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OCR
Oxford Cambridge and RSA

GCSE (9–1)

Exemplar Candidate Work

MATHEMATICS

J560
For first teaching in 2015

J560/03 Summer 2019 examination series

Version 1

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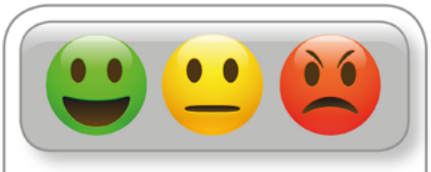

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Introduction

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 2 (b)

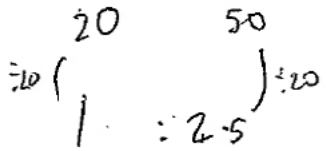
(b) The ratio 20 : 50 can be written in the form 1 : *n*.

Find the value of *n*.

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

Exemplar 1

2 marks



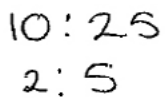
(b) *n* = 2.5 **[2]**

Examiner commentary

Many successful candidates used this method. The division by 20 to reduce the left hand side to 1 can be clearly seen.

Exemplar 2

1 mark



(b) *n* = 5 **[2]**

Examiner commentary

A number of candidates used this step process, dividing by one factor (often 2 or 10) and then another. Some stopped at an intermediate stage but scored 1 mark if the simplification was valid, like in this exemplar (2 : 5 seen).

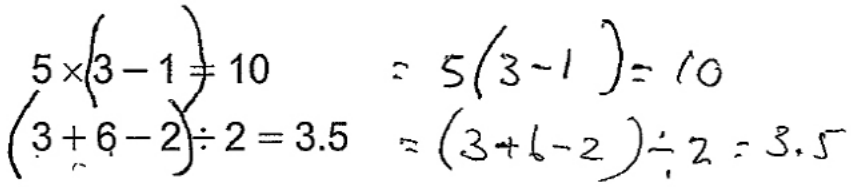
Question 3

3 Insert brackets to make each of these calculations correct.

$5 \times 3 - 1 = 10$

$3 + 6 - 2 \div 2 = 3.5$ [2]

Exemplar 1 2 marks

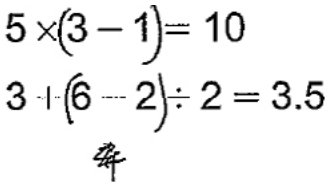


[2]

Examiner commentary

This candidate scores full marks for correct placement of brackets in both of the calculations. The inclusion of the values of the brackets e.g. $5 \times 2 = 10$ and $7 \div 2 = 3.5$, could have been shown for a full check.

Exemplar 2 1 mark



[2]

Examiner commentary

This candidate scores 1 mark for placing the brackets correctly in the first calculation. Many candidates were successful with this calculation.

Candidates did not do so well with the placement of brackets in the second calculation as there was a misconception that only two numbers could be enclosed in the brackets.

Few showed stages in working to check their placement, although the crossed out 4 in this exemplar suggests a check was made by the candidate.

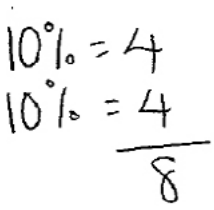
Question 4

4 Work out 20% of 40.

..... [2]

Exemplar 1

2 marks



..... 8 ..... [2]

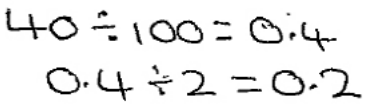
Examiner commentary

Full marks are awarded as the answer is correct.

Candidates should be encouraged to write their full method - if an error is made and no calculations are seen then no method marks can be awarded.

Exemplar 2

0 marks



..... 0.2 ..... [2]

Examiner commentary

A number of candidates used a 'non-calculator' approach, such as this. Some of these were successful but many floundered on misremembered processes. Her, "divide by 100 to find 1%" was presumably remembered but what part division by 2 played is a mystery.

No marks were scored as the process was incorrect.

Question 6 (a) and (b)

6 **(a)** These are the first five multiples of 15.

15 30 45 60 75

Write down the first five multiples of 30.

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

(b) Write down the lowest common multiple (LCM) of 15 and 30.

(b) ..... **[1]**

Exemplar 1

6 (a) 2 marks, 6 (b) 1 mark

6 **(a)** These are the first five multiples of 15.

15 30 45 60 75

Write down the first five multiples of 30.

(a) 30 , 60 , 90 , 120 , 150 **[2]**

(b) Write down the lowest common multiple (LCM) of 15 and 30.

(b) 30 **[1]**

Examiner commentary

Many complete and correct answers were seen to these linked questions.

Exemplar 2

6 (a) 2 marks and 6 (b) 0 marks

6 (a) These are the first five multiples of 15.

15 30 45 60 75

Write down the first five multiples of 30.

(a) 30, 60, 90, 120, 150 [2]

(b) Write down the lowest common multiple (LCM) of 15 and 30.

(b) 3 [1]

Examiner commentary

Approximately half of the candidates failed to score a mark in part (b) and many candidates confused LCM with Highest Common Factor (HCF), as seen in this exemplar. A common misconception was that 1 is not a factor.

Question 8

8 Find the value of $3g - h$ when $g = 4$ and $h = 5$.

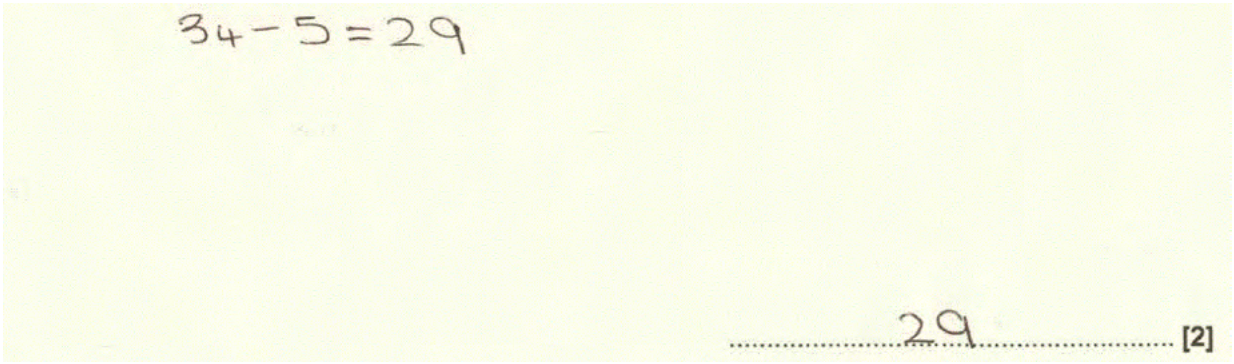
..... [2]

Exemplar 1 2 marks

Examiner commentary

The candidate showed clear layout of working, showing substitution and understanding of the 'missing' operation, ×, and of the order of operations. Full marks were credited.

Exemplar 2 0 marks



Examiner commentary

IThis exemplar shows an incorrect understanding of the substitution process The candidate did not appreciate that $3g$ means $3 \times g$. This misunderstanding was the most common reason for losing marks in this question.

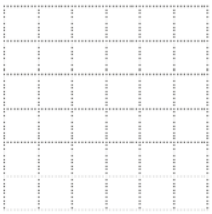
Question 9 (a) and (b)

9 Here are the first three patterns in a sequence.

Pattern 1 Pattern 2 Pattern 3

(a) Draw Pattern 4 in the sequence.

Pattern 4



[1]

(b) Without drawing it, work out how many dots there are in Pattern 8.
Explain how you decide.

..... dots because .....

.....

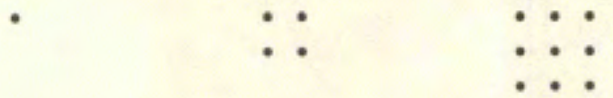
..... **[2]**

Exemplar 1

9 (a) 1 mark, 9 (b) 2 marks

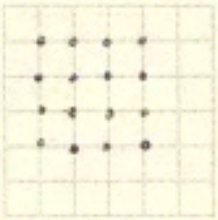
9 Here are the first three patterns in a sequence.

Pattern 1 Pattern 2 Pattern 3



(a) Draw Pattern 4 in the sequence.

Pattern 4



[1]

(b) Without drawing it, work out how many dots there are in Pattern 8.
Explain how you decide.

8×8=64

64 dots because you're squaring the number of the pattern, each time

[2]

Examiner commentary

In part (a), the candidate correctly completed the pattern and scored 1 mark.

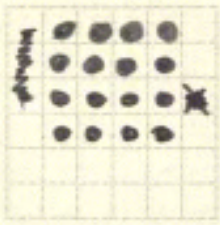
In part (b) the correct number of dots is given and the rule, demonstrated in the working space, is explained. Both marks are awarded.

Exemplar 2

9 (a) 1 mark, 9 (b) 0 marks

(a) Draw Pattern 4 in the sequence. 1, 3, 5, 7

Pattern 4



16

[1]

(b) Without drawing it, work out how many dots there are in Pattern 8.
Explain how you decide.

16 × 2 = 32

32 dots because you can times pattern 4 by 2 to make Pattern 8. [2]

Examiner commentary

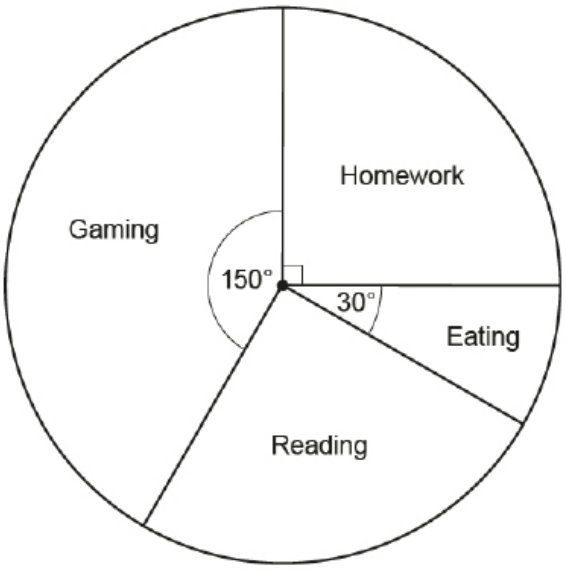
The diagram in part (a) was included to help with the understanding that these were square numbers.

A significant number of candidates could complete the diagram but missed the help that it offered for the subsequent part, as in this case.

The rule offered in part (b) did not link any of the diagrams and scored 0 marks.

Question 10 (b)

10 The pie chart shows how Jack spent his time one evening.



(b) Jack says

I spent $\frac{1}{3}$ of my time on Gaming.

Show that he is not correct.

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

Exemplar 1 — 1 mark

$\frac{1}{4} \times 2 = \frac{1}{2} + \frac{1}{12} = \frac{7}{12}$ $1 - \frac{7}{12} = \frac{5}{12}$ which is how much he spent time on Gaming **[2]**

Examiner commentary

The candidate has correctly calculated that the fractions of the circle for Homework, Eating and Reading leave $\frac{5}{12}$ of the circle for Gaming to score M1. However, they have not completed the argument by showing that $\frac{1}{3} = \frac{4}{12}$ and so the two are not equal.

The writing of incomplete statements was the most common reason for not being awarded full marks in this question.

Exemplar 2

1 mark

(b) Jack says

I spent $\frac{1}{3}$ of my time on Gaming.

Show that he is not correct.

150 + 90 + 30 = 270

360 − 270 = 90

Because a $\frac{1}{3}$ is 120°. [2]

$\frac{1}{3}$ of 360 = 120

gaming = 150°

homework = 90°

eating = 30°

reading = 90°

Examiner commentary

The candidate has correctly stated that $\frac{1}{3}$ of 360 = 120 and repeated in the working space the information from the diagram. However, they have not completed the argument that 120 is not 150 to demonstrate that Jack was wrong.

Candidates must give full answers to 'Show that...' questions.

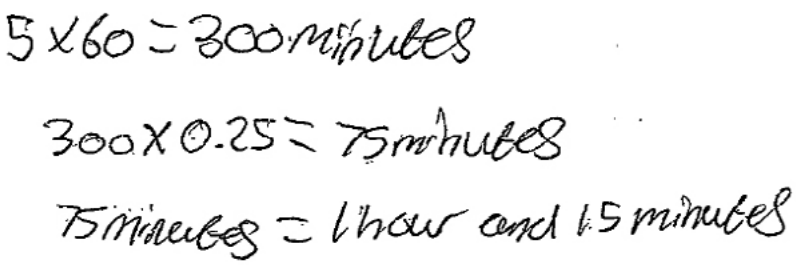
Question 10 (c)

(c) The pie chart represents 5 hours.

Find the time, in hours and minutes, that Jack spent reading.

(c) ..... h ..... min **[4]**

Exemplar 1 — 4 marks



(c) 1 h 15 min **[4]**

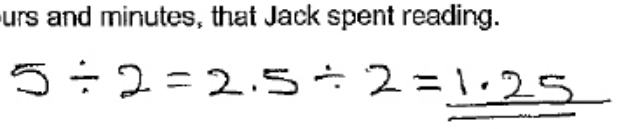
Examiner commentary

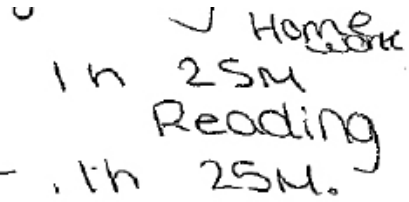
A clear and concise method to reach the correct answer.

Exemplar 2 — 3 marks

(c) The pie chart represents 5 hours.

Find the time, in hours and minutes, that Jack spent reading.





(c) 1 h 25 min **[4]**

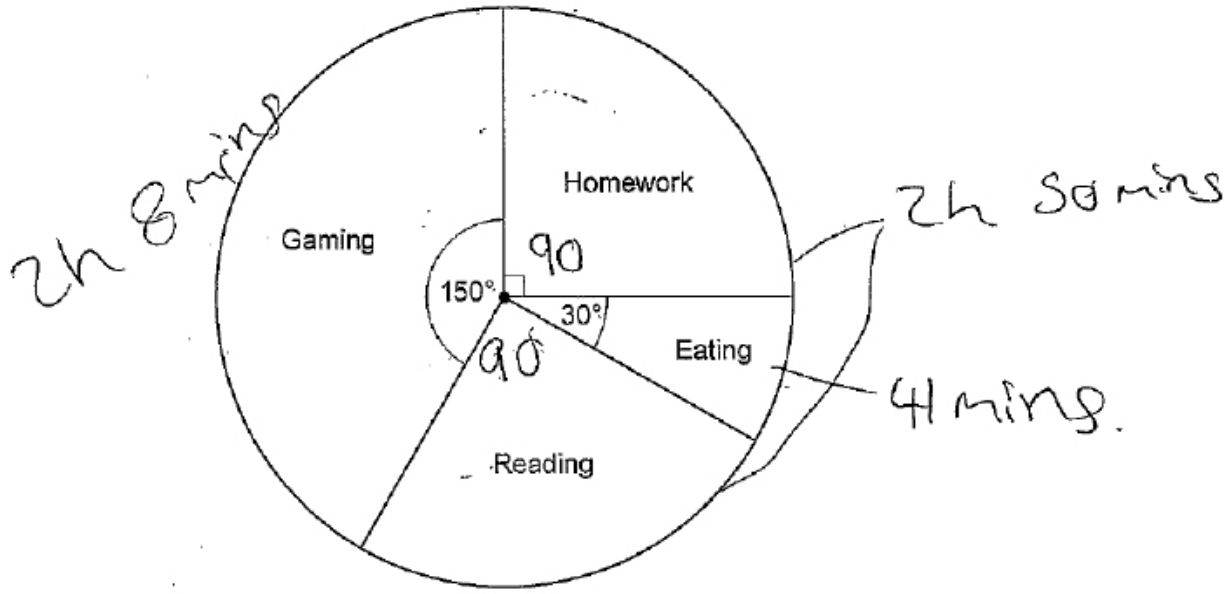
Examiner commentary

B3 was awarded for 1.25.

