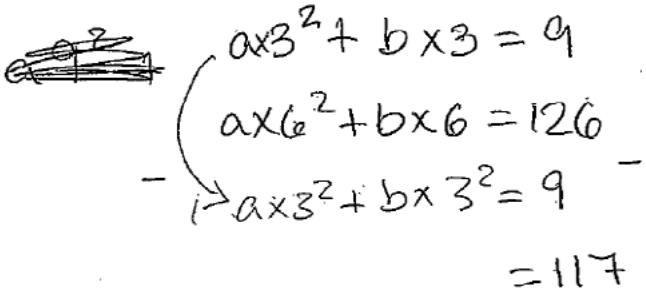
$b =$ −3.75 **[5]**

Examiner commentary

In the first equation the candidate uses $n = 2$ instead of $n = 3$ so B0 but the second equation is correct so we award B1. They then solve their simultaneous equations correctly so we award M1 for equating coefficients and M1 for eliminating one variable.

Exemplar 3

2 marks



(b) $a =$ .....

$b =$ ..... **[5]**

Examiner commentary

They have substituted in and formed the two simultaneous equations so they are awarded B1 for each. To gain more credit they need to attempt to solve these equations.

Question 13 (a) (ii)

Exemplar 1 — 1 mark

(ii) Find the interquartile range.

(ii) 160 - 177 cm [2]

Examiner commentary

The candidate has correctly identified the upper and lower quartiles so they are awarded B1 for either of these but they need to subtract them to find the range.

Question 13 (a) (iii)

Exemplar 1 — 2 marks

(iii) Calculate the percentage of the members who are at least 180 cm tall.

$\frac{100}{120} \times 100 = 83.\dot{3}$

(iii) 83.3 % [3]

Examiner commentary

The candidate has correctly read the 100 from the graph so they gain B1 and they also correctly convert that to a percentage of 120 and they are awarded M1. They need to subtract the 100 from 120 or subtract the 83.3 from 100 to gain full marks.

Exemplar 2 — 1 mark

(iii) Calculate the percentage of the members who are at least 180 cm tall.

120 people overall 20 over 180

20 ~~100~~ people are 180 cm/taller

120 = 100%
1.2 = 1%
20 = 24 %

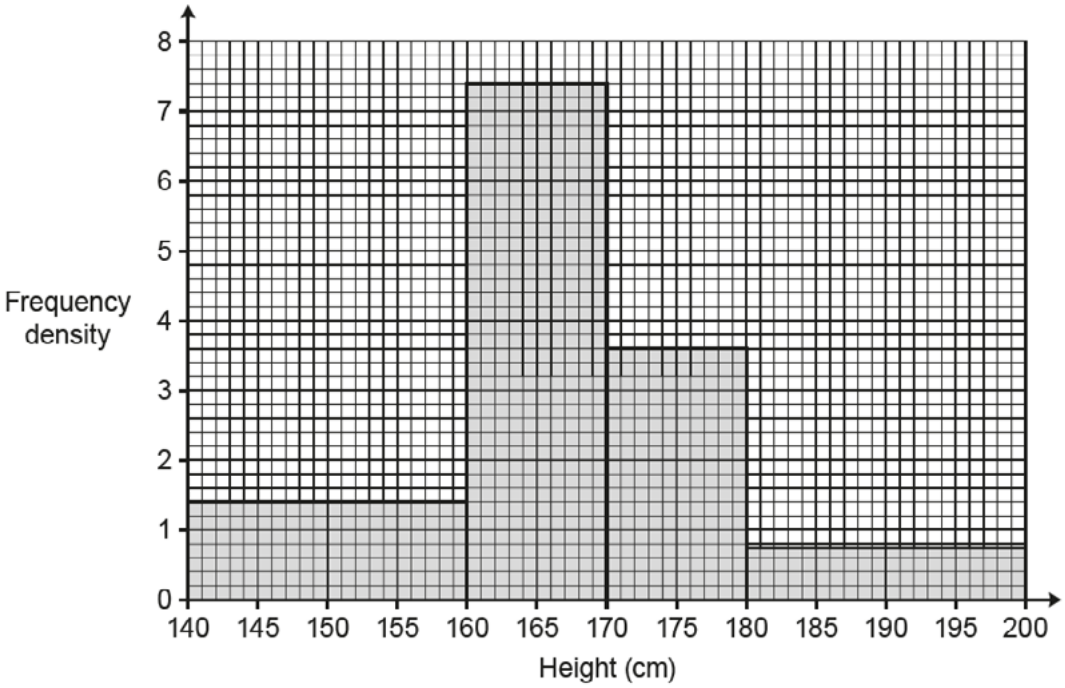
(iii) 24 % [3]

Examiner commentary

The candidate has identified 20 people having a height over 180 cm so we award B1. They do not have a complete method to write this as a percentage of 120 which is what they need to gain further credit.

Question 13 (b)

(b) The histogram summarises the heights of the 153 members of a swimming club.

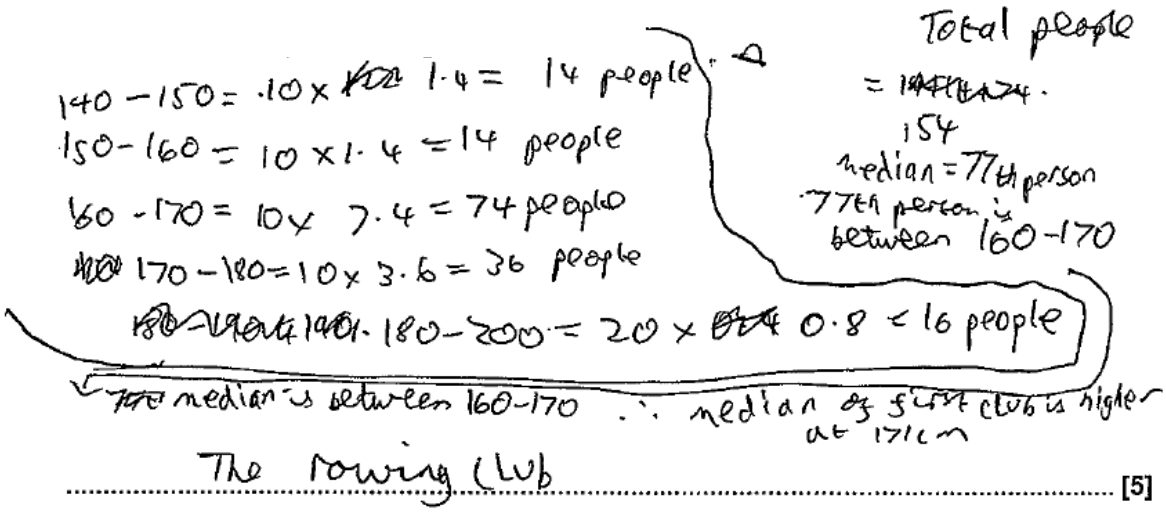


Which club has the greater median height?
You must show all your working.

