

Pearson Edexcel

Level 1/Level 2

GCSE (9-1) in Mathematics (1MA1)



**NOVEMBER 2018 EXEMPLAR STUDENT ANSWERS WITH
EXAMINER COMMENTS – COMMON QUESTIONS
(FOUNDATION & HIGHER)**

First certification 2017

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Introduction

The exemplar student responses for the November 2018 examination series focus on the common questions. The common questions appear in both the Foundation and Higher tier papers and target grades 4 and 5. Given the resitting focus of students that take the examinations in a November series, it is in these questions where we have the most examples. We hope this information will also be useful for all students sitting either tier.

In each section we state what the common question number is in both the Foundation and Higher tier paper. The examples we have used come from student responses on the Foundation tier but we have made sure these examples and examiner commentaries also reflect what was seen on Higher tier papers.

About this booklet

This booklet has been produced to support mathematics teachers delivering the new GCSE (9 – 1) Mathematics specification.

The booklet looks at the common questions across Foundation and Higher tiers from the November 2018 GCSE (9 – 1) Mathematics examinations. It shows real student responses to selected questions and how the examining team follow the mark schemes to demonstrate how the students would be awarded marks on these questions.

How to use this booklet

Our examining team have selected student responses to foundation tier questions from the November 2018 examination. Following each question you will find the mark scheme and a range of student responses. Examiner comments show how the mark scheme has been applied and highlight common errors.

Student response A

There are 12 counters in a bag.

3 of the counters are red.
1 of the counters is blue.
2 of the counters are yellow.
The rest of the counters are green.

Caitlin takes at random a counter from the bag.

(c) Show that the probability that this counter is yellow or green is $\frac{2}{3}$

$$\text{red} = 3 + 1 = \text{blue} = 4 \quad \frac{4}{12} \approx \frac{1}{3}$$

$$\frac{3}{3} - \frac{1}{3} = \frac{2}{3} \text{ (Probability it's yellow or green)}$$

the rest are yellow or green so $\frac{2}{3}$
must be the probability of yellow or green.

(3)

(Total for Question 7 is 5 marks)

3/3

Examiner Comments

This shows the most efficient approach where the calculation for the number of green counters is not required. The $\frac{4}{12}$ gets M1, $\frac{3}{3} - \frac{1}{3}$ gets the 2nd M1 and showing that this is $\frac{2}{3}$ gets the final communication mark.

Student response

Examiner commentary on the student response

Marks awarded for the question or question parts

Paper 1F and Paper 1H (non-calculator)

Exemplar Question 1

Paper 1F Question 20 (and Paper 1H Question 1)

20 Work out the value of $\frac{3^7 \times 3^{-2}}{3^3}$

.....
(Total for Question 20 is 2 marks)

Examiner Comments

This question assesses whether students can use and calculate with integer indices. It is expected that students will use the laws of indices to simplify the numerical expression before evaluating its value. Alternatively, students might evaluate the powers of 3, that is 2187, $\frac{1}{9}$ and 27 separately and then work out the value of the expression. This path is less likely to be successful on a non-calculator paper such as this. Students often find working with negative powers more challenging than working with positive powers. There is more scope for making arithmetic errors if students work out values of powers of 3 such as 3^7

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
20	9	M1	for a correct first step, using the laws of indices to simplify eg 3^2 or 3^{7+2} or 3^{7-3} or 3^{-2-3} or for using exact values, eg. $2187 \times \frac{1}{9}$ (= 243) or $2187 \div 27$ (= 81) or $\frac{1}{27 \times 9}$ (= $\frac{1}{243}$)	
		A1	cao	

Examiner Comments

Students are credited the first mark for using an index law to make a start on simplifying the expression, for example by simplifying $3^7 \times 3^{-2}$ to 3^5 . Alternatively they may evaluate two of the powers of 3 to score this mark.

The second mark can only be awarded for the value “9”. The question specifically asks students to “work out the value of” and not just to “simplify” the expression.

Student Response A

20 Work out the value of $\frac{3^7 \times 3^{-2}}{3^3} = 9$

$$3^7 \times 3^{-2} = 3^5$$

$$\frac{3^5}{3^3} = 3^2 = 3 \times 3 = 9$$

9

(Total for Question 20 is 2 marks)

2/2

Examiner Comments

A perfect solution. A correct first simplification is shown clearly. This is then used with the denominator of the expression to fully simplify the whole expression to 3^2 . The student then works out the value and records this on the answer line.