A number of candidates reached this point but did not recognise that the decimal 0.25 equates to 0.25 × 60 = 15 minutes.

Exemplar 3

1 mark



(c) The pie chart represents 5 hours.

Find the time, in hours and minutes, that Jack spent reading.

(c) ..... 1 ..... h ..... 25 ..... min **[4]**

Examiner commentary

The candidate does not understand how time relates to the pie chart and the sum of the times is not 5 hours.

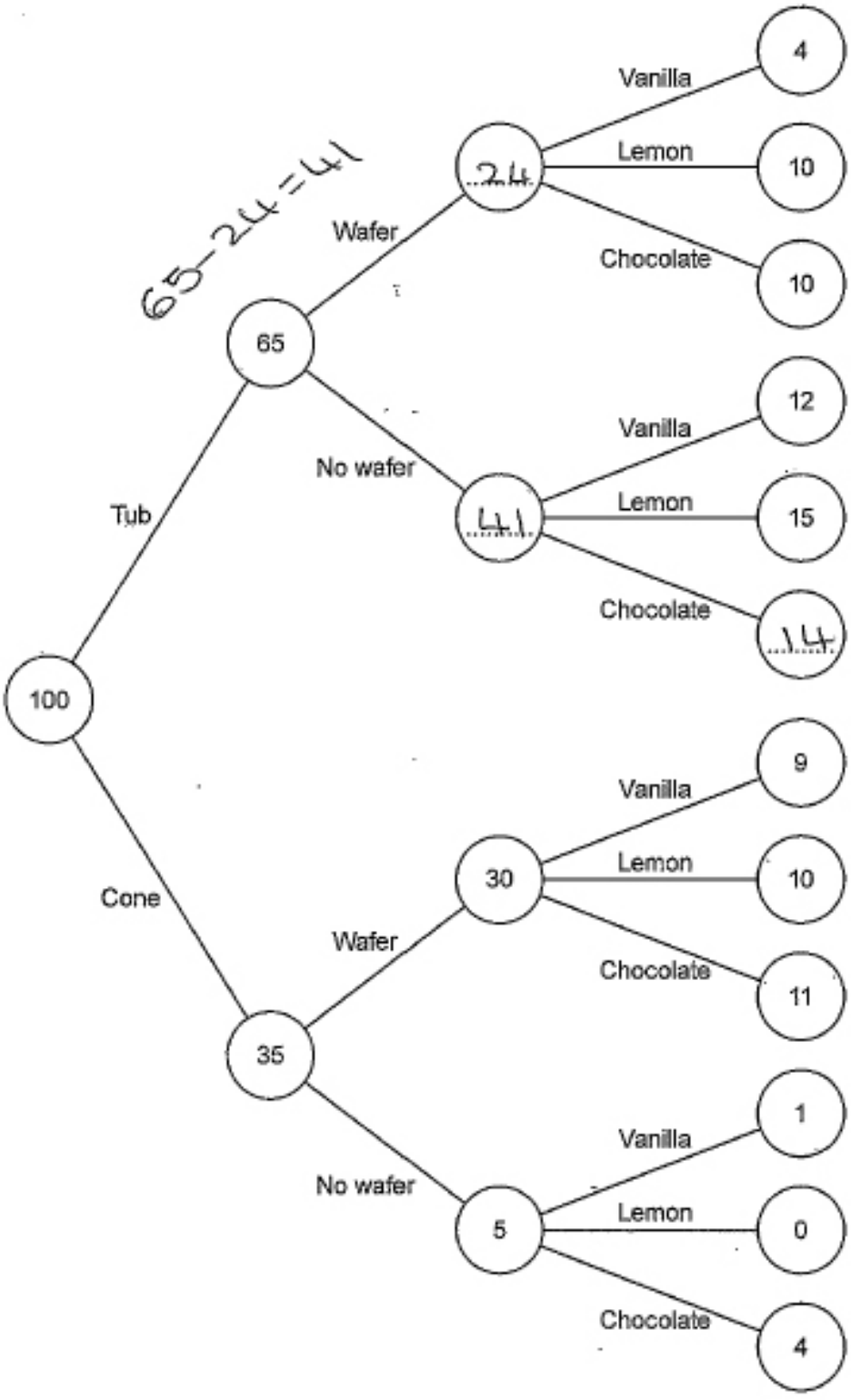
However, 1 mark (B1) is awarded for recognising that the sector angle for Reading is 90, which is marked on the diagram.

Question 11 (b) and (c)

Exemplar 1 11 (b) 2 marks and 11 (c) 3 marks

11 Megan's Cafe sells ice cream.
Customers choose to have a tub or a cone, and a wafer or no wafer.
They can choose vanilla, lemon or chocolate ice cream.

This frequency tree shows the number of people making some of the choices.



(b) Complete the frequency tree. **[2]**

(c) Which flavour of ice cream was most popular?
Show how you decide.

Vanilla = 4 + 12 + 9 + 1 = 26
Lemon = 10 + 15 + 10 + 0 = 35
Chocolate = 10 + 14 + 11 + 4 = 39

(c) ...Chocolate..... **[3]**

Examiner commentary

This exemplar shows a completely correct solution with clearly annotated working for 11(c).

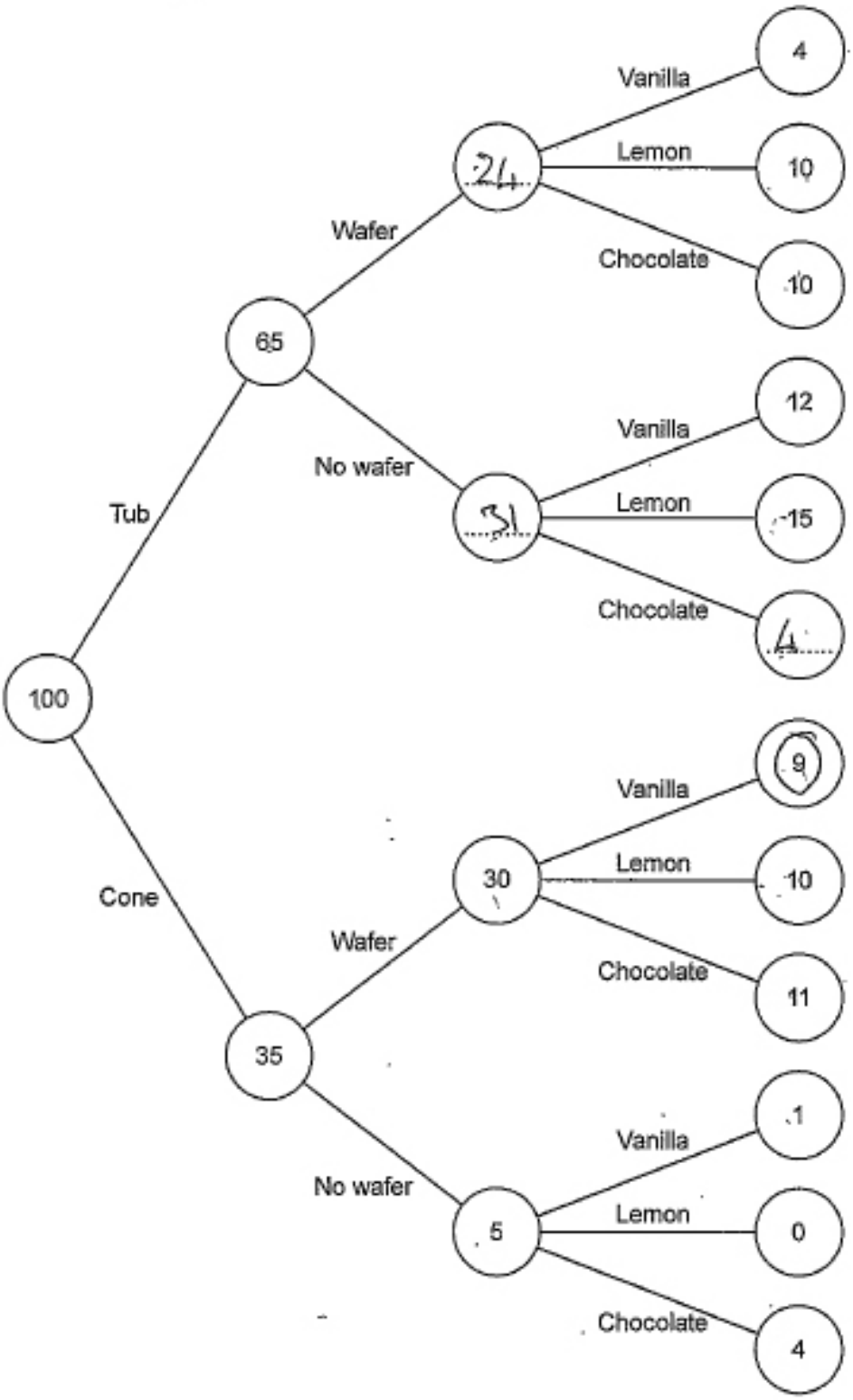
It is recommended that all candidates annotate their solutions.

Exemplar 2

11 (b) 1 mark and 11 (c) 2 marks

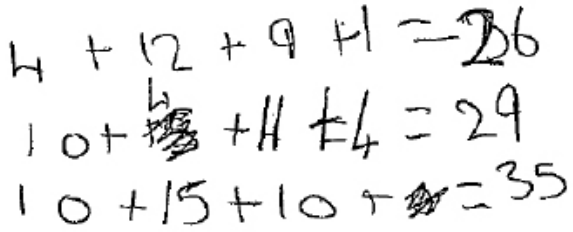
11 Megan's Cafe sells ice cream.
Customers choose to have a tub or a cone, and a wafer or no wafer.
They can choose vanilla, lemon or chocolate ice cream.

This frequency tree shows the number of people making some of the choices.



(b) Complete the frequency tree. **[2]**

(c) Which flavour of ice cream was most popular?
Show how you decide.



(c) Lemon **[3]**

Examiner commentary

The candidate makes an error in completing the initial diagram in part (b) but scores 1 mark for completing one correct entry.

Following through from the incorrect diagram, the candidate has found the correct sums from their diagram to score M2.

Question 12

12 Solve.

$4x + 5 = 35$

$x =$ ..... **[2]**

Exemplar 1

2 marks

$4x + 5 = 35$
$-5 \quad -5$
$4x = 30$
$\div 4 \quad \div 4$
$x = 7.5$

$x =$ 7.5 **[2]**

Examiner commentary

A completely correct method leading to the correct answer.

Candidates should be encouraged to always show working in case they do get reach the correct answer. Any numerical error in a correct method (that is not seen) will score 0 marks when the answer is incorrect.

Exemplar 2

0 marks

$4 + 5 = 9$
$35 - 9 = 26$
$x = 26$

$x =$ 26 **[2]**

Examiner commentary

A not untypical false method, demonstrating a complete misunderstanding of algebraic processes.

Question 13

13 Delroy drives 240 miles.
His car averages 40 miles per gallon of petrol.
Petrol costs £1.30 per litre.

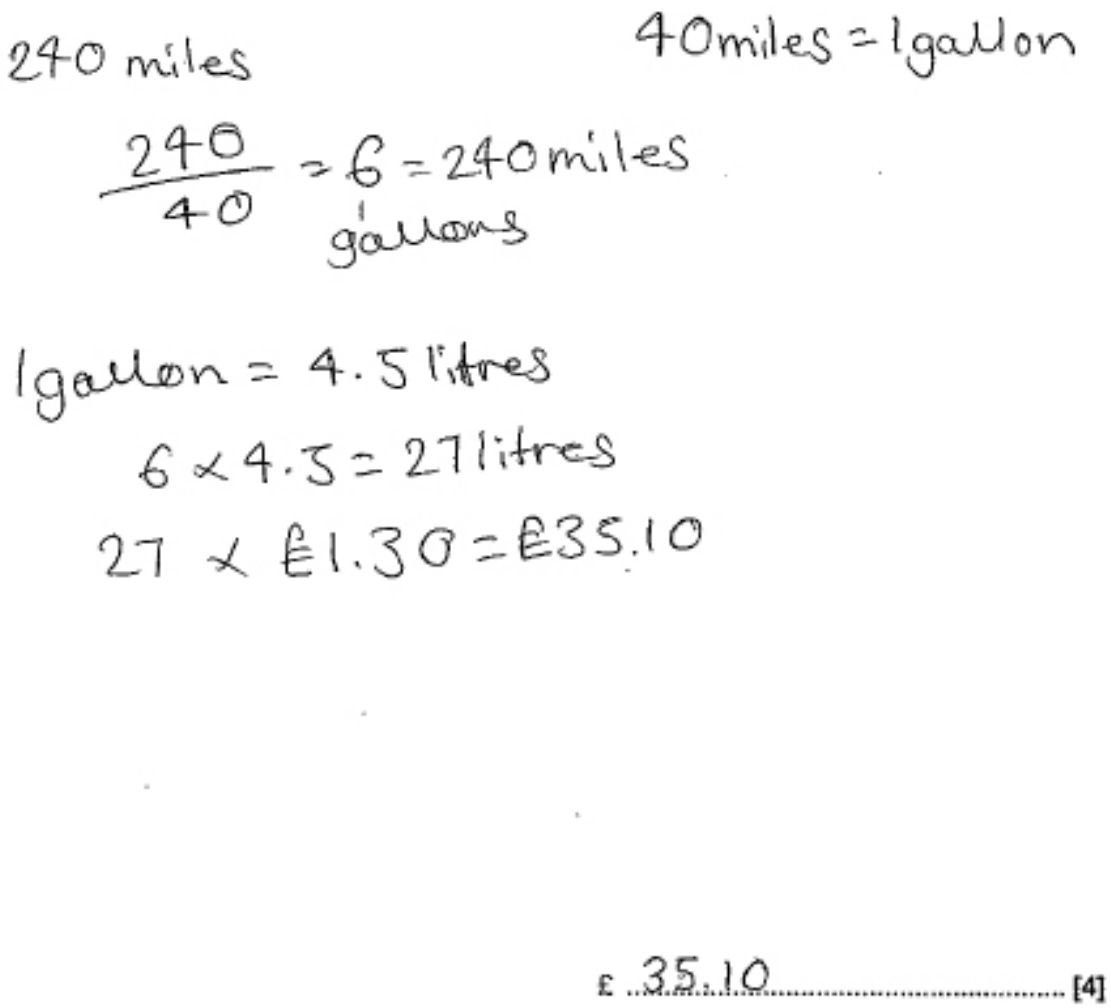
1 gallon is 4.5 litres.