..... [5]

Exemplar 1

5 marks



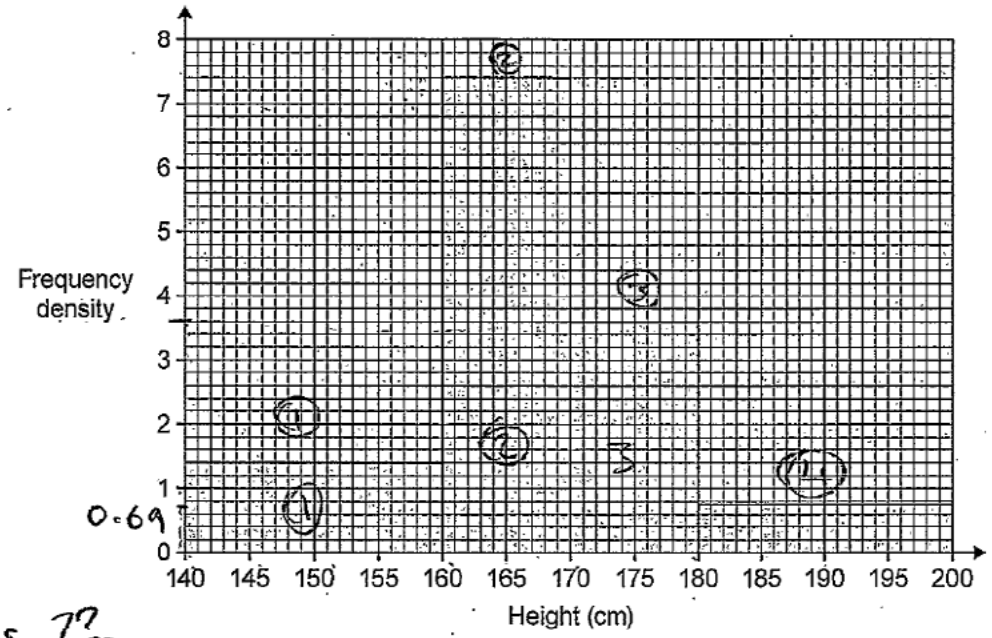
..... [5]

Examiner commentary

The candidate first shows 14, 14 and 74 which gains them M2. They then identify the middle one as the 77th one, getting B1. They identify the 160 to 170 as containing the median of the swimming club and they make the correct decision for rowing club thus gaining all the marks.

Exemplar 2

3 marks



Class 7?

Which club has the greater median height?
You must show all your working.

frequency / class width

1) 20 × 1.4 = 28 cm

2) 10 × 7.4 = 74 cm

3) 10 × 3.6 = 36 cm

4) 20 × 0.69 = 13.8 cm

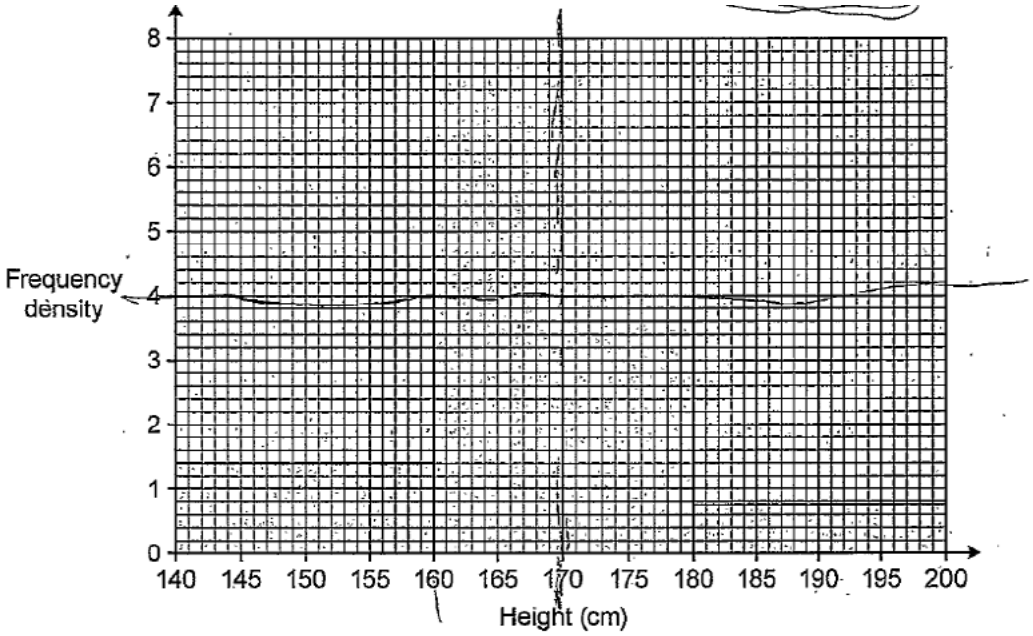
Club 2 : 160 ≤ x < 170 → 74 cm ..... [5]

Examiner commentary

In the working the candidate shows 28 and 74 so they score M2 for those. They also appear to have selected the group 160 to 170 for the swimming club so we award B1 for that. They have no mechanism to select the median group which is what they need to gain further credit.

Exemplar 3

1 mark



Which club has the greater median height? 60
You must show all your working.

$4 \times 7.4 =$

$9.4 - 4 = 3.4$

$10 \times 7.4 = 74$

74/153

..... [5]

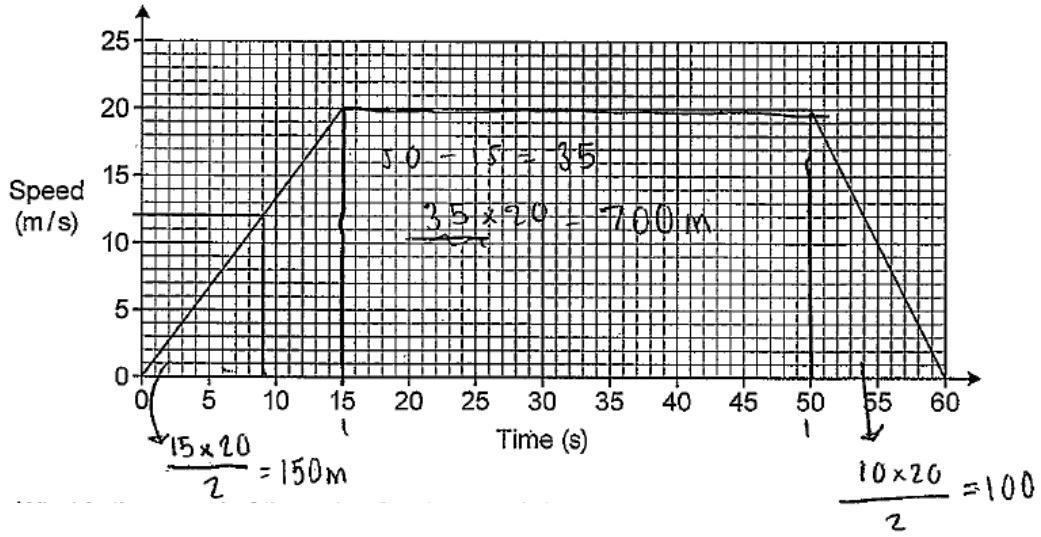
Examiner commentary

The candidate identifies 74 as the frequency of the second group so score M1. They need to find the frequency of the first group and then have a mechanism to find the middle value if they are going to gain further credit.