Student Response B

20 Work out the value of $\frac{3^7 \times 3^{-2}}{3^3}$

$3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 2187$
 $3^3 = 27$
 $3^{-2} = -9$

$$\begin{array}{r} 2187 \times -9 \\ \hline 27 \end{array}$$

$$\begin{array}{r} -18000 \\ -900 \\ -720 \\ -63 \\ \hline \end{array} +$$

(Total for Question 20 is 2 marks)

1/2

Examiner Comments

This student has correctly worked out the values of 3^7 and 3^3 and substituted them into the expression to score the first method mark. They have evaluated 3^{-2} incorrectly and so will not get a correct value for the whole expression and cannot be awarded the second mark.

Note that evaluating 3^{-2} as -9 was a commonly seen error.

Student Response C

20 Work out the value of $\frac{3^7 \times 3^{-2}}{3^3}$ $3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 =$

$$3 \times 3 = 9^5$$

$$7 - 2 = 5$$

$$3 \times 3 \times 3 = 27$$

$$\frac{9^5}{27}$$

$$\frac{9^5}{27}$$

(Total for Question 20 is 2 marks)

0/2

Examiner Comments

The student correctly decides to use the indices to help them but incorrectly simplifies $3^7 \times 3^{-2}$ to 9^5 and so cannot be given the mark for a correct first step and 0 marks are scored. Note that some students then continued their solution stating that $\frac{9^5}{3^3} = 3^2$. Examiners were careful not to award marks for “3²” from this incorrect method.

Exemplar Question 2

Paper 1F Question 21 (and Paper 1H Question 2)

21 $v^2 = u^2 + 2as$

$u = 12 \quad a = -3 \quad s = 18$

(a) Work out a value of v .

.....
(2)

(b) Make s the subject of $v^2 = u^2 + 2as$

.....
(2)

(Total for Question 21 is 4 marks)

Examiner Comments

This question assesses the ability of students to substitute numerical values into a formula together with the ability to rearrange a formula to change the subject.

In part (a) students are expected to substitute numbers into the given formula then to use this to work out the value of v . Students should show the substitution clearly, preferably in a single expression, that is $v^2 = 12^2 + 2 \times -3 \times 18$. Many students did not complete the evaluation without splitting the numerical expression into parts and this is a common stage when errors are made with signs being ignored or evaluated incorrectly. In this part of the question the value of 252 for v^2 was often seen. This arose from students working out $144 + 108$ instead of $144 - 108$. A significant number of students forget they need to take the square root to find the value of v and instead give the answer “36”.

Students often find rearranging formulae very challenging. A common error was writing down successive steps with both sides of the formula appearing at each stage. Part (b) of this question required two steps to be applied. Many students identified incorrect operations such as adding “ u^2 ” to both sides of the equation instead of subtracting “ u^2 ” or subtracting “ $2a$ ” instead of dividing by “ $2a$ ”.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
21(a)	6 or -6	M1	for $12^2 + 2 \times -3 \times 18 (= 36)$	Terms may be partially evaluated.
		A1	for 6 or $12^2 = 144$ and $2 \times -3 \times 18 = -108$ followed by $144 + -108$, accept ± 6	Only one value is required for full marks
(b)	$s = \frac{v^2 - u^2}{2a}$	M1	for subtracting u^2 from both sides or dividing all terms by $2a$ as the first step	Must see this step carried out, not just the intention shown
		A1	$s = \frac{v^2 - u^2}{2a}$ oe	

Examiner Comments

The substitution in part (a) may be seen in stages. For example, $12^2 = 144$ and $2 \times -3 \times 18 = -108$ followed by $144 + -108$ will score the first mark as would, for example, $12^2 = 121$ and $2 \times -3 \times 18 = -118$ followed by $121 + -118$. The latter presentation shows a correct substitution even though the evaluation of the parts is inaccurate. Note that $12^2 = 144$ and $2 \times 3 \times 18 = 108$ followed by $144 + 108$ would not score the first mark because the sign of a has not been taken into account. The question requires only one of the values 6 or -6 for the award of the second mark.

In part (b) the first mark may only be awarded after a correct first step has been applied and both sides of the formula are seen so, for example, " $v^2 - u^2$ " alone does not get credit but " $v^2 - u^2 = 2as$ " does get credit.