How much does Delroy spend on petrol for this journey?

£ ..... **[4]**

Exemplar 1

4 marks



£ 35.10 **[4]**

Examiner commentary

A correct and well annotated solution that also includes units.

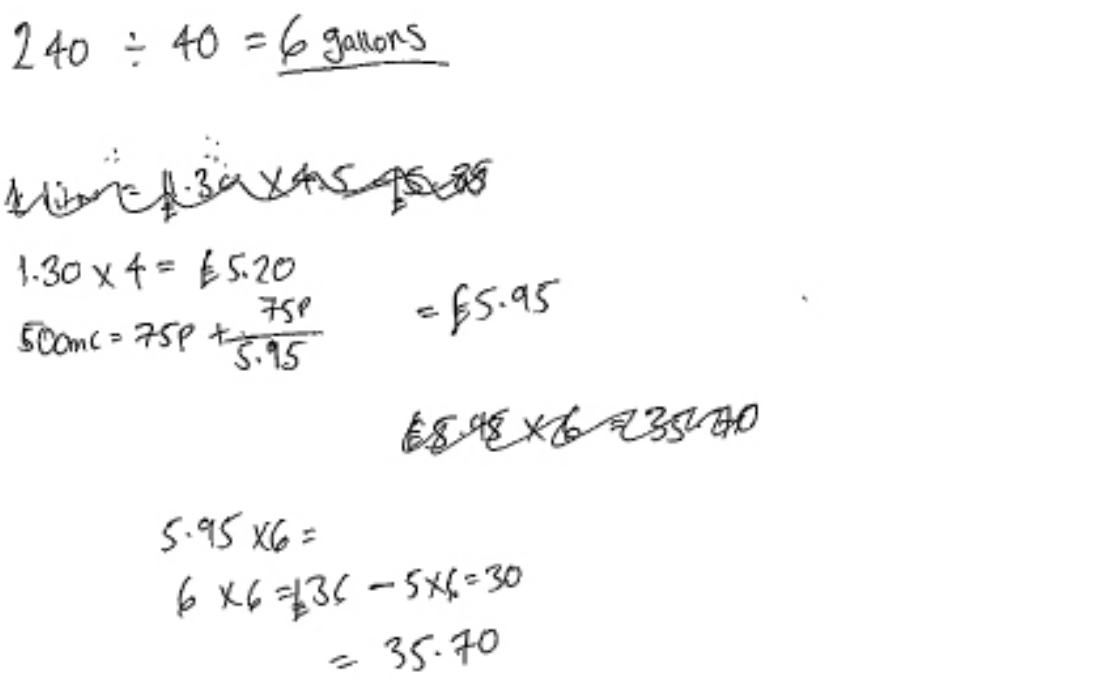
Exemplar 2

3 marks

13 Delroy drives 240 miles.
His car averages 40 miles per gallon of petrol.
Petrol costs £1.30 per litre.

1 gallon is 4.5 litres.

How much does Delroy spend on petrol for this journey?



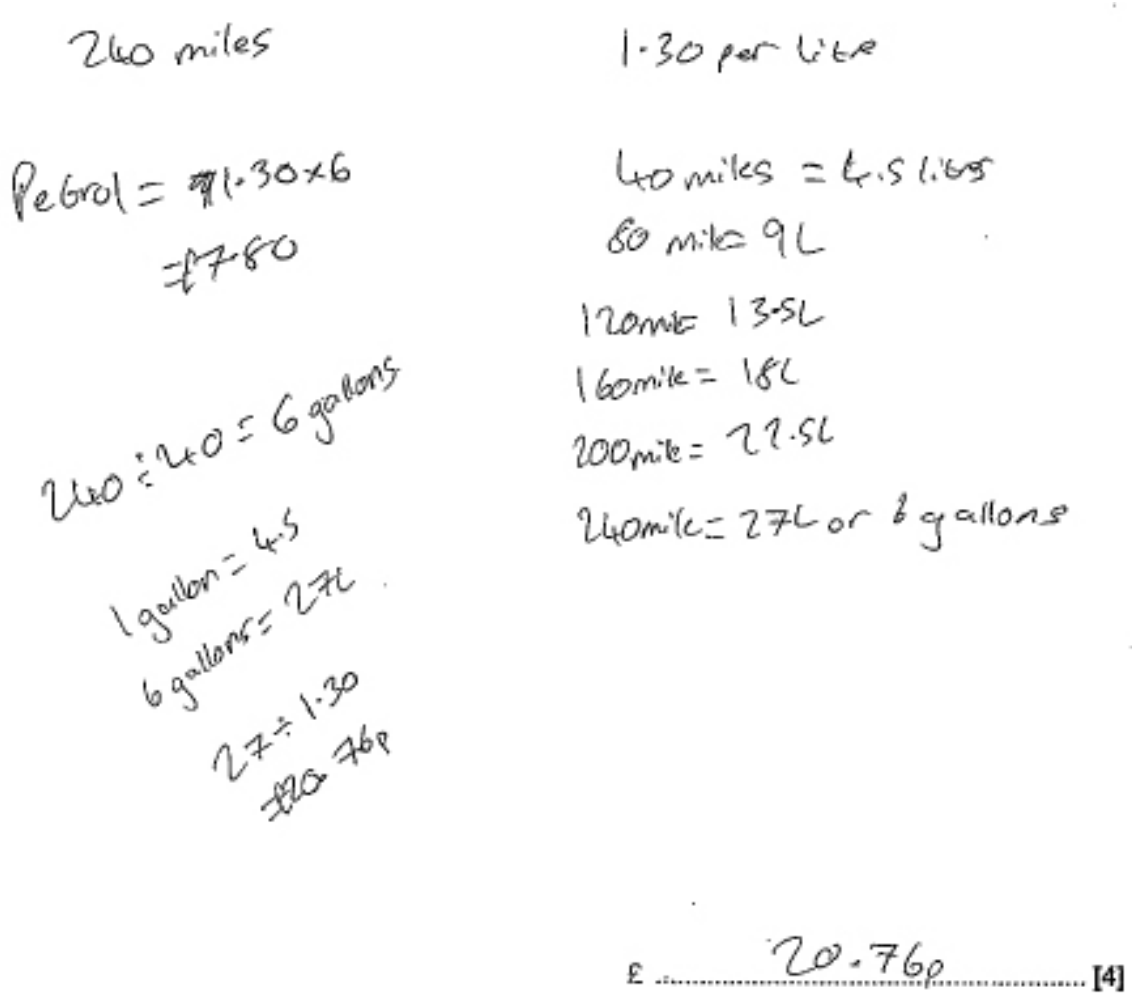
£ 35.70 [4]

Examiner commentary

M1 is awarded for 240 ÷ 40 = 6. Following this, the multiplication by 4.5 is done by multiplying by 4, halving 130 and adding the two together. This was not the most efficient method and resulted in an error being made (130 ÷ 2 = 75, rather than 65). However, the process is correct for M2.

Exemplar 3

2 marks



Examiner commentary

It is unclear where the candidate has started the solution. The working on the right hand side might be a check of the division on the left, it could be their method of division or it could be their method of changing gallons to litres.

M1 is awarded for reaching 6 gallons. A further M1 is awarded for converting this to 27 litres. After the 6 gallons and 27 litres, the information is misused and so no further marks are scored.

Exemplar 4

1 mark

240 miles.
Average = 40 miles Per gallon.
Petrol = £1.30 per litre.
1 gallon = 4.5 litres.
1.30 × 4 = 5.2.

240 ÷ 4 = 60 gallon of petrol
13 litres = 1.30 × 13 = 16.9

£ 16.90p [4]

Examiner commentary

The candidate has repeated some of the information at the start of the solution. However, much of it has been misused.

The candidate has not divided 240 by 40 but by 4 and there is no later division by 10 to correct the error.

At the end of the solution is a clear number of litres (13) multiplied by 1.30 which is evaluated correctly and this earns the SC1 mark. It is unclear where the 13 litres has come from.

Question 14

Exemplar 1 5 marks

14 Joan makes cups of tea and coffee at a lunch club.
Each cup requires 250 ml of boiling water.
She has a kettle that boils up to 1.7 litres of water each time.

She boils 10 litres of water in an urn.
She then uses the kettle to boil the rest of the water she needs.

Find the least number of times that Joan needs to boil the kettle to make 56 cups.
Show how you decide.

1L = 1000 ml
14000

each cup = 250 ml = water x 56

56 cups = 14000 ml = 14 litres

10 litres = 1 urn

got 4 litres left

She boils kettle 3 times
each time with 1.7 litres to get
4 litres. (approx)

4 ÷ 1.7 = 2.3̇ ← can't boil a kettle 2.3 times, round up to 3 times

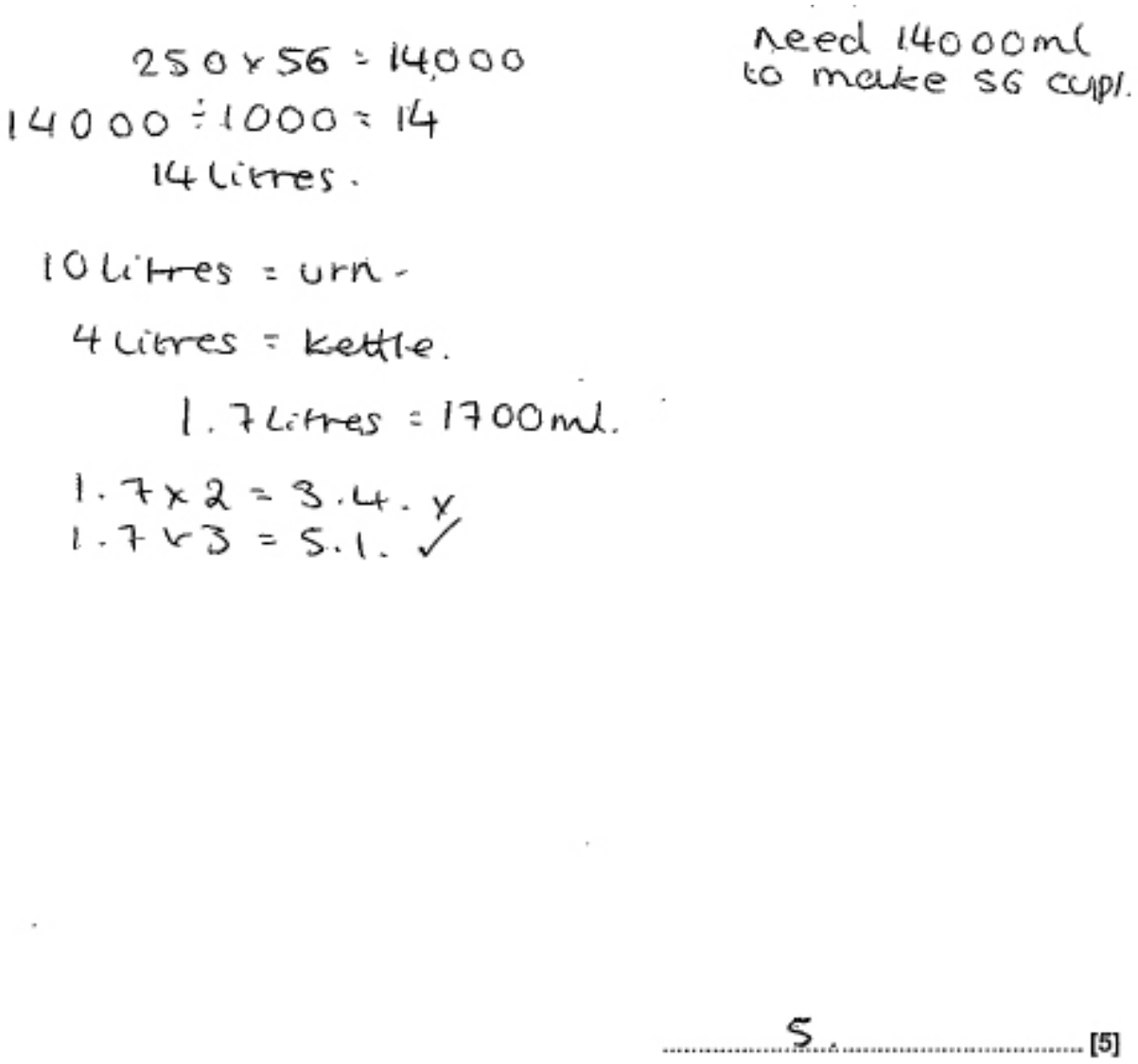
3 ..... [5]

Examiner commentary

A completely correct and well annotated solution using the expected method and demonstrating all of the steps.

Exemplar 2

4 marks



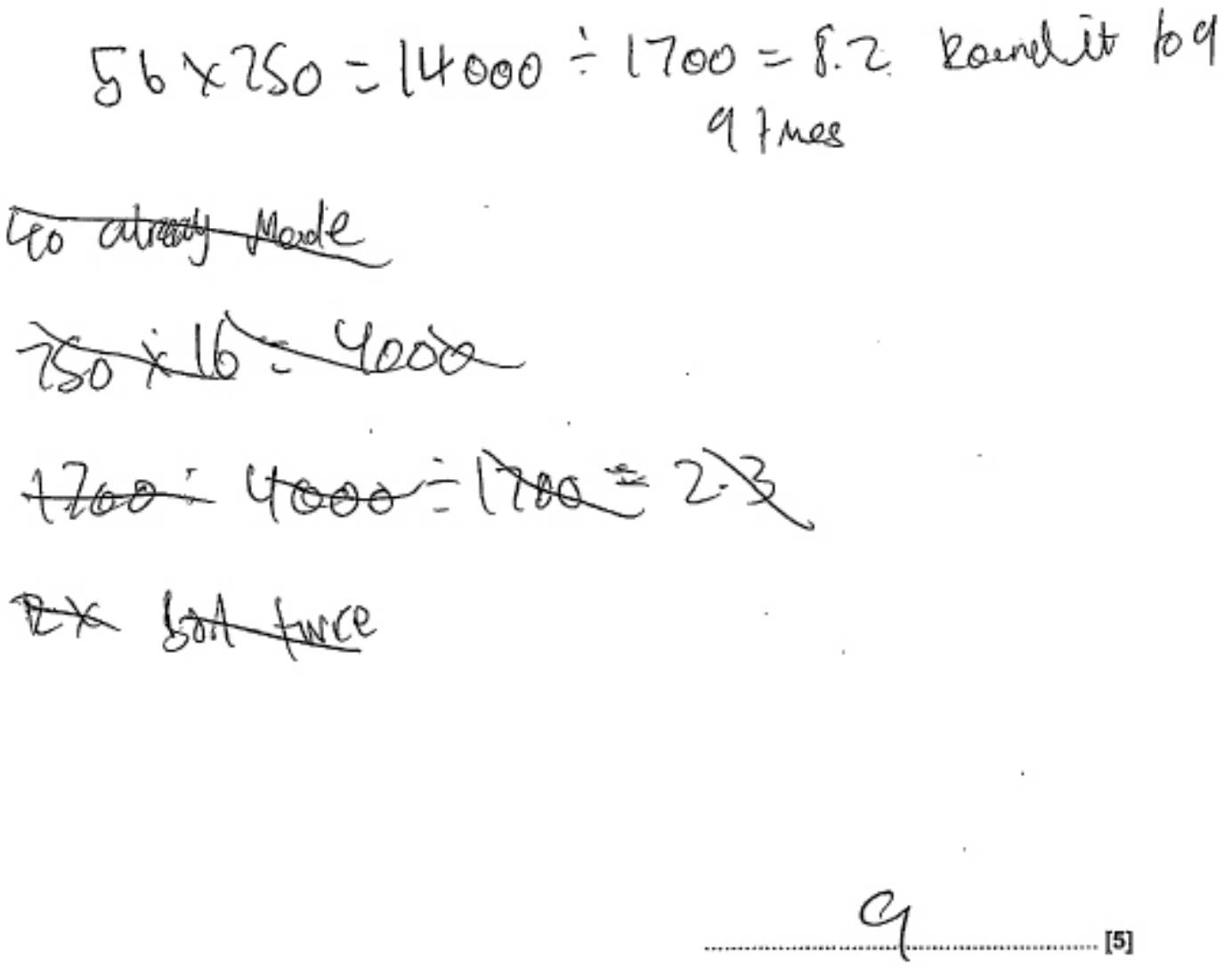
Examiner commentary

This candidate scored 4 marks out of a possible 5 marks.