Question 14 (c)

Exemplar 1 5 marks

14 The graph shows the speed of a train during the first 60 seconds of motion.



(c) Work out the average speed of the train, in m/s, during the 60 seconds.

Speed = distance / time.

Total distance = 150+700+100=950

= 950/60 = 15.83

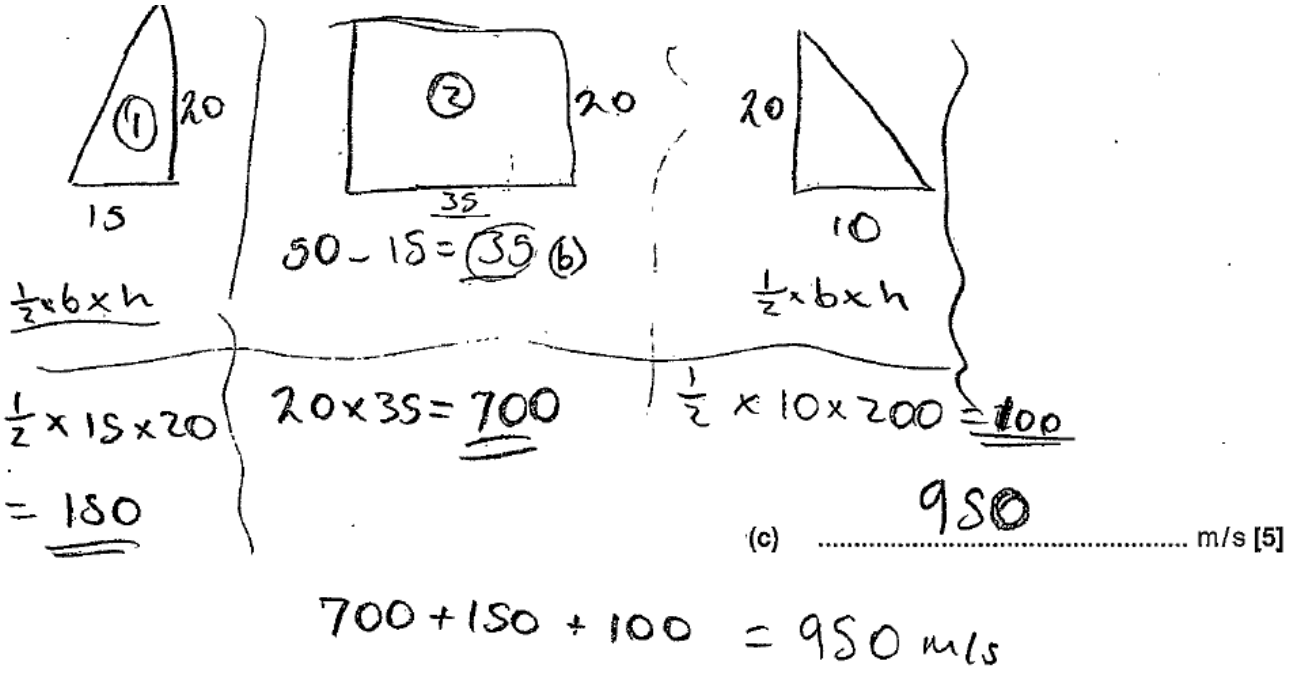
(c) 15.83 m/s **[5]**

Examiner commentary

The candidate attempts to find the area under the graph which gains M1 and then works out the correct area, both on the graph and in the working space, which gains them M2. The area which represents the distance is divided by the time to give the average speed and for this they are awarded M1 A1.

Exemplar 2

3 marks



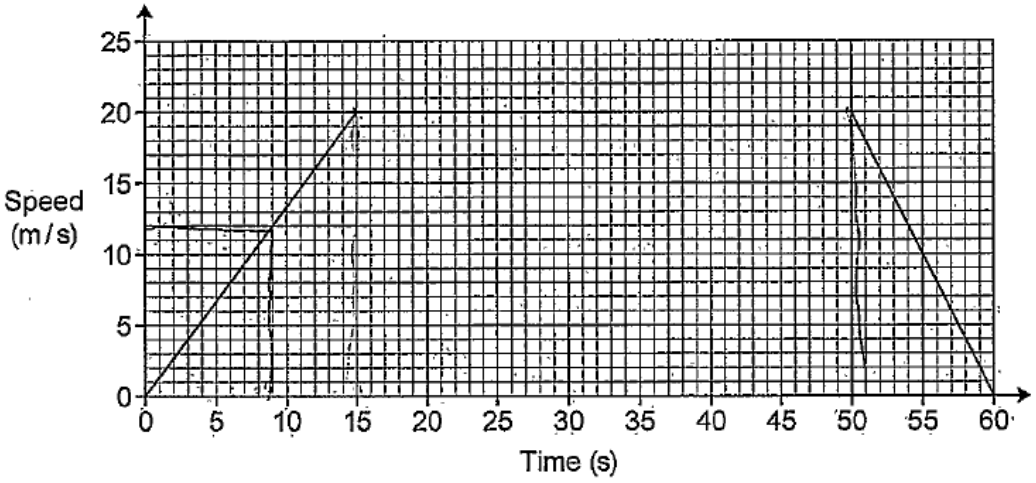
Examiner commentary

The candidate attempts to find the area under the graph which gains M1 and then works out the correct area in the working space, which gains them M2. The diagrams in the working space clearly show what they are doing. They need to divide this area by the time to find the average speed.

Exemplar 3

3 marks

14 The graph shows the speed of a train during the first 60 seconds of motion.



(c) Work out the average speed of the train, in m/s, during the 60 seconds.

$S = \frac{D}{T}$

$\frac{1}{2}(20\times15)$, 20×35 $\frac{1}{2}(20\times5)$

↓

$150 + 700 + 50 = 900$

$\frac{900}{60} = 15$

average speed = 15

(c) ..... 15 ..... m/s **[5]**

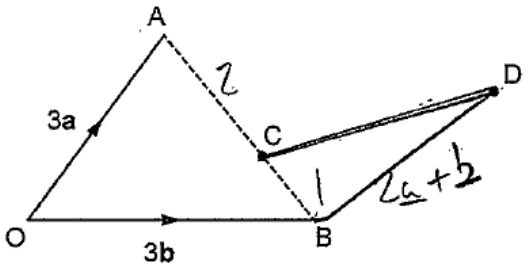
Examiner commentary

The candidate attempts to find the area under the graph which gains M1 and then attempts to work out the correct area in the working space, but they make one error, which gains them M1. The area of the final triangle should have a 10 instead of the 5. They then divide their area by the time to find the average speed and they gain M1 for this.