Note that alternative equivalent correct formulae will get full marks, for example, " $s = (v^2 - u^2) \div 2 \div a$ ".

Student Response A

21 $v^2 = u^2 + 2as$

$u = 12 \quad a = -3 \quad s = 18$

(a) Work out a value of v .

$$v^2 = u^2 + 2as$$

$$v^2 = 12^2 + (2 \times -3 \times 18)$$

$$v^2 = 12^2 + (2 \times -54)$$

$$v^2 = 12^2 + -108$$

$$v^2 = 144 + -108$$

$$v^2 = 36$$

$$v = 6$$

$18 \times -3 = -54$

$$\begin{array}{r|l} -3 & \\ \hline 10 & -30 \\ \hline 8 & -24 \\ \hline & 120 + 24 \\ & 12^2 = 144 \end{array}$$

$$\begin{array}{r} 144 \\ -108 \\ \hline 36 \end{array}$$

$v = 6$
(2)

2/2

(b) Make s the subject of $v^2 = u^2 + 2as$

$$\begin{array}{l|l} v^2 & = u^2 + 2as \\ -u^2 & -u^2 \\ \hline v^2 - u^2 & = 2as \\ \div 2a & \div 2a \\ \hline \frac{v^2 - u^2}{2a} & = s \end{array}$$

$s = \frac{v^2 - u^2}{2a}$
(2)

(Total for Question 21 is 4 marks)

2/2

Examiner Comments

A perfect and well-presented response. In part (a) the student shows a clear substitution together with accurate evaluation to work out the value of v^2 before writing down a correct value for v on the answer line.

In part (b) the student clearly shows their intention to subtract u^2 from each side of the formula and carries it out successfully to score the first mark for a correct first step. A second and final step is also shown clearly and so full marks are given.

Student Response B

21 $v^2 = u^2 + 2as$

$u = 12 \quad a = -3 \quad s = 18$

(a) Work out a value of v .

$$12^2 + 2 \times -3 \times 18 =$$

$$144 + -108 =$$

$$\begin{array}{r} 31 \\ 144 \\ -108 \\ \hline 36 \end{array}$$

$$\begin{array}{r} 36 \\ \hline (2) \end{array}$$

1/2

(b) Make s the subject of $v^2 = u^2 + 2as$

$$\begin{array}{l} v^2 = u^2 + 2as \\ -u^2 \quad -u^2 \\ \hline v^2 - u^2 = 2as \div 2a \\ v^2 - u^2 \div 2a = s \end{array}$$

$$\begin{array}{r} v^2 - u^2 \div 2a = s \\ \hline (2) \end{array}$$

(Total for Question 21 is 4 marks)

1/2

Examiner Comments

In part (a) the student shows a correct and clear substitution together with evaluation to find the value of v^2 . However, they do not take the square root to find a value for v and so can only score 1 of the 2 marks available in this part of the question.

In part (b) a correct first step is shown and carried out. The student then indicates a further correct step, that of dividing by $2a$. The student carries out this step but does not place brackets in their expression round " $v^2 - u^2$ " or write it correctly in fractional form and so cannot be awarded the final mark.

Student Response C

21 $v^2 = u^2 + 2as$

$u = 12 \quad a = -3 \quad s = 18$

(a) Work out a value of v .

$$\begin{array}{l}
 12^2 + 2 \times -3 + 2 \times 18 \\
 12^2 = 144 \\
 2 \times -3 = -6 \\
 2 \times 18 = 36 \\
 144 + 30 = 174 \\
 36 + -6 = 30 \\
 \hline
 174 \\
 (2)
 \end{array}$$

0/2

(b) Make s the subject of $v^2 = u^2 + 2as$

$$\begin{array}{l}
 v^2 = u^2 + 2as \\
 v^2 + 2a = u^2 + \cancel{2a} \quad (\div 2a) \\
 v^2 + 2a \div u^2 = \cancel{2a} \quad (\div u^2) \\
 v^2 + 2a \div u^2 = s \\
 \hline
 v^2 + 2a \div u^2 = s \\
 (2)
 \end{array}$$

(Total for Question 21 is 4 marks)

0/2

Examiner Comments

The student has recognised they need to substitute values into the formula given in part (a). However, they have interpreted the formula incorrectly and have multiplied the a and the s by 2 and added them instead of multiplying the product as by 2. Neither the mark for a correct substitution nor the accuracy mark can be earned.