- M1 is awarded for finding the volume of water required, in ml.
- B1 is awarded for correctly converting 14 000 (ml) to litres.
- M1 is awarded for finding the number of litres required (4) using the kettle.
- There is an implied division of 4 by 1.7 through the process of finding multiples of 1.7 and so a further M1 can be awarded.
- The outcome is misinterpreted and so the candidate does not earn the final mark.

Exemplar 3

4 marks

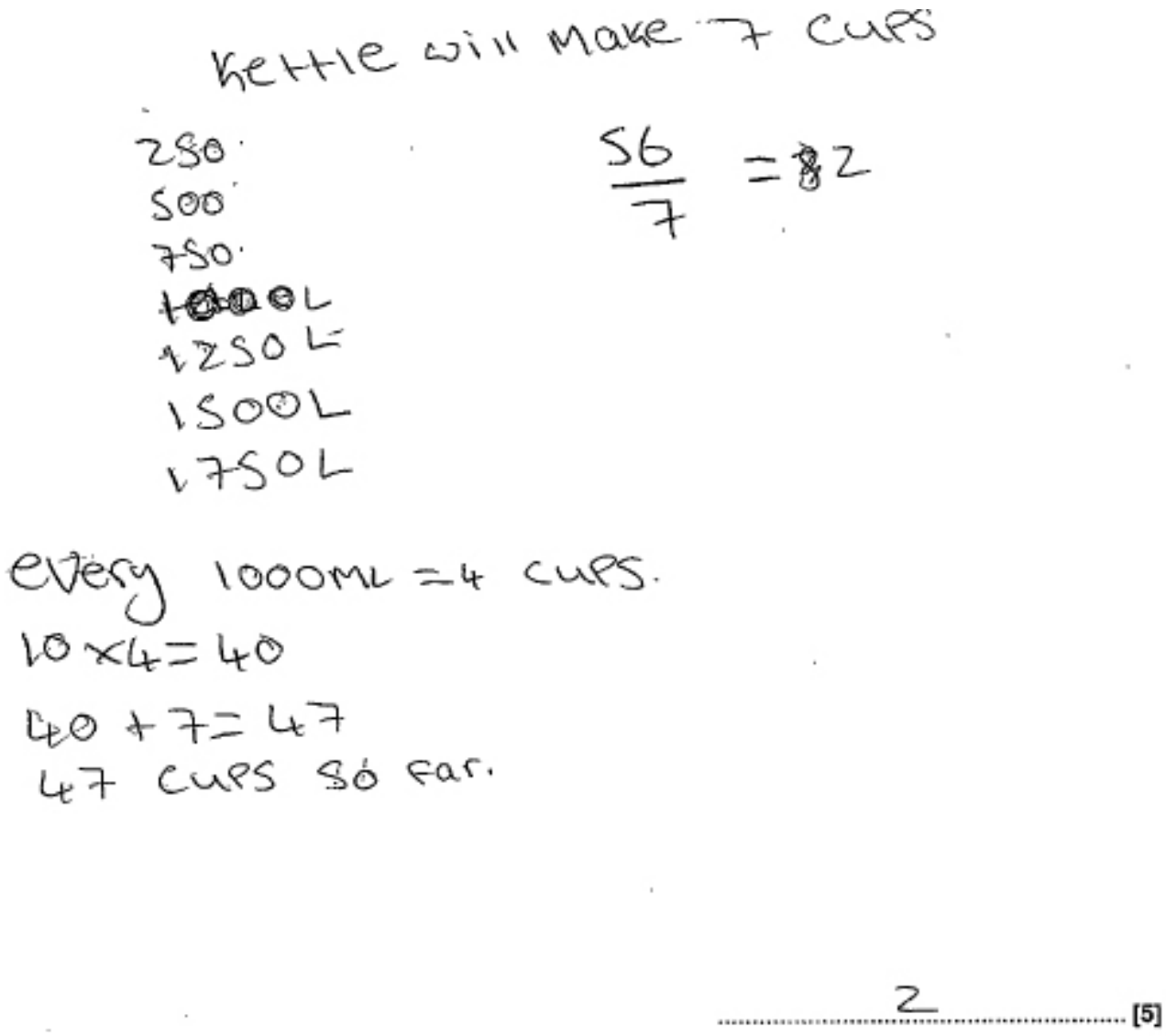


Examiner commentary

The candidate has misread the question and does not use the urn in their method. The working makes this misunderstanding clear. Each step of the expected working (for this method) is seen and B4 is scored for an answer of 9.

Exemplar 4

2 marks



Examiner commentary

The candidate appears to be following the alternative method of working in cups as shown in the mark scheme.

The solution starts with a condoned statement, that the kettle will boil 7 cups of water (even though this is not completely correct) and earns M1. The candidate earns a second M1 for working out that there will be 40 cups from the urn.

7s are not added until 56 is reached or passed and an incorrect answer is given.

Question 15 (a)

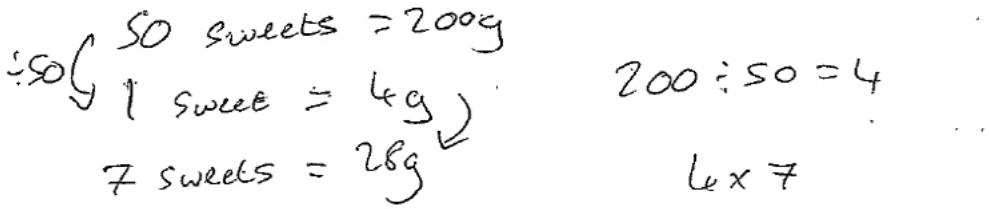
15 (a) 50 sweets weigh 200 g.

If each sweet weighs the same, work out the weight of 7 sweets.

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

Exemplar 1

2 marks



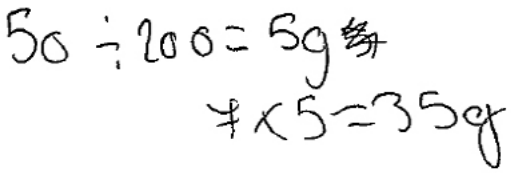
(a) 28 g **[2]**

Examiner commentary

This exemplar demonstrates a commonly used tabular layout used for these types of questions. Method and divisions are correct so the candidate scores both marks.

Exemplar 2

0 marks



(a) 35 g **[2]**

Examiner commentary

A solution that demonstrates a frequent error made by candidates...the order of division. Had the division been written correctly the M1 could have been awarded.

Question 15 (b)

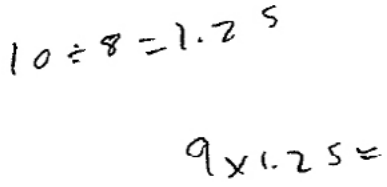
(b) *b* is directly proportional to *a*.
b is 10 when *a* is 8.

Work out *b* when *a* is 9.

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

Exemplar 1

2 marks



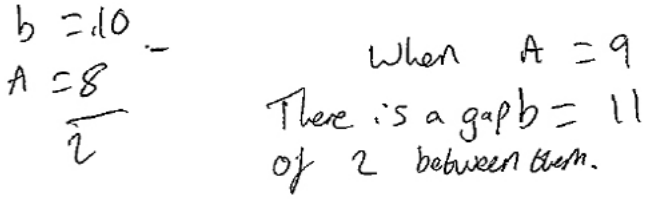
(b) *b* = 11.25 **[2]**

Examiner commentary

A complete and correct method to score both marks.

Exemplar 2

0 marks



(b) *b* = 11 **[2]**

Examiner commentary

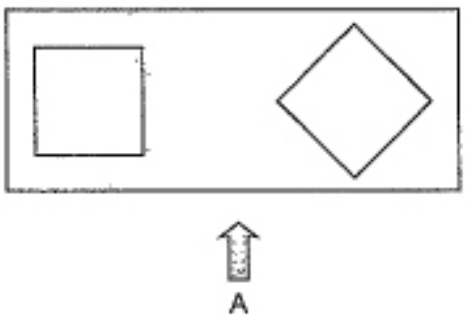
This exemplar shows the most common incorrect way to answer this question.

Candidates assumed, incorrectly, that the step of 2 between *a* and *b* would be the same for all values.

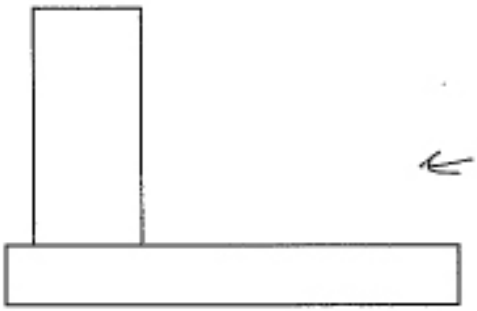
Question 16

Exemplar 1 2 marks

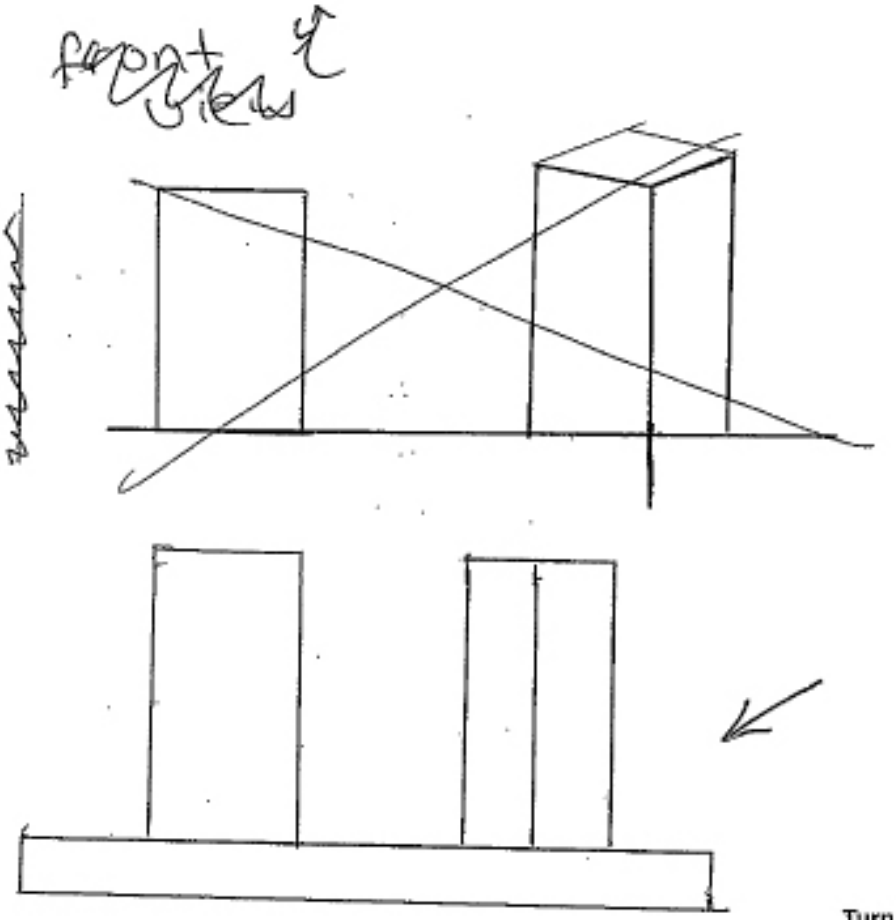
16 This is the plan view of a 3D object.



Complete the diagram below to show the front view of the 3D object from A.



[2]

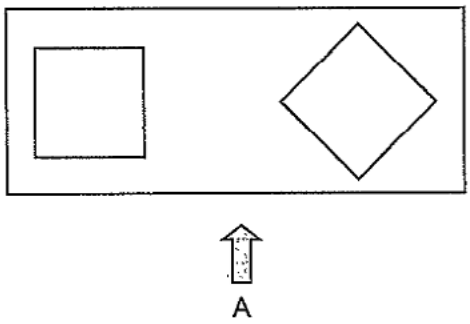


Turn over

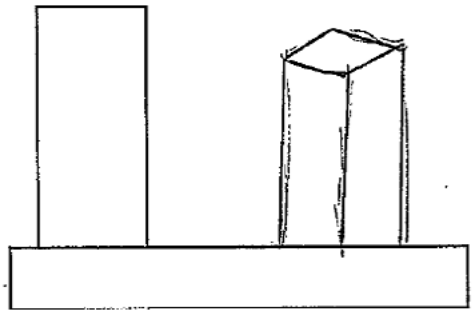
Examiner commentary

After a false response, that is clearly deleted and therefore ignored, a correct drawing is shown. The candidate has drawn the left hand column wider than in the original diagram but this is condoned. The right hand column has an acceptable correct width (it is wider than the left hand column on the original diagram) and a roughly central leading edge. Both marks are awarded.

Exemplar 2 1 mark



Complete the diagram below to show the front view of the 3D object from A.



[2]

Examiner commentary

No candidates used construction lines from the given diagram down to the front view to guide their drawing of the answer.

No candidates saw the second 'column' as a hole in the base. Most drew the second column as the same width as the given one (meaning they could not score the first mark) but then did score the second B1 for a (roughly) central leading edge shown.

Most candidates showed the top of the column as an oblique face and so lost the first mark.

Question 17 (a)

17 A grain of salt weighs 6.48×10^{-5} kg on average.
A packet contains 0.35 kg of salt.

(a) Use this information to calculate the number of grains of salt in the packet.