Question 15

Exemplar 1 5 marks

15 The diagram shows triangle OAB and points C and D.



Not to scale

$\overrightarrow{OA} = 3\mathbf{a}$ and $\overrightarrow{OB} = 3\mathbf{b}$.
C lies on AB such that AC = 2CB.
D is such that $\overrightarrow{BD} = 2\mathbf{a} + \mathbf{b}$.

Show, using vectors, that OCD is a straight line. **[5]**

$\overrightarrow{AB} = -3\underline{a} + 3\underline{b}$

$\overrightarrow{AC} = -2\underline{a} + 2\underline{b}$

$\therefore \overrightarrow{OC} = -2\underline{a} + 2\underline{b} + 3\underline{a}$

$= \underline{a} + 2\underline{b}$

$\overrightarrow{OD} = 3\underline{b} + 2\underline{a} + \underline{b}$

$= 2\underline{a} + 4\underline{b}$

$= 2(\underline{a} + 2\underline{b})$

$\therefore$ OCD lie on a straight line because $\overrightarrow{OC}$ is a multiple of $\overrightarrow{OD}$

$\underline{a} + 2\underline{b}$ $2(\underline{a} + 2\underline{b})$

Thus they are parallel

AND $\overrightarrow{OC}$ and $\overrightarrow{OD}$ share a common point O

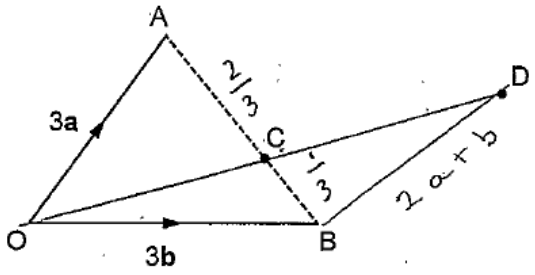
Therefore they must be on a straight line.

Examiner commentary

The candidate delivers a complete and correct proof. They show $\overrightarrow{OC} = \mathbf{a} + 2\mathbf{b}$ and $= 2\mathbf{a} + 4\mathbf{b}$ and then $\overrightarrow{OD} = 2(\mathbf{a} + 2\mathbf{b})$. They also make the statement '$\overrightarrow{OC}$ is a multiple of $\overrightarrow{OD}$' which should really be the other way round but we can accept this as $\frac{1}{2}$ can be implied as the multiplier.

Exemplar 2

3 marks



Not to scale

$\overrightarrow{OA} = 3\mathbf{a}$ and $\overrightarrow{OB} = 3\mathbf{b}$.
C lies on AB such that AC = 2CB.
D is such that $\overrightarrow{BD} = 2\mathbf{a} + \mathbf{b}$.

Show, using vectors, that OCD is a straight line. **[5]**

$\overrightarrow{OCD} = \overrightarrow{OB} + \overrightarrow{BD}$

$3b + 2a + b = 2a + 4b$

$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$

$= -3a + 3b = 3b - 3a$

$\overrightarrow{AC} = \frac{2}{3} \times 3b - 3a$

$\frac{2}{3}(3b - 3a)$

$\overrightarrow{CB} = \frac{1}{3}(3b - 3a)$

$\frac{3b - 3a}{3}$

$= b - a$

$\overrightarrow{OC} = \overrightarrow{OB} + \overrightarrow{BC}$

$= 3b + a - b$

$= a - 2b$

$\overrightarrow{CD} = \overrightarrow{CB} + \overrightarrow{BD}$

$= b - a + 2a + b$

$= 2a - a + 2b$

have same coefficients

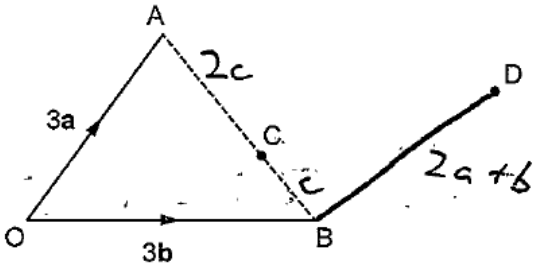
+ gradients, are on the same STRAIGHT line.

Examiner commentary

We condone OCD for $\overrightarrow{OD}$ so we award M1 for OCD = 2**a** + 4**b**, B1 for $\overrightarrow{AB}$ = 3**b** – 3**a** and M1 for $\overrightarrow{OC}$ = 3**b** + **a** – **b**. Unfortunately, the candidate simplified $\overrightarrow{OC}$ incorrectly because the next step is to show $\overrightarrow{OD} = 2\overrightarrow{OC}$ which they are unable to do.

Exemplar 3

1 mark



Not to scale

$\overrightarrow{OA} = 3\mathbf{a}$ and $\overrightarrow{OB} = 3\mathbf{b}$.
C lies on AB such that AC = 2CB.
D is such that $\overrightarrow{BD} = 2\mathbf{a} + \mathbf{b}$.

Show, using vectors, that OCD is a straight line. [5]

$\overrightarrow{OD} = 2a + 4b$

$\overrightarrow{OC} = 3b - c$

$\overrightarrow{CD} = 2a + b + c$

$\overrightarrow{OC} + \overrightarrow{CD} = \overrightarrow{OD}$

(as $3b - c + 2a + b + c = 2a + 4b$)

therefore OC is on the line OD * and it must therefore be straight due to having 3 points, as, if it wasn't, it would be multiple lines.

* or the vectors show it travels through C to get to D.

Examiner commentary

$\overrightarrow{OD} = 2\mathbf{a} + 4\mathbf{b}$ is correct and gains M1. The candidate tries to use $\overrightarrow{OC} + \overrightarrow{CD} = \overrightarrow{OD}$ to show that the three points lie on a straight line but that theorem does not show this.