In part (b) a possible correct first step is indicated, that of dividing both sides by $2a$. This is not carried out and so examiners cannot award any marks.

Exemplar Question 3

Paper 1F Question 22 (and Paper 1H Question 3)

- 22** A bonus of £2100 is shared by 10 people who work for a company.
40% of the bonus is shared equally between 3 managers.
The rest of the bonus is shared equally between 7 salesmen.

One of the salesmen says,

“If the bonus is shared equally between all 10 people I will get 25% more money.”

Is the salesman correct?

You must show how you get your answer.

(Total for Question 22 is 5 marks)

Examiner Comments

This question assesses the ability of a student to translate a problem in a real context into a series of mathematical processes. The student is required to decide what to do in order to comment on the statement the salesman makes. They then have to work out any relevant values and interpret their findings in the context of the problem.

Students are expected to find and compare the bonus a salesman will get (or the total of all the bonuses the salesmen get) under the two different schemes and relate their findings to the statement given.

Students usually showed correct processes to find the bonus each salesman would get if 60% of the £2100 was shared equally between the 7 salesmen. However, many students were not clear what to do after this. Some students mistakenly worked out 25% of £210 as their next step.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
22	No (supported)	P1	for start to process, eg $2100 \times \frac{40}{100}$ (= 840) or $100 - 40$ (= 60)	May compare bonus shares of a single salesman or total bonus share for all 7 salesmen.
		P1	for process to find the 7 salesmen's share of bonus, eg $2100 - "840"$ (= 1260) or $2100 \times \frac{"60"}{100}$ (= 1260)	
		P1	for process to find bonus amount each salesman gets eg $"1260" \div 7$ (= 180) or process to find the total bonus for all salesmen if shared equally, eg $\frac{2100}{10} \times 7$ (= 1470)	
		P1	for process to compare what a single salesman gets under each scheme, eg $"180" \times \frac{25}{100}$ (= 45) and $\frac{2100}{10} - "180"$ (= 30) or $"180" \times \frac{25}{100}$ (= 45) and $"180" + "45"$ (= 225) oe and $\frac{2100}{10}$ (= 210) or $(\frac{2100}{10} - "180") \div "180"$ $\times 100$ (= 16.6...) or process to compare what all salesmen get under each scheme, eg $"1260" \times \frac{25}{100}$ (= 315) and $"1470" - "1260"$ (= 210) or $"1260" \times \frac{25}{100}$ (= 315) and $"1260" + "315"$ (= 1575) oe and $"1470"$	

Question	Answer	Mark	Mark scheme	Additional guidance
		A1	<p>or (“1470” – “1260”) ÷ “1260” × 100 (= 16.6...)</p> <p>‘No’ supported by correct figures, eg 45 and 30, 225 and 210, 315 and 210 or 1575 and 1470 or 16.6...)(% and 25%)</p>	Do not award unless correct figures have been shown to support a statement made that the salesman was not correct.

Examiner Comments

It is important that correct processes are rewarded in this question. Processes which are written correctly but which contain arithmetic errors were commonly seen. Examiners were careful not to undervalue such work.

The use of quotes in the mark scheme show that the award of a mark will depend on a previous correct process which would result in that value being correct if the student had not made any arithmetic errors.

The final mark requires a correct decision to be recorded together with correct values to support that decision.

Student Response A

- 22 A bonus of £2100 is shared by 10 people who work for a company.
40% of the bonus is shared equally between 3 managers.
The rest of the bonus is shared equally between 7 salesmen.

One of the salesmen says,

"If the bonus is shared equally between all 10 people I will get 25% more money."

Is the salesman correct?

You must show how you get your answer.

$$2100 \div 10 = 210 \times 4 = 840 \text{ between 3 managers}$$

$$2100 - 840 = 1260 = 7 \text{ salesmen}$$

$$\begin{array}{r} \cancel{2100} \\ 7 \overline{)1260} \\ \underline{018} \\ 7 \overline{)126} \times 10 = 1260 \end{array}$$

Each salesmen gets £180 each

$$2100 \div 10 = £210 \text{ each if shared equally}$$

$$210 - 180 = £30 \text{ ponds difference}$$

$$180 \div 10 = 18 \times 2 = 36 + 9(\%) = 45 = 25\%$$

The salesman is not correct because if he ^{was} ~~wants~~ to get 25% more money he would have to get £45 where in fact he only gets £30.