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

Exemplar 1

1 mark

$0.0000648 \times 0.35 = 2.268 \times 10^{-5}$.

(a) 2.268×10^{-5} **[2]**

Examiner commentary

The method is incorrect but B1 is awarded for correctly converting 6.48×10^{-5} to an ordinary number.

Question 17 (b)

(b) Explain why your answer to part **(a)** is unlikely to be the actual number of grains of salt in the packet.

.....

.....

..... **[1]**

Exemplar 1 — 0 marks

"You can't have a decimal place for salt.

Examiner commentary

Many candidates found it difficult to give a precise answer. This candidate was very close but should have said, "You can't have a decimal value for the number of grains of salt".

Many candidates focussed on the practicalities of the process rather than the information that was given.

Question 18

18 Tom researches the weights of plant seeds.

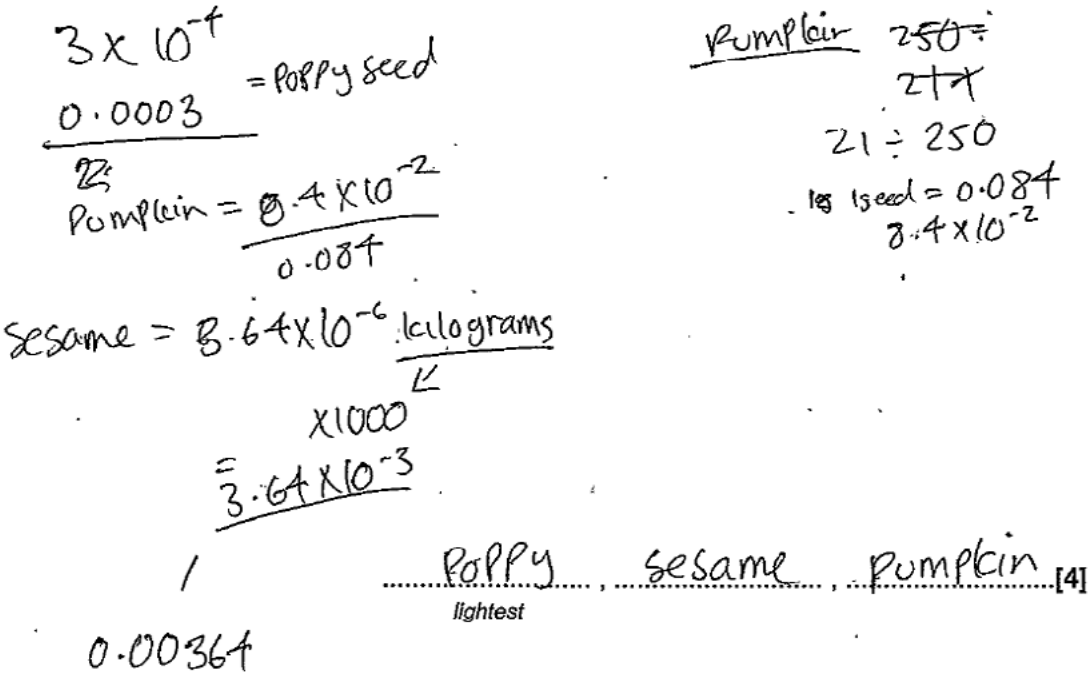
- One poppy seed weighs 3×10^{-4} grams.
- 250 pumpkin seeds weigh 21 grams.
- One sesame seed weighs 3.64×10^{-6} kilograms.

Write the three types of seed in order according to the weight of one seed.
Write the lightest type of seed first.
You must show how you decide.

..... , ... , ...[4]
lightest

Exemplar 1

4 marks

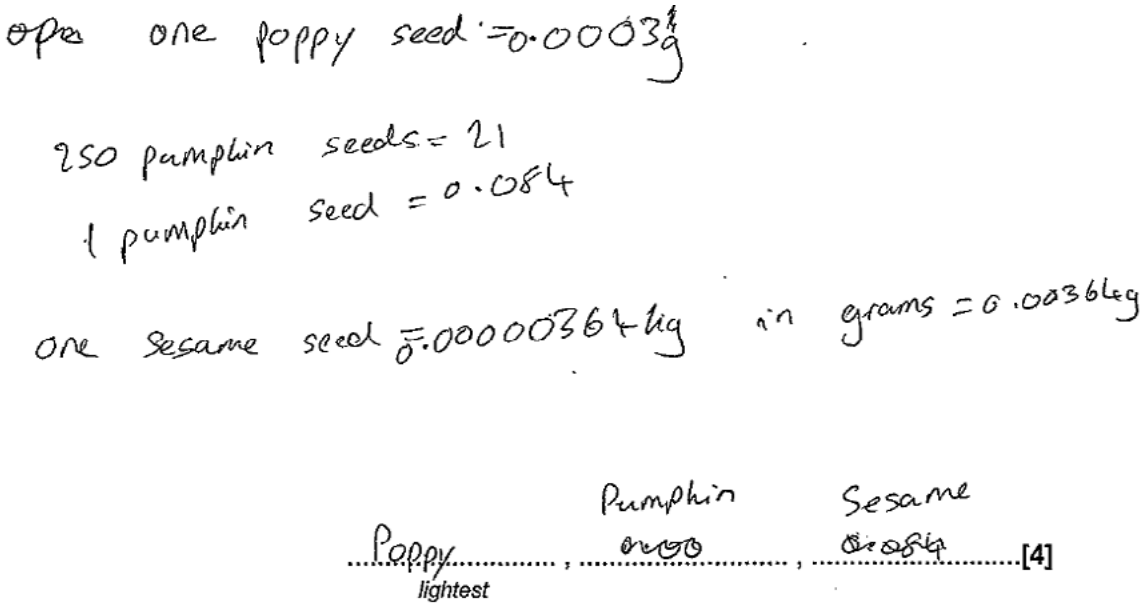


Examiner commentary

This candidate has a complete and correct method and scores full marks. This was rarely seen.

Exemplar 2

3 marks



Examiner commentary

The candidate has found the correct weight of a pumpkin seed in grams (0.084).

They have also found the correct weight of a sesame seed, also in grams (0.00364).

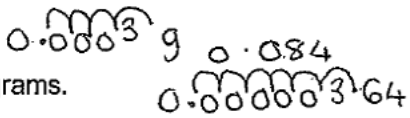
The weight of a poppy seed is correct too (0.003).

The order is incorrect but all three weights are in a correct comparable form so the candidate scores B3.

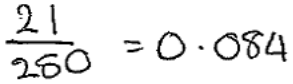
Exemplar 3

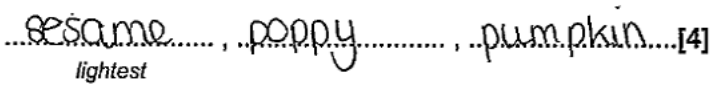
1 mark

- One poppy seed weighs 3×10^{-4} grams.
- 250 pumpkin seeds weigh 21 grams.
- One sesame seed weighs 3.64×10^{-6} kilograms.



Write the three types of seed in order according to the weight of one seed.
Write the lightest type of seed first.
You must show how you decide.





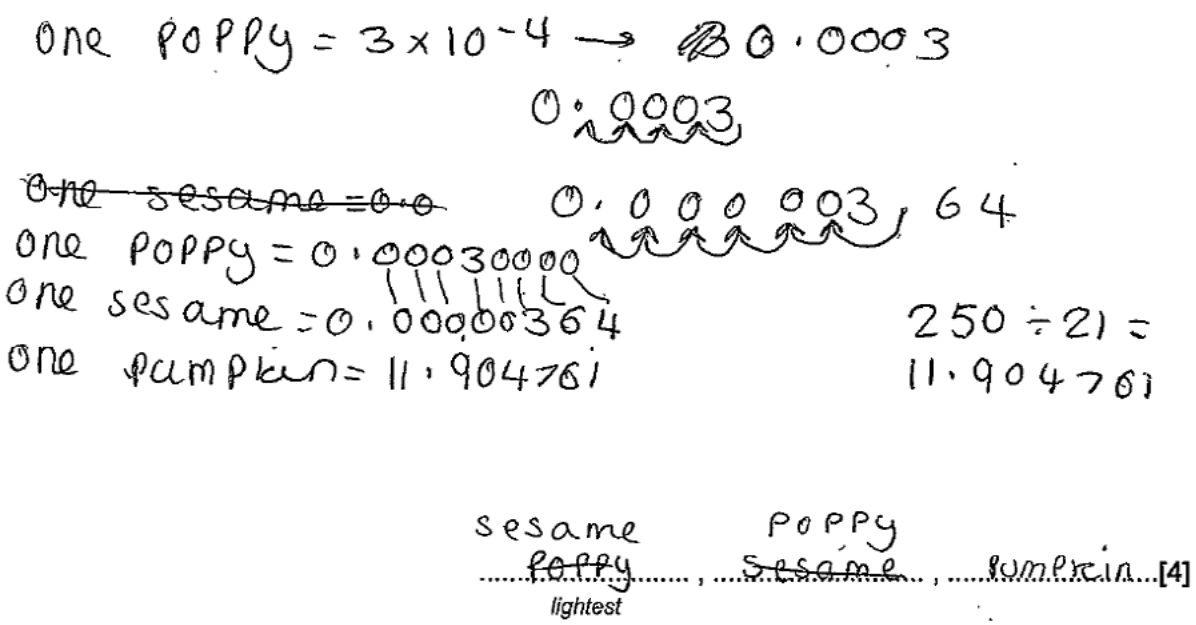
Examiner commentary

The candidate has found the correct weight in grams for a pumpkin seed. However, the weight of a sesame seed is still in kilograms and so no valid ordering is possible.

B1 is awarded for the weight of a pumpkin seed (0.084).

Exemplar 4

0 marks



Examiner commentary

The weight of the pumpkin seed is not seen in grams as the calculation is in the wrong order (250 ÷ 21 g and not 21 g ÷ 250). This was a common error.

The poppy seed and sesame seed are not seen in comparable form. Poppy is converted to grams as an ordinary number (0.003) but sesame is still in kilograms and not grams.

Question 20

20 Sophie is organising a raffle.

- Each raffle ticket costs 50p.
- She sells 400 tickets.
- The probability that a ticket, chosen at random, wins a prize is 0.1.
- Each winning ticket receives a prize worth £3.

Sophie says

I expect the raffle to make over £100 profit.

Show that Sophie is wrong.

.....

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

Exemplar 1

4 marks

0.50p × 400 = £200 made from selling tickets

20 tickets win a prize

0.1 × 400 = 40

20 × £3 = £60

200 - £60 = £140.

40 × 3 = £120

140

200 - 120 = £80

She will only make £80, which is under £100.

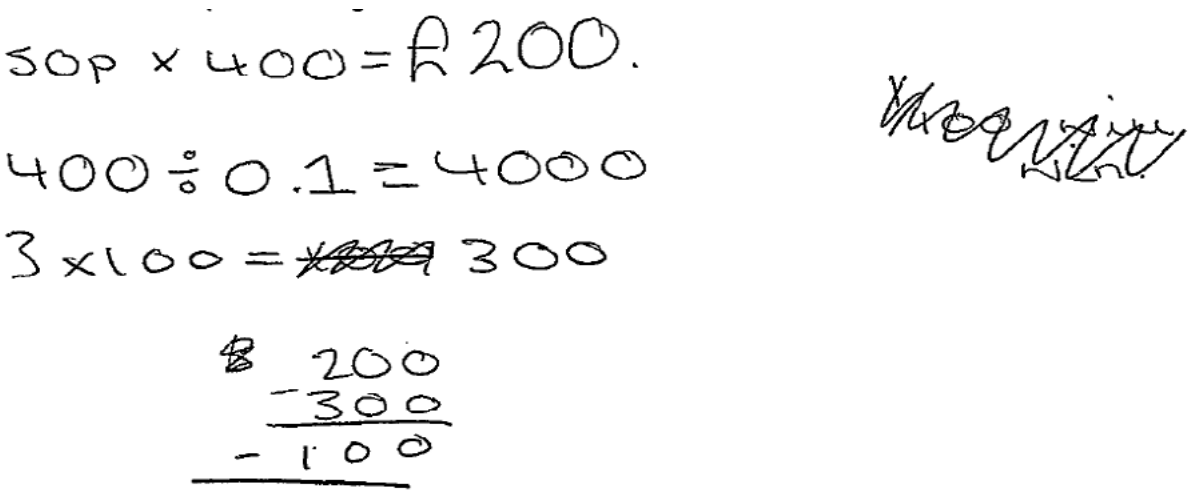
[4]

Examiner commentary

A complete and correct method, using the first method shown in the mark scheme, which scores full marks.

The incorrect method was ignored as this was not the method which led to the answer given on the answer line. Candidates should be reminded to cross out working that has been replaced and that is not used to work out their final answer.

Exemplar 2 — 1 mark



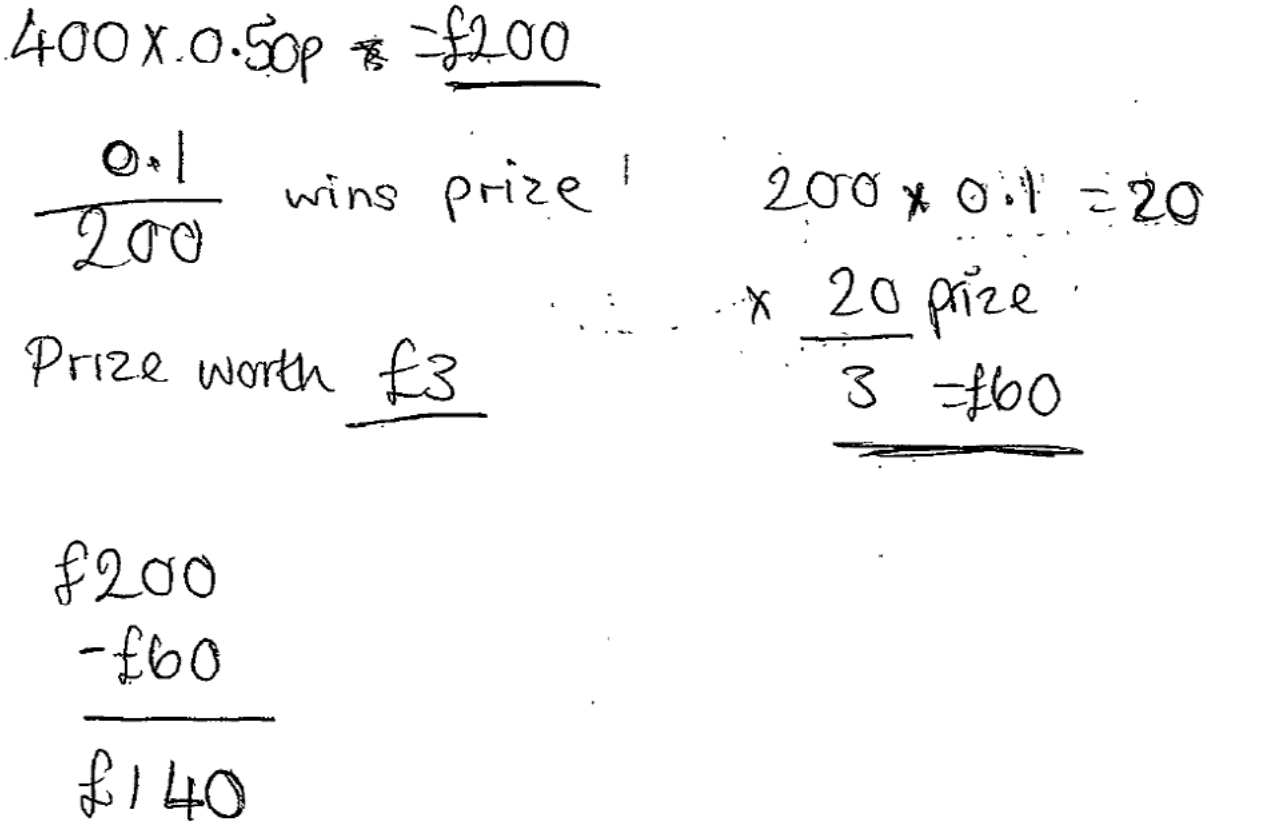
She will lose £100 because she has to buy 100 gift North £3 but she only has £200 cash. So she is losing £100 [4]

Examiner commentary

The candidate begins by correctly working out the amount taken and is awarded B1. They then attempt to work out the number of winners but incorrectly divide 400 by 0.1 rather than multiplying 400 by 0.1. No further marks are awarded.