Question 16 (a)

Exemplar 1 1 mark

16 (a) The table shows values of x and y.

x	4	16	36
y	6	3	2

Show that these values fit the relationship that y is inversely proportional to $\sqrt{x}$. [2]

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

1) $6 = \frac{k}{\sqrt{4}} \rightarrow 6 = \frac{k}{2}$ (x2)

$12 = k$

Examiner commentary

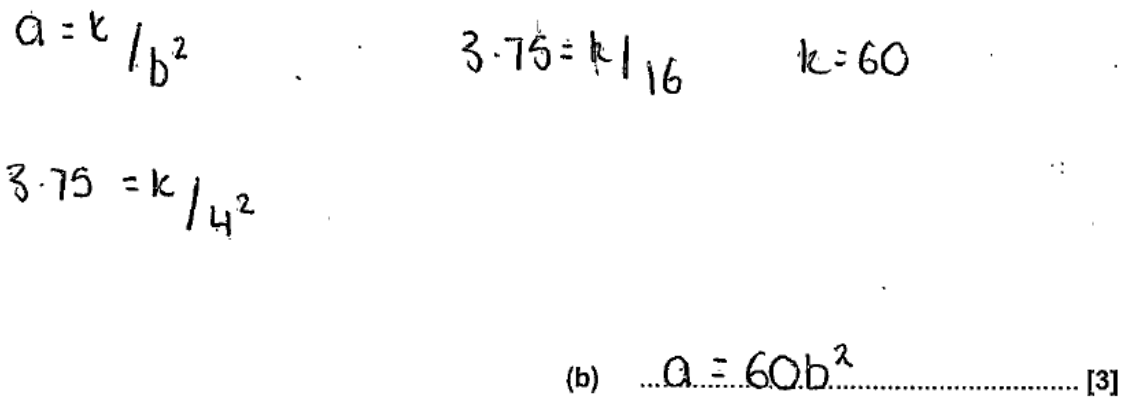
The candidate correctly works out the relationship for one pair of values, $x = 4$ and $y = 6$. However, the question asks that the relationship fits all the values so we do require that they test at least one more pair of values to gain the second mark.

Question 16 (b)

Exemplar 1 2 marks

(b) a is inversely proportional to b^2 and $a = 3.75$ when $b = 4$.

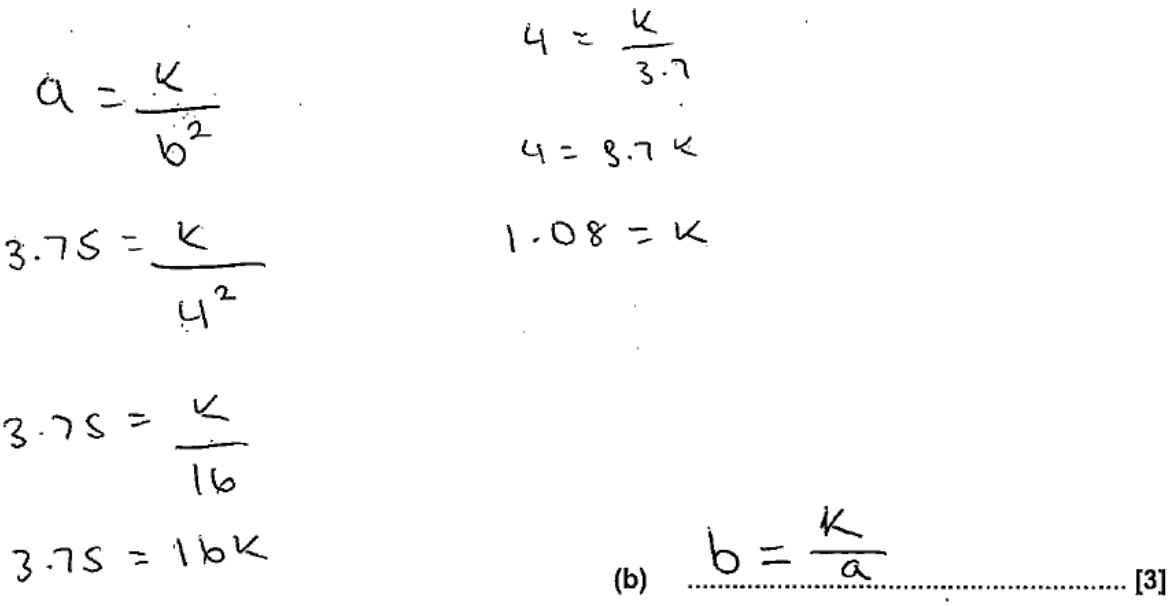
Find a formula linking a and b.



Examiner commentary

For writing $a = \frac{k}{b^2}$ the candidate gains M1 and then B1 for working out the value of k as 60. To be awarded full marks they must write out the correct formula which they have not done and this is a common error.

Exemplar 2 1 mark



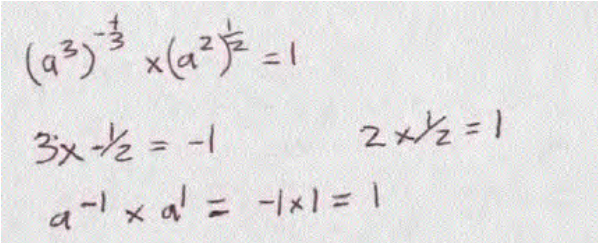
Examiner commentary

For writing $a = \frac{k}{b^2}$ candidate gains M1. The B1 is awarded for the correct value of k, which they fail to obtain. The error is that they should do 3.75×16 but they have written $16k$ instead. The third line of working is correct and will lead to the correct answer and 3 marks if they had correctly followed this through.

Question 17

17 Show that $(a^3)^{-\frac{1}{3}} \times (a^2)^{\frac{1}{2}} = 1$. [3]

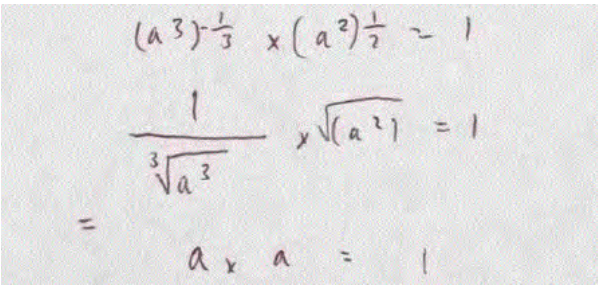
Exemplar 1 2 marks



Examiner commentary

The candidate has kept the same order so we can reward $(a^3)^{-\frac{1}{3}} = a^{-1}$ with B1 and $(a^2)^{\frac{1}{2}} = a^1$ with another B1. We can accept the second line of $3 \times -\frac{1}{2} = -1$ as $-\frac{1}{2}$ is likely to be a transcription error of $-\frac{1}{3}$. For the final mark they need to show that this is equal to 1 and either $\frac{a}{a}$ or a^0 will do this.

Exemplar 2 1 mark



Examiner commentary

In the final line of working, the first term should be $\frac{1}{a}$ so gains B0 but the second term is correctly given as a so gains B1. It can be seen that in the second line they have correctly dealt with the negative power so if they had written in the third line $\frac{1}{a} \times a = 1$ they would have gained all 3 marks.