(Total for Question 22 is 5 marks)

5/5

Examiner Comments

This response demonstrates the most common student approach to this question.

It also shows clearly how the student got their answer.

P1 for process to calculate 40% of 2100, ie for $2100 \div 10 \times 4$

P1 for process to calculate the 7 salesmen share of the bonus, ie for $2100 - 840$

P1 for process to find the bonus for each salesman, ie $1260 \div 7$

P1 for process to find figures which can be compared to answer the question, ie for $210 - 180$

and for finding 25% of 180. Note that this mark was awarded for $210 - 180$ and £45. There was a weakness in the way the student showed the process to find 25% of 180 but the “45” was enough to support the fact that a correct process has been used. Had the student made an arithmetic error,

examiners would have looked for $\frac{25}{100} \times 180$ or equivalent to award the mark.

A1 for a correct decision, that the salesman is not correct, supported by the two correct values 30 and 45.

Student Response B

- 22 A bonus of £2100 is shared by 10 people who work for a company.
 40% of the bonus is shared equally between 3 managers.
 The rest of the bonus is shared equally between 7 salesmen.

One of the salesmen says,

"If the bonus is shared equally between all 10 people I will get 25% more money."

Is the salesman correct?

You must show how you get your answer.

$$40 \times 2100 = 84000 \div 100 = \pounds 840$$

$$\begin{array}{r} 2000 \quad 100 \\ 40 \overline{) 84000} \quad 4000 \\ \underline{84000} \end{array}$$

$$840 \div 3 = \pounds 280 \text{ each manager}$$

$$3 \overline{) 840} \begin{array}{r} 280 \end{array}$$

$$\begin{array}{r} 1000 \\ 2100 \\ - 840 \\ \hline 1260 \end{array}$$

$$1260 \div 7 = \pounds 180 \text{ each salesman}$$

$$7 \overline{) 1260} \begin{array}{r} 180 \end{array}$$

$$25 \times 180 = 4500 \div 100 = 45$$

$$\begin{array}{r} 20 \overline{) 4500} \begin{array}{r} 200 \\ 500 \end{array} \\ \underline{4000} \\ 500 \end{array}$$

$$180 + 45 = \pounds 225 = 25\% \text{ more salesman}$$

$$\text{All equal: } 2100 \div 10 = \pounds 210 \text{ each}$$

$$\begin{array}{r} 2000 \\ 1600 \\ 500 \\ 400 \\ \hline 3500 \end{array}$$

∴ the salesman is wrong because 25% more would be £225 and if its ~~equally~~ equally split it is ~~£210~~ £210 each, there is a £15 difference.

(Total for Question 22 is 5 marks)

Examiner Comments

Correct processes are shown to find the bonus each salesman gets (£180) when they share 60% of the total bonus of £2100 so the first three process marks are awarded. The student then shows a process to find the amount a salesman would get if they received 25% more money. The process is correct but there is an arithmetic error in working out 25×180 . As the process is correct and the student works out how much the bonus will be if all 10 people share it equally they are then given the fourth process mark. The student gives a correct conclusion but because one of the figures used in the comparison is not correct the final mark, an accuracy mark, cannot be given.

Student Response C

- 22 A bonus of £2100 is shared by 10 people who work for a company.
 40% of the bonus is shared equally between 3 managers.
 The rest of the bonus is shared equally between 7 salesmen.

One of the salesmen says,

"If the bonus is shared equally between all 10 people I will get 25% more money."

Is the salesman correct?

You must show how you get your answer.

7
14
21
28
35
42
48
56
63
70

$$£2100 \div 10\% = £210$$

$$x \begin{array}{r} 20010/0 \\ 4 \overline{) 80040} \end{array}$$

$$£210 \times 4 = £840$$

$$£840 \div 3 = £280$$

$$x \begin{array}{r} 280 \\ 3 \overline{) 840} \end{array}$$

$$£2100 - £280$$

$$\begin{array}{r} 2100 \\ 280 \\ \hline 1820 \end{array}$$

$$1820 \div 7 = £196$$

$$\begin{array}{r} £196 \\ 7 \overline{) 1820} \end{array}$$

$$25\% = \underline{\underline{£196}}$$

(Total for Question 22 is 5 marks)

1/5

Examiner Comments

This response shows a correct process to find 40% of 2100 and the student is credited with 1 mark for this. However, the student does not subtract 840 from 2100 but instead subtracts 280 ($840 \div 3$) from 2100. The response cannot therefore be awarded any further marks.