Exemplar 3

1 mark



Examiner commentary

This exemplar illustrates another common misunderstanding with this question.

The candidate begins by correctly working out the amount of money taken and scores B1. However, they have applied the winning chance to the money taken (£200) rather than the 400 participants. No further marks are awarded.

Question 21

21 A bag contains some counters.

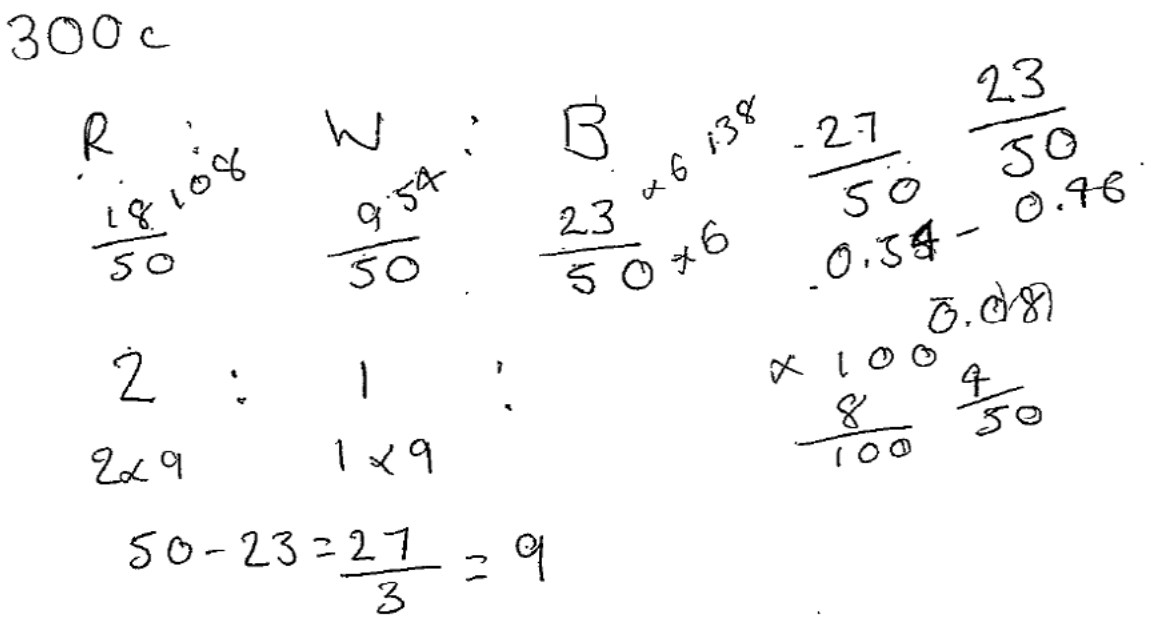
- There are 300 counters in the bag.
- There are only red, white and blue counters in the bag.
- The probability of picking a blue counter is $\frac{23}{50}$.
- The ratio of red counters to white counters is 2 : 1.

Calculate the number of red counters in the bag.

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

Exemplar 1

4 marks



108 **[4]**

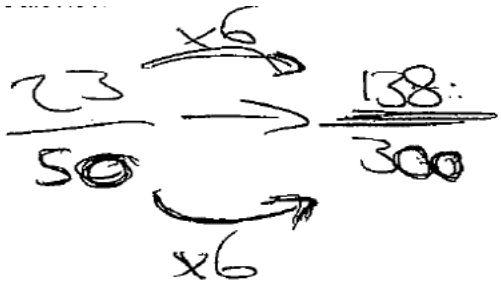
Examiner commentary

A complete and correct method, using the alternative method shown in the mark scheme, which scores full marks.

The organisation of the solution could have been better but the proportions of the colours are easily seen as fractions. The candidate hops between decimals and fractions and there is no clear route to the answer but the reasoning may be followed.

Exemplar 2

2 marks



300 − 138 = 162

162 ÷ 3 = 54

2 : 1 → 2 + 1 = 3

54 + 27

81 ..... [4]

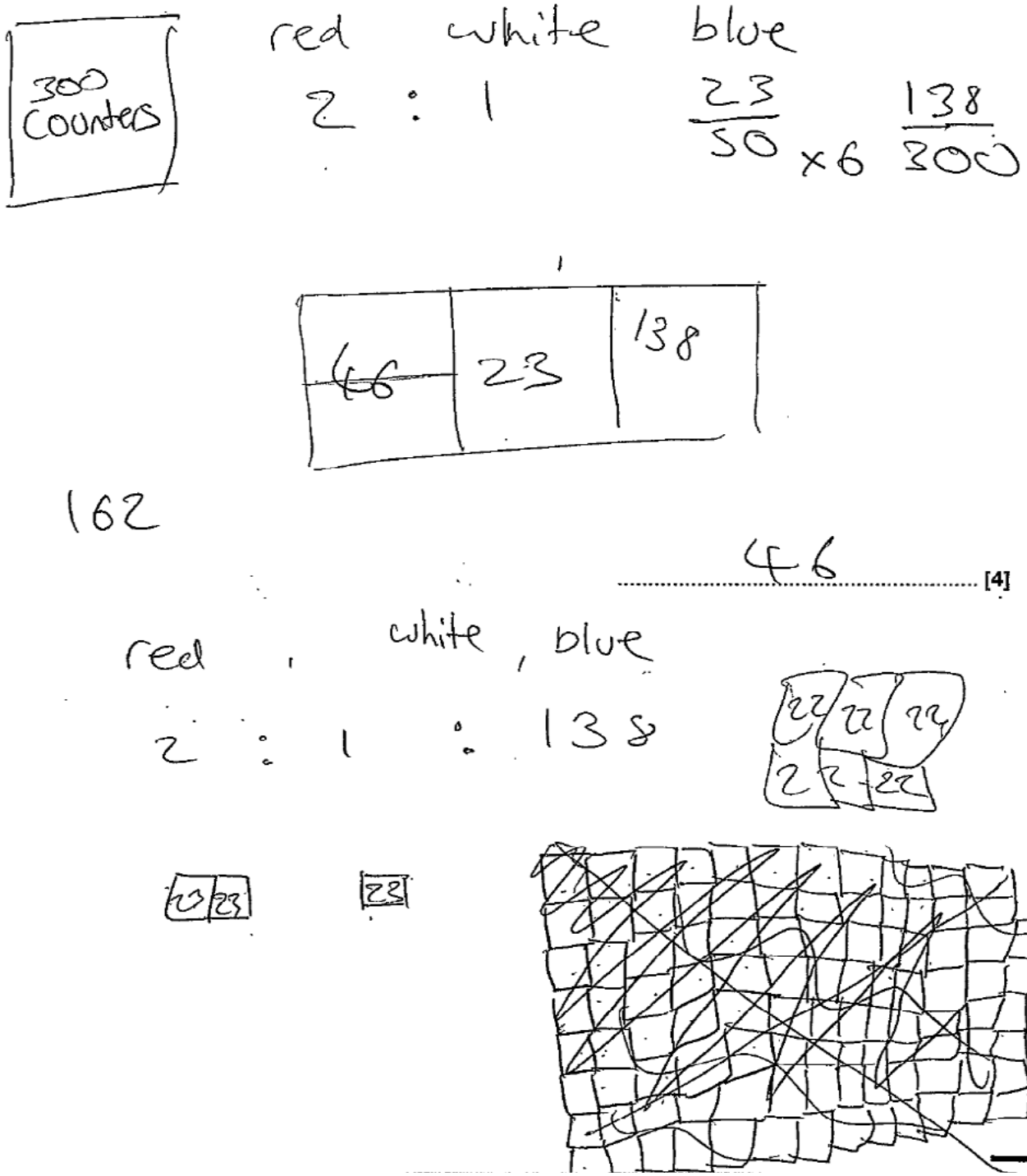
Examiner commentary

The candidate begins well and converts $\frac{23}{50}$ to $\frac{138}{300}$. Identifying this was the calculation for 'blue' is recommended to make the working clear. Following this, the candidate subtracts 138 from 300 to get 162. This evidence scores M2. Again, indicating this was the calculation for 'white and red' is recommended.

Following this, the candidate divides by 3 for the ratio 1 : 2 but at this point the method breaks down and no further marks are awarded.

Exemplar 3

2 marks

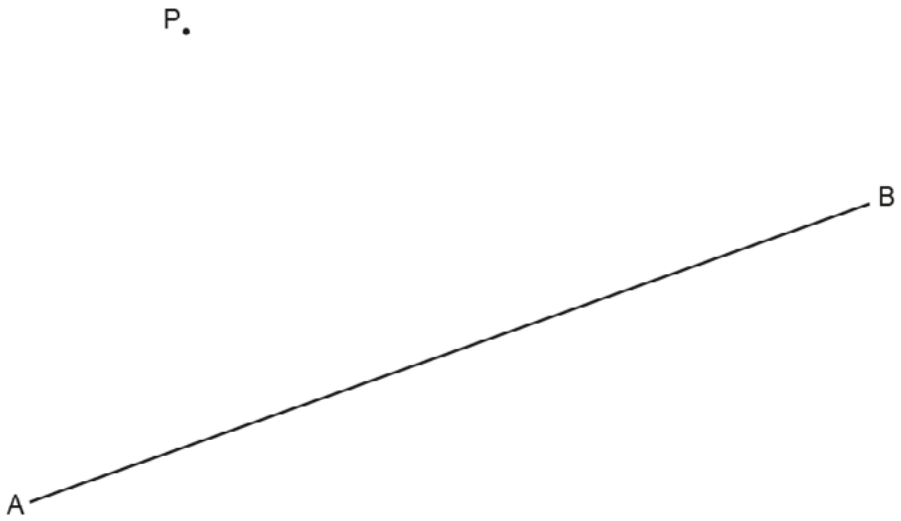


Examiner commentary

The first stage is correct and $\frac{138}{300}$ is seen. After that 162 appears to the left and this implies the method for M2. After that, the diagrammatic approach does not lead to a correct answer and the candidate demonstrates the problem that many candidates had with sorting out the ratio.3 for the ratio 1 : 2 but at this point the method breaks down and no further marks are awarded.

Question 22

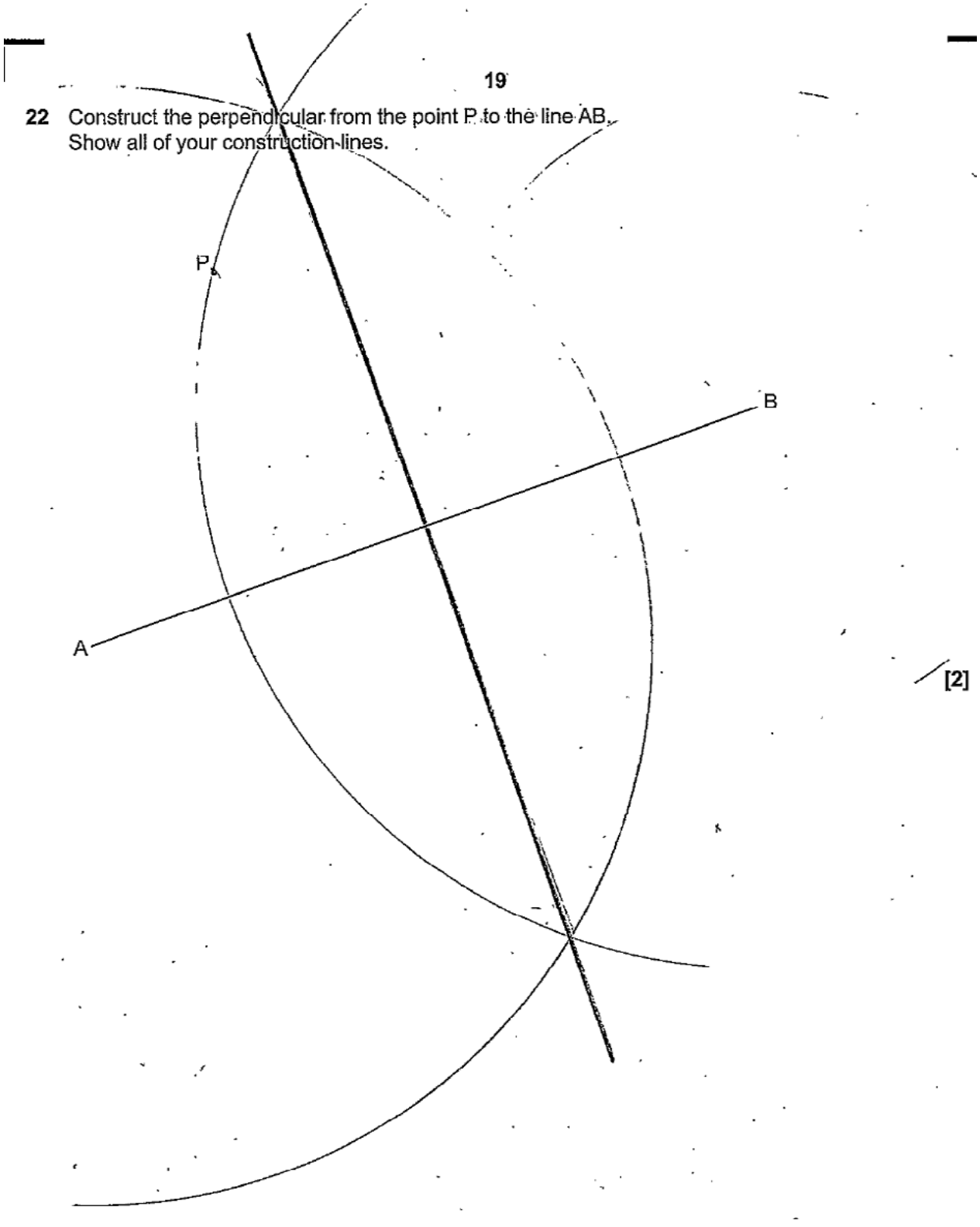
22 Construct the perpendicular from the point P to the line AB.
Show all of your construction lines.