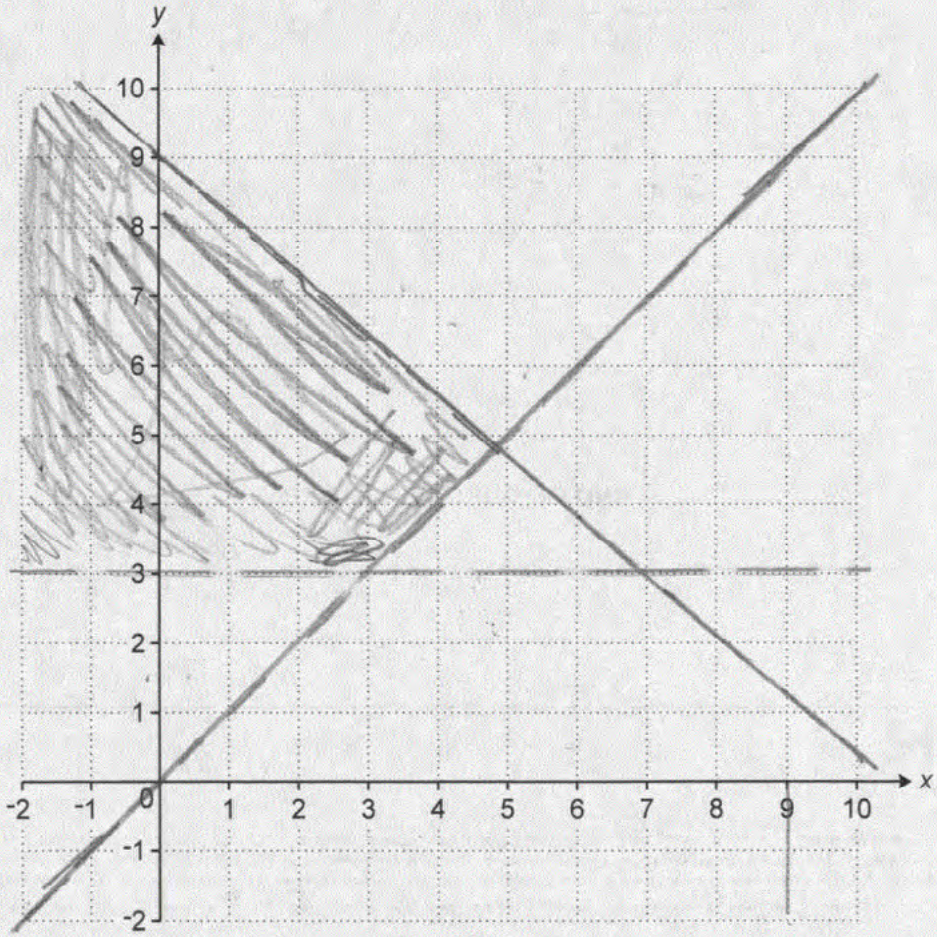
Question 18

Exemplar 1 5 marks

18 Region **R** satisfies these inequalities.

$y > 3$
$y \geqslant x$
$x + y \leqslant 9$ → $x+y<=9 \rightarrow x-9<=-y \rightarrow y<=x+9$

By drawing three straight lines on the grid, find and label the region **R**.



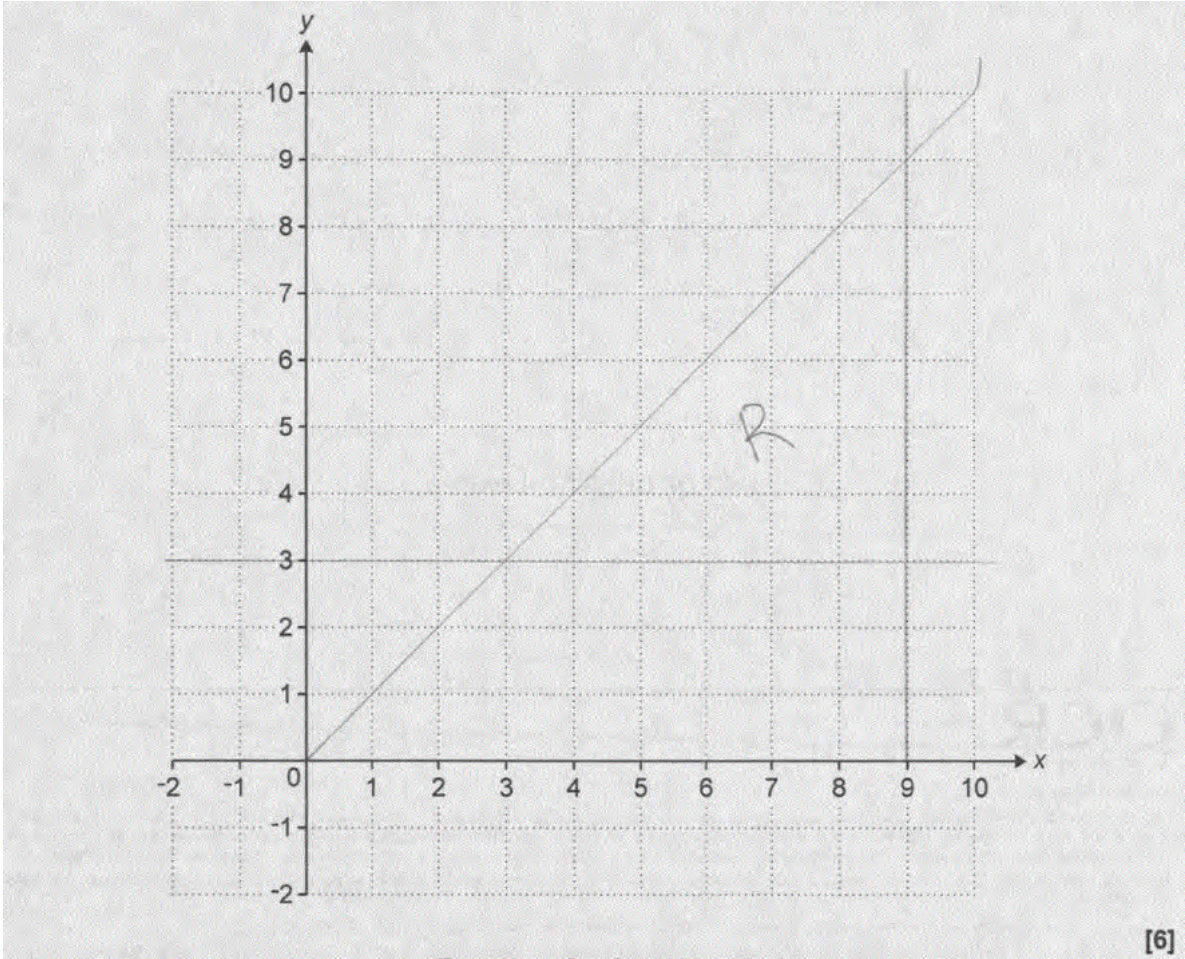
[6]

Examiner commentary

The $y = 3$ line is correct and the region is on the correct side of the line so B2. The line $y = x$ is correct and the region is on the correct side of the line so B2. Both lines look roughly drawn but they are straight and ruled so we allow them. The candidate loses one mark because the line $x + y = 9$ is inaccurate so B0 but the line is close enough to the correct line so we can award the region B1 as it is on the correct side of the line.