Exemplar Question 4

Paper 1F Question 23 (and Paper 1H Question 4)

23 It would take 120 minutes to fill a swimming pool using water from 5 taps.

(a) How many minutes will it take to fill the pool if only 3 of the taps are used?

..... minutes

(2)

(b) State one assumption you made in working out your answer to part (a).

.....

.....

(1)

(Total for Question 23 is 3 marks)

Examiner Comments

This question assesses the ability of a student to carry out a routine procedure albeit in the content area of inverse proportion which the majority of students find challenging.

Students should show the calculation they carry out in order to get their answer.

Though students' comments in part (b) suggested that they appreciated that the less taps that are used the longer it will take to fill the pool, they often appeared not to have taken this into account when answering part (a) of the question. Instead, students often gave an incorrect approach based on direct proportion, working out that it would take 24 minutes for 1 tap to fill the pool so 72 minutes for 3 taps to fill the pool.

For part (b) many students did not understand what was required and instead either described the calculation they did or made a statement such as "the less taps there are the more time it takes to fill the pool". While the latter statement is true, it is not an assumption made in order to work out a correct answer to the problem.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
23(a)	200	M1 A1	for $120 \times 5 \div 3$ oe cao	
(b)	statement	C1	<p>Statement that each tap fills at the same rate or that the rate does not change over time</p> <p>Examples</p> <p>Acceptable responses:</p> <p>Taps are running at the same speed</p> <p>They (clearly referring to taps) all fill the pool with the same volume of water</p> <p>The amount of water is the same in the same time (again referring to taps)</p> <p>Each tap is doing a fifth of the filling</p> <p>That all taps take equal time to fill the pool</p> <p>All taps produce the same amount of water</p> <p>That the water flow stays at the same rate over the whole time.</p> <p>Unacceptable responses</p> <p>It will take more time because there are less taps</p> <p>The less taps used the longer it takes to fill the pool</p> <p>That 1 tap can take up to 24 mins each</p> <p>3 taps will take longer to fill the pool</p>	Any statement referring to the same amount of water flowing from each tap is acceptable.

Examiner Comments

The mark scheme for part (a) is straightforward: one mark for a correct method and one mark for a correct answer.

For the mark to be awarded in part (b), students needed to refer to the rate of flow being the same from each tap or equivalent. Examiners needed to make a professional judgement as to whether the statement made by the student was worthy of credit. Statements provided in the mark scheme provide some examples of acceptable responses together with some examples of responses that are not acceptable.

Student Response A

23 It would take 120 minutes to fill a swimming pool using water from 5 taps.

(a) How many minutes will it take to fill the pool if only 3 of the taps are used?

$$5 \times 120 = 600 \div 3 = 200$$

~~3/1000~~

200 minutes
(2)

(b) State one assumption you made in working out your answer to part (a).

taps work at the same rate

(1)

(Total for Question 23 is 3 marks)

3/3

Examiner Comments

This fully correct response with method clearly shown in part (a) together with a concise and correct statement in part (b) scores full marks.

Student Response B

23 It would take 120 minutes to fill a swimming pool using water from 5 taps.

(a) How many minutes will it take to fill the pool if only 3 of the taps are used?

$$120 \text{ mins} = 5 \text{ taps}$$

$$\begin{array}{rcl} 5 \text{ taps} & : & = 120 \\ 1 \text{ " } & & = 120 \times 5 \\ 3 \text{ " } & & = \frac{120 \times 5}{3} = 200 \text{ min} \end{array}$$

200 minutes (2)

(b) State one assumption you made in working out your answer to part (a).

if 5 taps fill 120 mins then 3 taps takes more minutes.

(1)

(Total for Question 23 is 3 marks)

2/3

Examiner Comments

This student clearly shows a good understanding of the situation and produces a model solution to part (a). However, they do not give a statement related to the flow of water from the taps being equal in part (b) and so cannot be awarded the mark available.

Note that many students made a statement similar to the one presented here.