[2]

Exemplar 1

0 marks

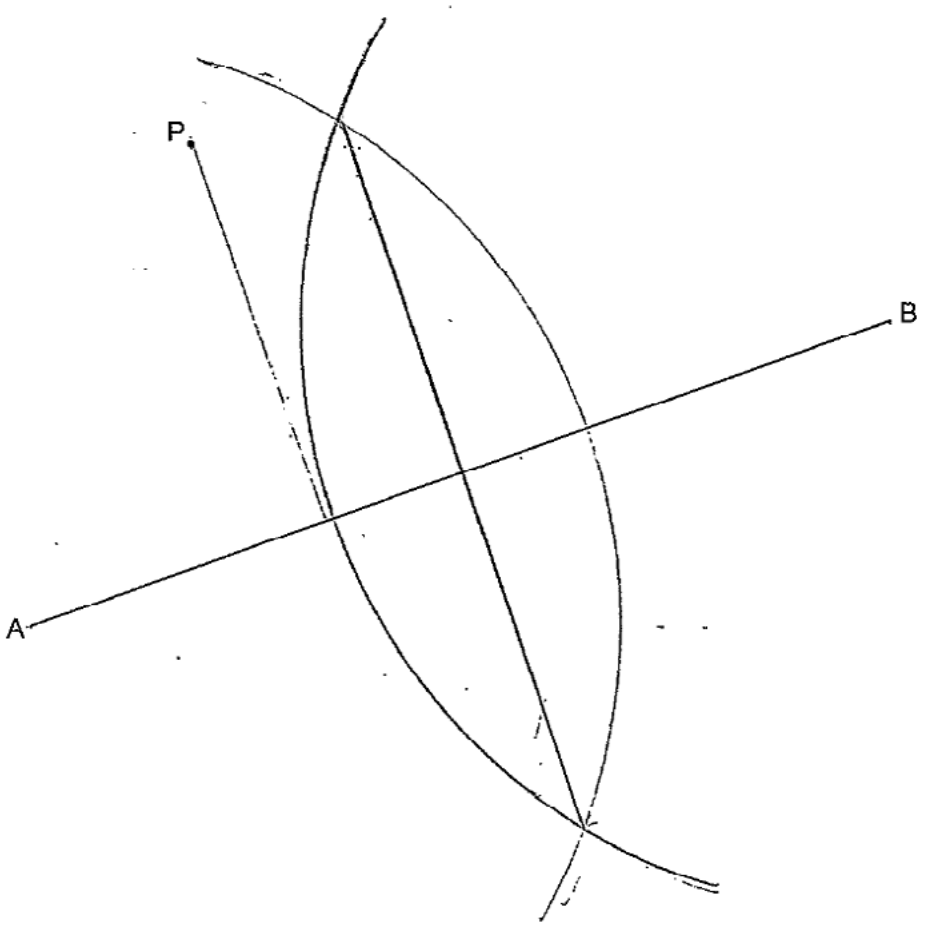


Examiner commentary

This response typifies the usual, wrong, construction used for this question. Candidates have confused 'perpendicular from a point to a line' with 'perpendicular bisector'.

Exemplar 2

0 marks



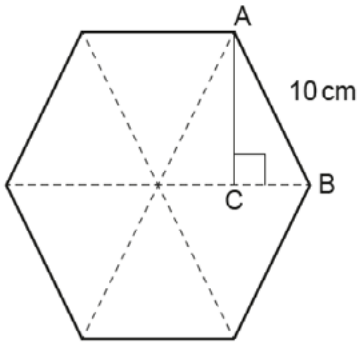
[2]

Examiner commentary

A line that could have scored a mark (B1 for a line within tolerance but no construction arcs) is seen but so too is a construction for the perpendicular bisector. This is a choice of answers and so 0 is awarded.

Question 23 (a)

23 The diagram shows a regular hexagon made from six equilateral triangles.
Each side is 10 cm.
The angle ACB is a right angle.

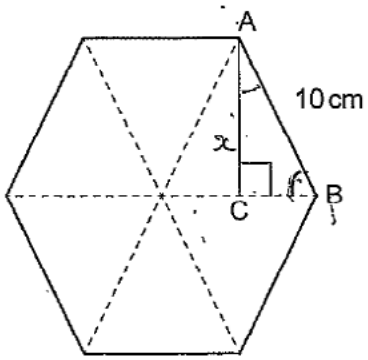


Not to scale

(a) Show that AC = 8.66 cm, correct to 3 significant figures. **[4]**

Exemplar 1

4 marks



Not to scale

SOH CAH TOA

(a) Show that AC = 8.66 cm, correct to 3 significant figures. **[4]**

~~Cos 60°~~

$AC = \cos 30° = \frac{AC}{10} = 10 \times \cos 30° = x$

$10 \times \cos 30° = 8.660$

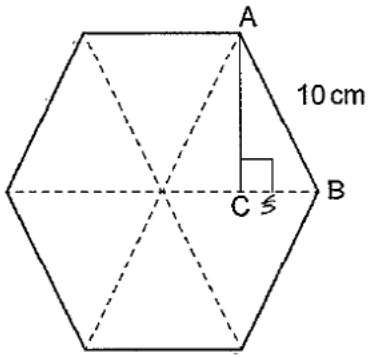
$AC = 8.66\text{cm}$

Examiner commentary

A complete and correct trigonometric method with 30 clearly used as an angle.

Exemplar 2

4 marks



Not to scale

(a) Show that AC = 8.66 cm, correct to 3 significant figures. **[4]**

$10^2 - 5^2 = AC$

$100 - 25 = AC$ ~~75~~ $\sqrt{75} = 8.660$

~~[illegible]~~

Examiner commentary

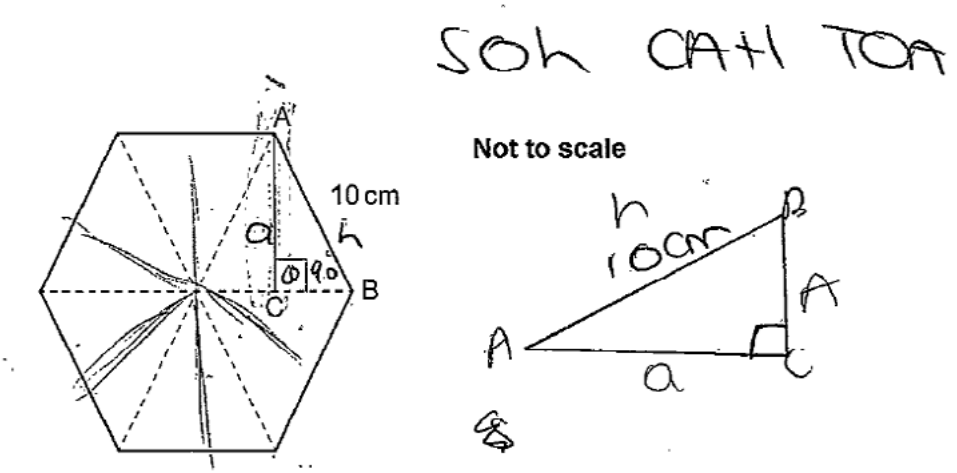
This exemplar demonstrates the alternative method of using Pythagoras theorem.

- B1 is scored for 5 seen as the length of a side (on the diagram in this case).
- The full statement of Pythagoras theorem is seen in two stages for M2.
- The final value to one more decimal place than the given value of 8.66 is seen for the final A1.

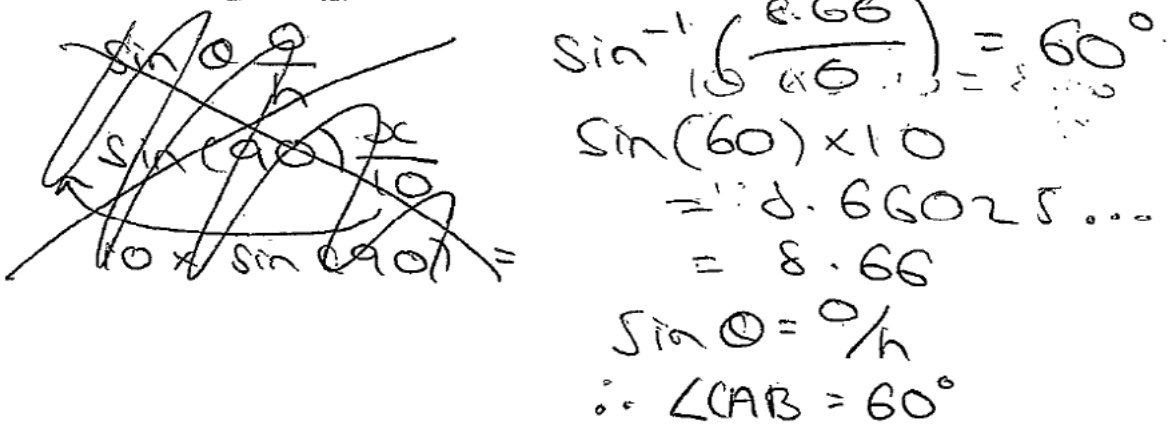
A number of candidates reached $\sqrt{75}$ but then only gave the value as 8.66 and so did not score the final mark.

Exemplar 3

0 marks



(a) Show that AC = 8.66 cm, correct to 3 significant figures. **[4]**



Examiner commentary

A number of candidates attempted to use trigonometry in answering the question.

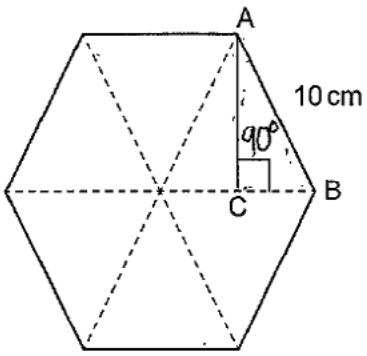
This example has been included because the candidate has used the value they have been required to show in their solution. The argument appears to be circular with the given value being used to find 60° and then using this to find the given value.

Had the line sin(60) × 10 = 8.66025... (in which 60 is clearly used as an angle) been seen alone then full marks would have been scored.

Very few candidates scored 1 mark for identifying 60 on the diagram but showing no further work of value.

Exemplar 4

0 marks



Not to scale

(a) Show that AC = 8.66 cm, correct to 3 significant figures. [4]

$\angle ACB = 90^\circ$

$90^\circ + 90^\circ = 180$

$10 - 8.66 = 1.34$ cm

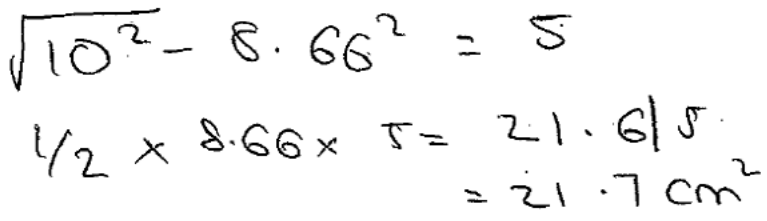
Examiner commentary

A number of responses demonstrated this technique of attempting to use angles, and 1.34 made a frequent appearance in candidate's scripts.

Question 23 (b) (i)

(b) (i) Show that the area of triangle ACB is 21.7 cm^2, correct to 3 significant figures. **[2]**

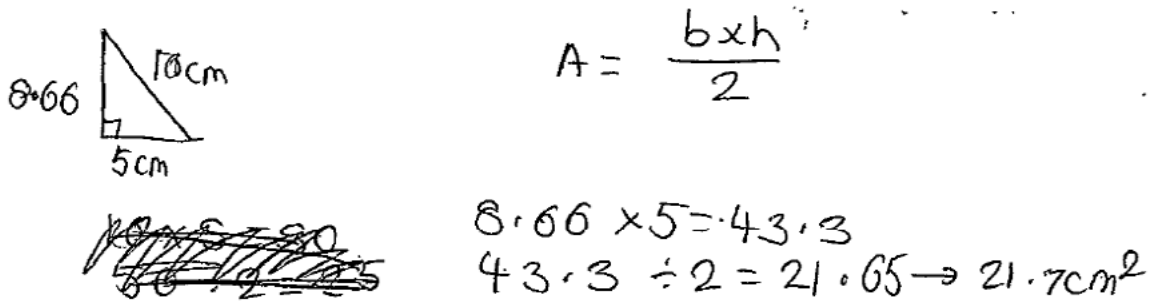
Exemplar 1 — 2 marks



Examiner commentary

The candidate uses an extended method, first calculating the base of the triangle. From there the method is as expected and the calculation is evaluated to one more place (21.65) than the question asks for so that rounding can be shown. Full marks are awarded.

Exemplar 2 — 2 marks



Examiner commentary

Although one step in the initial calculation is not written down (10 ÷ 2), the value of the base is given as 5 cm on their diagram and so the complete method is seen for M1.

The value of $\frac{b \times h}{2}$ is seen as 21.65, so to one more decimal place than the value to be shown (21.7) and so the second mark is awarded.

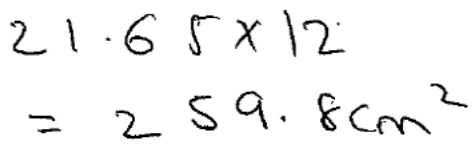
Question 23 (b) (ii)

(ii) Find the area of the hexagon, giving your answer to an appropriate degree of accuracy.

(ii) ..... cm^2 [2]

Exemplar 1

1 mark



(ii) 259.8 cm^2 [2]

Examiner commentary

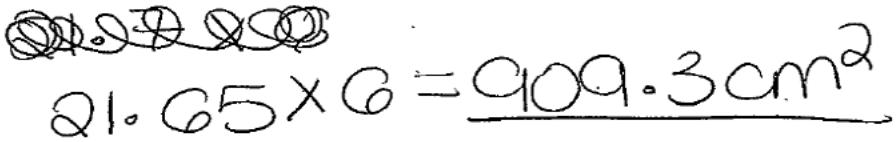
The candidate uses the value calculated in part (b)(i) correctly and the answer is within the range 259.8 to 260.4 to score B1. The final mark is not awarded as no rounding has taken place.

No follow through is allowed in this question as the area of triangle ACB is given.

The candidate is invited to round their answer to an appropriate degree of accuracy. An answer given to 3 significant figures is appropriate as all values have either been given to this accuracy or are to 1 figure in the question.