Exemplar 2

3 marks

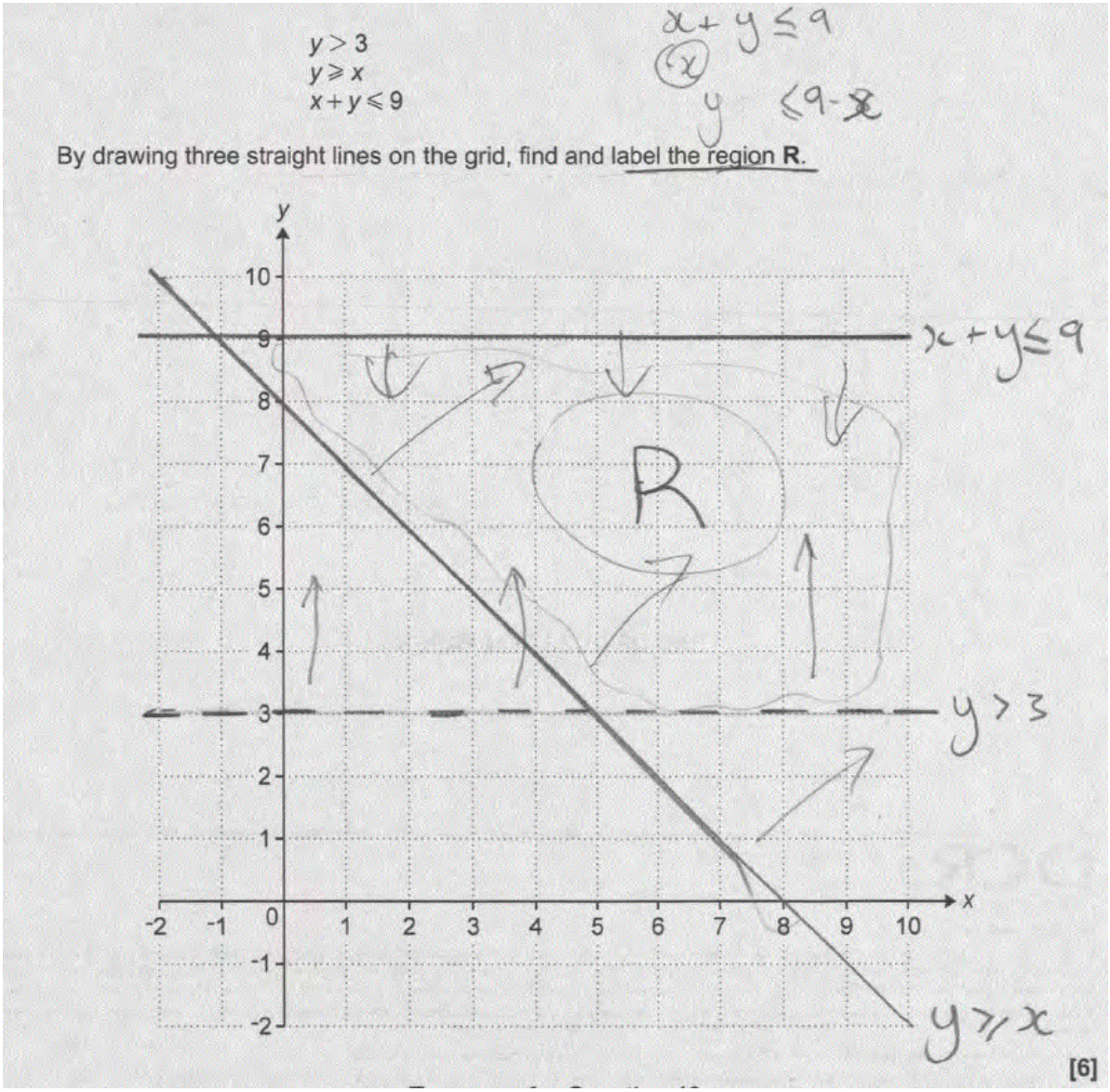


Examiner commentary

In this question we condoned an incorrect line style. The $y = 3$ line is correct and the region is on the correct side of the line so we award B2. The line $y = x$ is correct but the region is on the wrong side of the line so B1 is awarded for the line only. The line $x + y = 9$ is incorrect as they have drawn the line $x = 9$ so B0 and the region also scores B0.

Exemplar 3

2 marks



Examiner commentary

The $y = 3$ line is correct and the region is on the correct side of the line so B2. The line $y = x$ is incorrect and therefore the region scores B0. The line $x + y = 9$ is incorrect so B0 and therefore the region scores B0. The candidate needed to draw the two lines correctly and accurately to score more marks.