Student Response C

23 It would take 120 minutes to fill a swimming pool using water from 5 taps.

(a) How many minutes will it take to fill the pool if only 3 of the taps are used?

$$120 \div 5 \quad 5 \overline{) 120} \begin{array}{r} 024 \\ \underline{10} \\ 20 \\ \underline{15} \\ 50 \\ \underline{45} \\ 50 \\ \underline{45} \\ 50 \\ \underline{45} \\ 50 \\ \underline{45} \\ 50 \\ \underline{45} \\ 50 \end{array}$$

24 mins for 1 tap

$$24 \times 3 = 72$$

$$\begin{array}{r} 24 \\ \times 3 \\ \hline 72 \end{array}$$

72 minutes
(2)

(b) State one assumption you made in working out your answer to part (a).

~~24 mins That all taps are the same width~~

That all taps produce the same amount of water

(1)

(Total for Question 23 is 3 marks)

1/3

Examiner Comments

This student realises that they need to divide by either 3 or 5 and multiply by the other but unfortunately, they make the common error of dividing by 5. This is a method using direct proportion, not inverse proportion and examiners were disappointed that few students realised that a time of 72 minutes with 3 taps would seem at odds with the time of 120 minutes with 5 taps stated in the question. No marks scored in this part of the question.

The assumption in part (b) is worthy of the award of a mark since it reflects the idea that each tap contributes equally to filling the pool. Note that this mark is independent of the marks awarded in part (a).

Exemplar Question 5

Paper 1F Question 24 (and Paper 1H Question 5)

24 A plane travels at a speed of 213 miles per hour.

(a) Work out an estimate for the number of seconds the plane takes to travel 1 mile.

..... seconds
(3)

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

.....
.....
(1)

(Total for Question 24 is 4 marks)

Examiner Comments

This question assesses the ability of students to use compound units, in this case speed, together with the need to change between units of time and make estimates where necessary to solve a problem without the use of a calculator.

It is expected that students will round the 213 to say 200 so making the calculation needed more manageable.

In part (b) students need to state whether their answer to part (a) is an underestimate or overestimate and give a reason related to their working in part (a) to support their answer.

A common misconception in answering part (b) of the question was that rounding the speed down would reduce the time taken for the plane to travel 1 mile.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
24(a)	16 to 20	P1	for using time = $\frac{\text{distance}}{\text{speed}}$, eg $\frac{1}{200}$ or $\frac{1}{213}$ or for 1 hour = $60 \times 60 (= 3600)$ seconds	Calculation could be done in stages.
		P1	complete process, eg $\frac{1}{200} \times 60 \times 60$ oe or $\frac{1}{213} \times 60 \times 60$	
		A1	for answer in range 16 to 20	
(b)	decision with reason	C1	(dep on correct use of time = $\frac{\text{distance}}{\text{speed}}$) for reason related to their response to part(a), eg overestimate as speed rounded down	

Examiner Comments

A correct process to change 1 hour to seconds or to use time = $\frac{\text{distance}}{\text{speed}}$ is sufficient for the award of the first mark. These may be seen as part of a calculation. For the award of the second process mark a complete process to find the time in seconds must be seen. However this does not have to include rounded values. Full marks for this part are awarded for an answer in the given range.

Note that correct use of time = $\frac{\text{distance}}{\text{speed}}$ in part (a) is needed before examiners can consider whether the answer to part (b) is worthy of the mark available.

Student Response A

24 A plane travels at a speed of 213 miles per hour.

(a) Work out an estimate for the number of seconds the plane takes to travel 1 mile.

$$1 \text{ hr} = 3600 \text{ secs}$$

$$\frac{3600}{213}$$

$$\frac{36}{2} = 18$$

$$\frac{3600}{200}$$

$$\frac{36\cancel{00}}{2\cancel{00}}$$

$$\underline{\hspace{2cm} 18 \hspace{2cm}} \text{ seconds}$$

(3)

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

OVERESTIMATE AS I HAVE
REDUCED THE MILES

(1)

(Total for Question 24 is 4 marks)

3/3

1/1

Examiner Comments

The student scores full marks in part (a).

The first process mark is given for $1 \text{ hr} = 3600 \text{ seconds}$.

The second process mark is given for $\frac{3600}{213}$ (or $\frac{3600}{200}$). The student rounds 213 to 200 to aid their calculation and has an answer 18, in the range 16–20 which leads to the award of full marks for this part of the question.

Having used $\text{time} = \frac{\text{distance}}{\text{speed}}$ in part (a), the student's answer to part (b) is assessed. A good explanation is given and scores the mark available.