Exemplar 2

0 marks



(ii) 909.3 cm^2 [2]

Examiner commentary

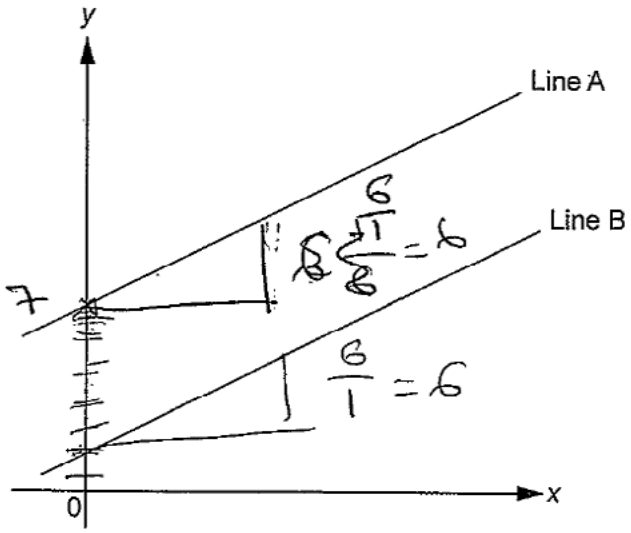
The candidate has used their value from part (b)(i) but only multiplied by 6 and not 12. No marks are awarded.

Another common error was to confuse area with perimeter.

Question 24

Exemplar 1 4 marks

24 The graph shows two parallel lines, Line A and Line B.



Not to scale

Line A has equation $y = 6x + 7$.
Line B passes through the point (4, 26).

Find the equation of Line B.

- $y = mx + c$
- $y = 6x + 7$
- $y = 6x + 1$
- gradient
- $y = 6x + c$ → y intercept
- $y = 6x + 2$

$y = 6x + 2$ **[4]**

Examiner commentary

This is a rare example of a correct answer. The candidate clearly understands that lines that are parallel have the same gradient. However, it does appear that they have used a 'Not to scale' diagram to estimate the intercept as 2 as no other clear method to obtain the intercept is shown.

Exemplar 2

1 mark

A = 6x + 7
B = 4x + 26

B = 4x + 26
(÷4) (÷4)
B = x + 6.5

6x + 6·5 ..... [4]

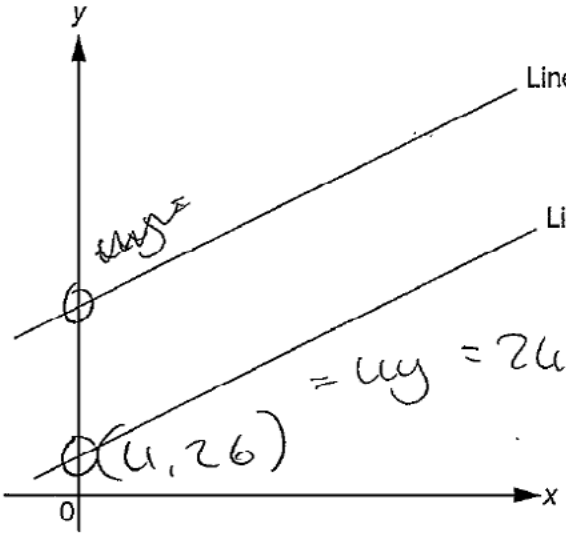
Examiner commentary

There is no clear method shown in this working. The answer appears to come from dividing 26 by 4 which places it within the acceptable range for k in the B1 evidence.

If the candidate had written $y = 6x + 6.5$ then 2 marks would have been scored.

Exemplar 3

0 marks



Line A has equation $y = 6x + 7$.
Line B passes through the point (4, 26).

Find the equation of Line B.

$y = 6x + 4$

$\times 4$

$4y = 24x + 16$

..... [4]

Examiner commentary

The candidate demonstrates a common misunderstanding that (4, 26) must somehow be used as multipliers for the coefficients of the equation of the given line or may be used to replace the coefficients e.g. ($y =$) $4x + 26$ or $26 = 4y + k$.

Another misconception was that for lines to be parallel, the constant (c) must be constant.

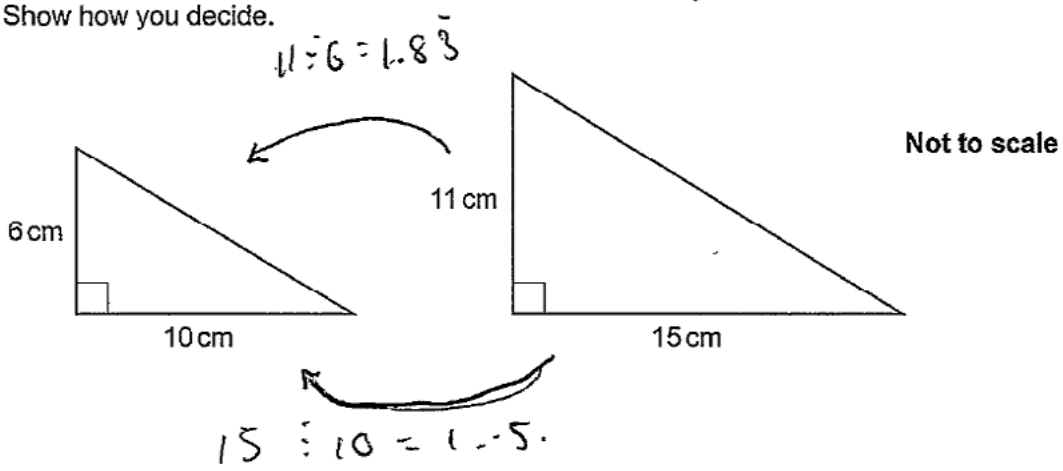
The majority of candidates did not have any techniques available to answer this question.

Question 25

Exemplar 1

2 marks

25 Are these two triangles mathematically similar?
Show how you decide.



..... because .....

.....

.....

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

Examiner commentary

The candidate clearly shows the working for, and correct values of, two multipliers (despite the direction of the arrows) so M2 is awarded. There is no conclusion so the final mark is not awarded.

Exemplar 2

0 marks

$\frac{15}{10}$ 1.5 $\frac{11}{6}$ 1.83

Yes because The Triangle has increased by 5 cm.

[3]

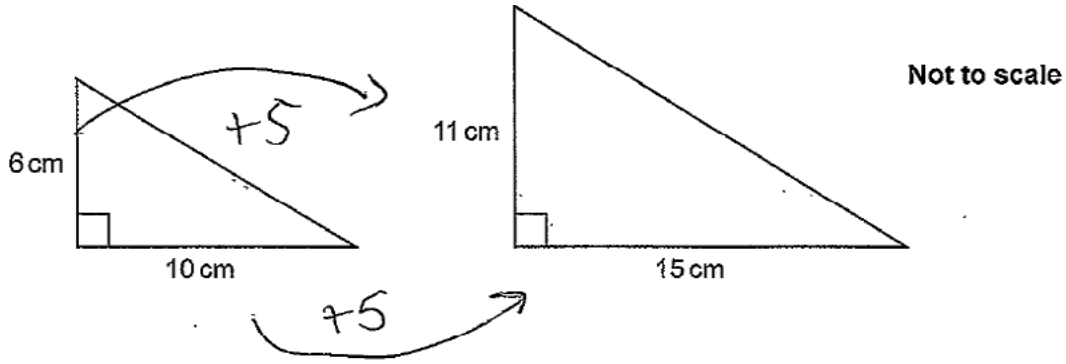
Examiner commentary

The candidate has explicitly found two multipliers for corresponding pairs of sides. Candidates needed to show the fraction or division that gave rise to the multiplier to score the marks as this is a "Show that..." question and so M2 can be awarded.

However, the candidate abandons their work and draws an incorrect conclusion. As the method that leads to the answer is marked and the answer is clearly based on the false premise that sides are increased by 5 cm, 0 is awarded.

Exemplar 3

0 marks



Yes because the second triangle is just an enlargement of 5

[3]

Examiner commentary

The candidate demonstrates a very common misconception confusing a multiplier with an addition relationship. Many took the difference between corresponding sides (+ 5) and concluded that both triangles were similar.

Another common misconception was that similarity depends on area. Such candidates would find the area of both triangles and maybe find a multiplier. This false method scored 0 marks.

Another false method was to use Pythagoras to find the hypotenuses and then draw some conclusion, often based on the triangles having right angles.

Question 26 (a)

26 (a) A number, g, is given as 4.05, correct to 2 decimal places.

Complete the error interval for g.

(a) ..... $\leqslant g <$ ..... **[2]**

Exemplar 1 — 2 marks

26 (a) A number, g, is given as 4.05, correct to 2 decimal places.

Complete the error interval for g. 4.050

(a) 4.045 $\leqslant g <$ 4.055 **[2]**

Examiner commentary

This is a rare example where the 'base value' of 4.050 has been given and this leads to two correct values on the answer line.

Question 27

Exemplar 1 3 marks

27 Solve by factorising.

$x^2 + 3x - 10 = 0$

$(x - 2)(x + 5) = 0$

$x =$ 2 or $x =$ −5 **[3]**

Examiner commentary

A correct factorisation leading to the correct roots and full marks given.

Exemplar 2 2 marks

$(x - 2)(x + 5) = 0$.

$x =$ 2 or $x =$ 5 **[3]**

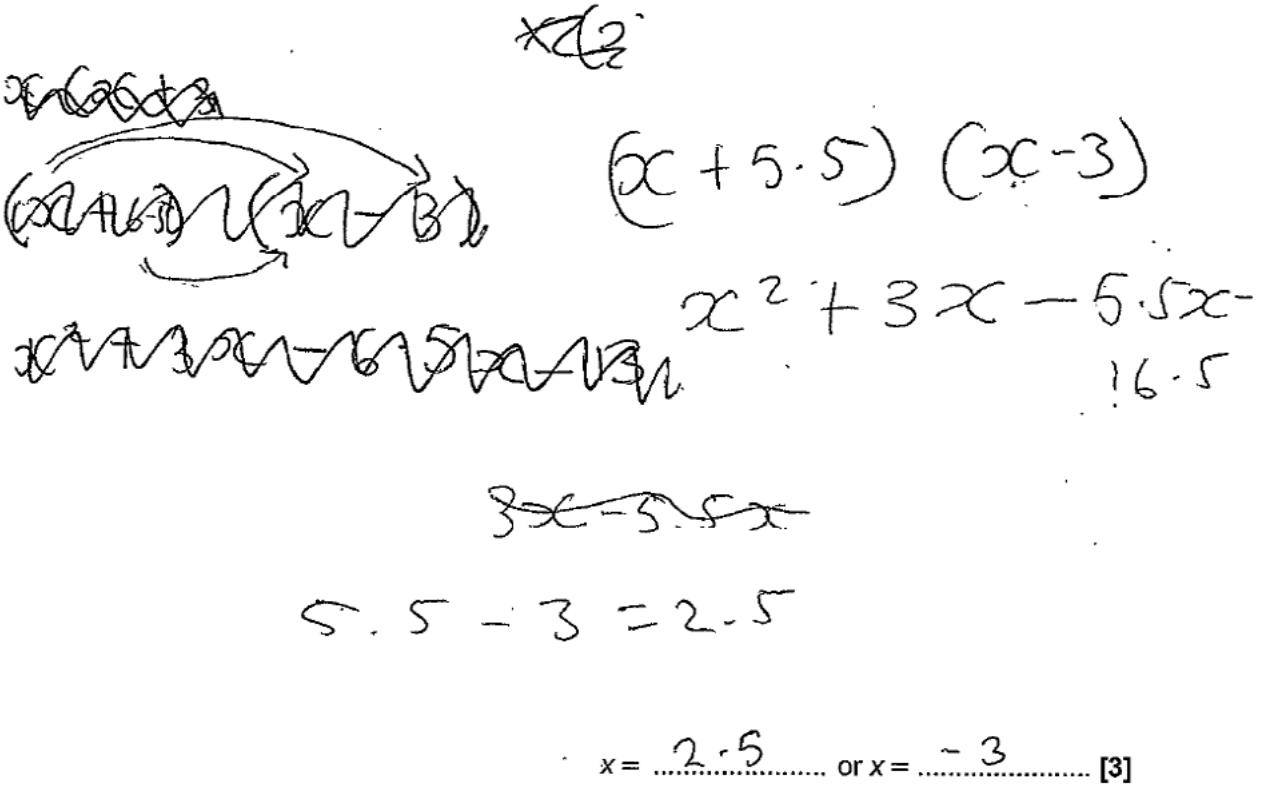
Examiner commentary

The factorisation is correct and scores M2. However, the candidate has just copied the constants from each factor and not solved $x - 2 = 0$ or $x + 5 = 0$.

Many candidates who factorised the equation did not show this intermediate step, so the error demonstrated by this candidate was reasonably common.

Exemplar 3

0 marks



Examiner commentary

The candidate did attempt to factorise. However, the values used did not multiply to give ⁻10 nor add to give 3 and so neither M1 nor M2 could be awarded. If they had given the solutions ⁻5.5 and 3, then SC1 could have been awarded.

Trial and improvement and attempts to rearrange the equation and solve as though this was a linear equation were common incorrect methods.

Question 28 (b)

(b) The length of each side of a plastic cube is $2a$ millimetres.
The cube has mass $32a^2$ grams.

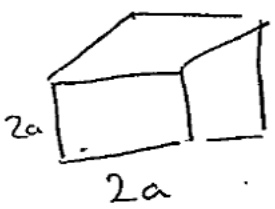
Find an expression for the density of the cube in its simplest form.
Give the units of your answer.

(b) density = ...

units ..... **[5]**

Exemplar 1

4 marks



density = $\frac{\text{mass}}{\text{vol}}$

$2a \times 2a \times 2a = 8a^3$

$\text{density} = \frac{32a^2}{8a^3} = 4a^1$

(b) density = $4a^1$

units g/mm^3 **[5]**

Examiner commentary

This candidate wrote the density formula at the start of his working.

M1 is awarded for correctly finding the volume.

M1 is awarded for correctly using the density formula.

The first A1 is awarded for 4 as the numerator

The second A1 is not earned as the candidate gave a^1 rather than a^{-1}.

The units are correct so the final mark is awarded.

Exemplar 2

1 mark

density = mass / volume

$2a(16a)$ $\quad \frac{64a^2}{2a^2} = 32a^2$

density = $\frac{32a^2}{64a^2} = 0.5$

(b) density = 0.5

units g/mm^3 [5]

Examiner commentary

The method was flawed as the attempt to find the volume ($2a \times 16a$) was incorrect and did not yield a three dimensional value. No method marks were awarded.

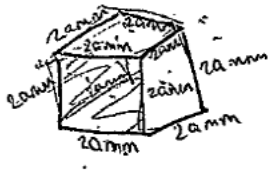
The units were correct and so 1 mark awarded.

Exemplar 3

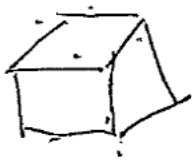
0 marks

Density = mass / volume

$\frac{32a^2}{24}$



6 × 2amm



V = x-sectional area × length

12 × 2 = 24

(b) density = 42·6

units g/cm³ [5]

Examiner commentary

The candidate confused volume with surface area. The area of a face was given as $2a$ and so $2a \times 6$ was used. There was no attempt to find $(2a)^3$. No method marks could be awarded.

The mark for the units was not awarded as the candidate did not realise that lengths were in mm and so volume would be in mm^3.

A large number of candidates were not familiar with the density formula.

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