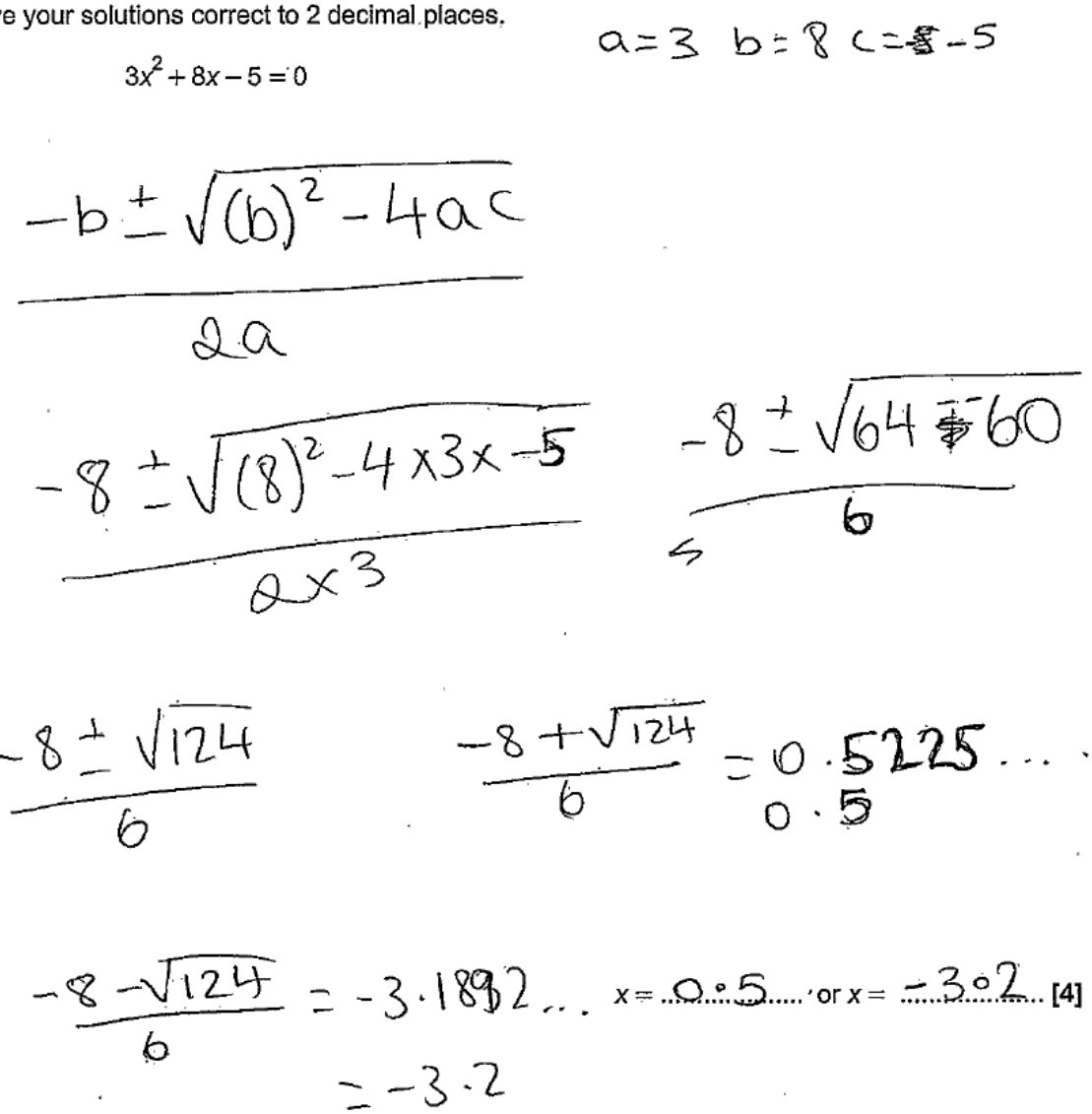
Question 19

Exemplar 1

3 marks

19 Solve this equation algebraically.
Give your solutions correct to 2 decimal places.

$3x^2 + 8x - 5 = 0$



Examiner commentary

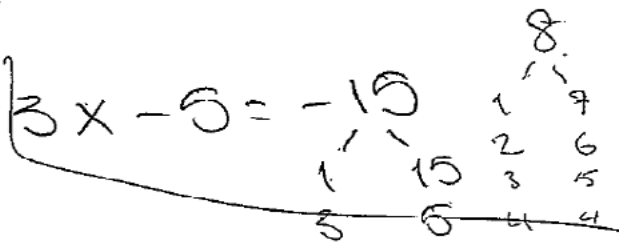
The algebraic method is correct so M2 is awarded and the candidate has the correct full answers so A1 because their answers are correct to 3 decimal places. However, they have not given the final answers to the accuracy required so they do not get the final mark.

Exemplar 2

1 mark

19 Solve this equation algebraically.
Give your solutions correct to 2 decimal places.

$3x^2 + 8x - 5 = 0$



$\frac{b \pm \sqrt{b^2 + 4ac}}{2a}$

$\frac{8 \pm \sqrt{(8^2) + 4 \times 3 \times -5}}{2 \times 3} = 1.6 \rightarrow +$
$1 \rightarrow -$

~~8~~

$x =$ 1.6 or $x =$ 1 [4]

Examiner commentary

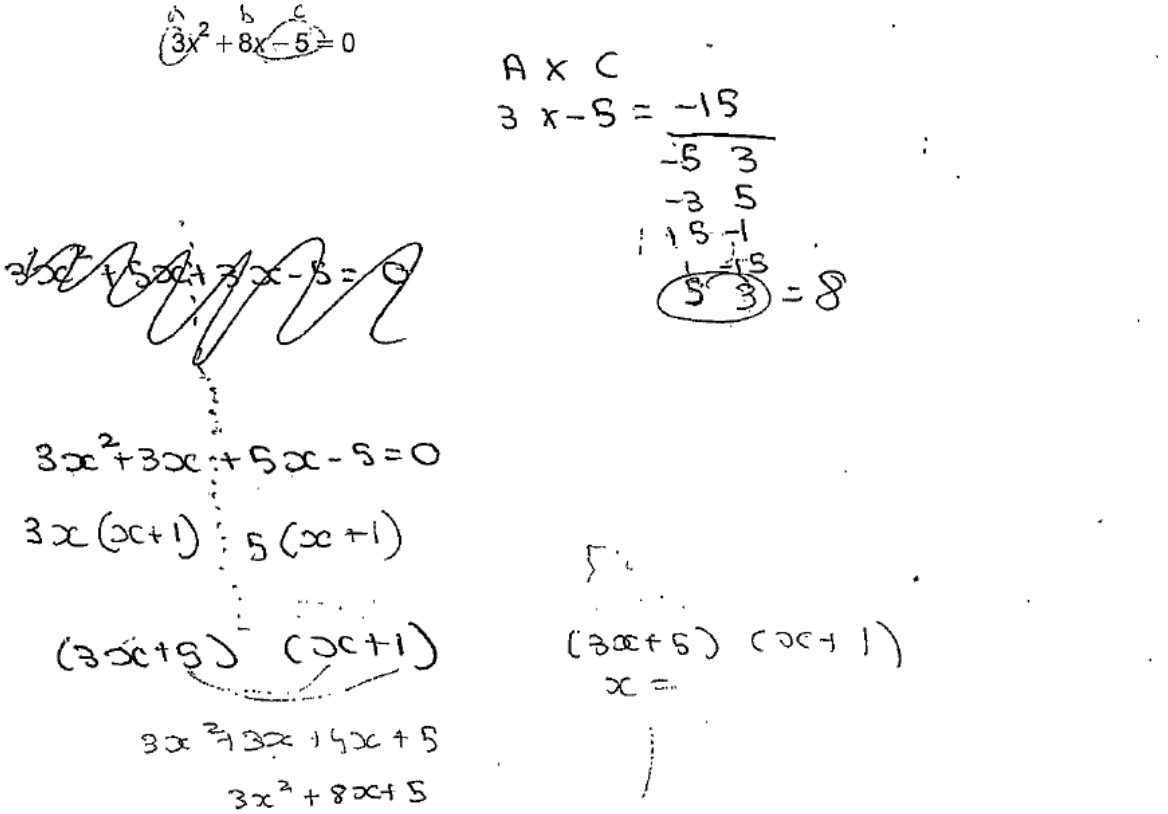
The quadratic formula has been written incorrectly so, in the numerator, it should be $-b$ and $-4ac$, so two errors means we can award M1 only.

Exemplar 3

1 mark

19 Solve this equation algebraically.
Give your solutions correct to 2 decimal places.

$3x^2 + 8x - 5 = 0$



$x =$ 0.52 or $x =$ -3.19 [4]

Examiner commentary

The two answers are correct but there is no supporting algebraic working so we can only award 1 mark. The question asks for an algebraic solution so we need to see the evidence of their method. Their working does not lead to their answer.

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