Student Response B

24 A plane travels at a speed of 213 miles per hour. \rightarrow 60 mins in 1 hr.
3600 51h
(a) Work out an estimate for the number of seconds the plane takes to travel 1 mile.

Handwritten work for part (a):

$\frac{3600}{213} \rightarrow 220$
round down.

Triangle diagram:
T

SD

66060

210 $\overline{) 3630}$ 7047

7047 seconds
(3)

2/3

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

Underestimate as planes can fly very quickly per second and I don't know what distance is heading.

(1)

(Total for Question 24 is 4 marks)

0/1

Examiner Comments

This response shows a complete process ($3600 \div 213$) in part (a) so the first 2 marks are awarded. The 213 is rounded but nevertheless the calculation is not carried through accurately and the answer given is not in the range given in the mark scheme. The third mark cannot be awarded. The answer to part (b) does not take into account the rounding in part (a) and therefore does not gain this mark.

Student Response C

24 A plane travels at a speed of 213 miles per hour.

(a) Work out an estimate for the number of seconds the plane takes to travel 1 mile.

$$\frac{S}{DT} \quad \frac{P}{ST}$$

$$\frac{\text{Distance}}{\text{Speed}} = \text{Time}$$

$$\frac{1}{213} = \frac{1}{200}$$

60mph
1 minute
per mile
200 mph
= 15 seconds

15 seconds
(3)

1/3

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

Under estimate just to round 213 mph down to 200 mph.

(1)

(Total for Question 24 is 4 marks)

0/1

Examiner Comments

This student starts well. They use the formula $\text{time} = \frac{\text{distance}}{\text{speed}}$ in part (a) correctly to score the first process mark for $\frac{1}{200}$.

Though the student begins the process of trying to take into account the need to work in seconds, they do not show the process in enough detail and do not obtain a time in the range accepted so cannot be awarded the second or third mark.

The answer “underestimate” because 213 has been rounded down is contradictory and cannot be awarded a mark.

Exemplar Question 6

Paper 1F Question 25 (and Paper 1H Question 6)

25 Solve the simultaneous equations

$$\begin{aligned}5x + y &= 21 \\ x - 3y &= 9\end{aligned}$$

$x =$

$y =$

(Total for Question 25 is 3 marks)

Examiner Comments

This question assesses whether students can solve two simultaneous equations in two variables by using a routine procedure. It is expected that students will probably multiply one of the equations by a constant in order to make the coefficients of x or the coefficients of y equal. They should then use the appropriate operation to eliminate one variable and find the value of the other variable. Students are then expected to show a substitution in order to find the value of the second variable. In cases where students get as far as making the coefficients of one variable equal, they sometimes have difficulty deciding which is the appropriate operation and in ensuring that accuracy is maintained throughout the solution.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
25	$x = 4.5,$ $y = -1.5$	M1	correct process to eliminate one variable (condone one arithmetic error)	Fractions do not need to be in simplest form
		M1	(dep) for substituting found value in one of the equations or correct process after starting again (condone one arithmetic error)	
		A1	for $x = 4.5, y = -1.5$ oe	

Examiner Comments

The first mark is for students getting as far as eliminating one variable. Examiners allowed one arithmetic error in this stage of the solution. Most students use the method of making coefficients equal before adding or subtracting the equations as appropriate. However some students may use alternative methods such as rearranging one equation to make one variable the subject then substituting into the second equation. The second mark can only be awarded if the first mark has been given and is for a correct process to find the second variable. The third (accuracy) mark is given for correct values of x and y . These values may be given in fraction or decimal form. Where they are given as fractions, they need not be in simplest form.

Student Response A

25 Solve the simultaneous equations

$$\begin{aligned} 5x + y &= 21 \\ x - 3y &= 9 \end{aligned}$$

$$x = (21 - y) / 5$$

$$x = 9 + 3y$$

$$45 + 15y = 21 - y$$

$$15y + 1y = 21 - 45$$

$$16y = -24$$

$$y = \frac{-24}{16} = \frac{-3}{2}$$

$$x = 9 + 3 \cdot \left(\frac{-3}{2} \right)$$

$$x = 9 - \frac{9}{2}$$

$$2x = 18 - 9$$

$$x = 9/2$$

$$\begin{array}{r} 45 \\ - 21 \\ \hline 24 \end{array}$$

$$x = \underline{9/2}$$

$$y = \underline{-3/2}$$

(Total for Question 25 is 3 marks)

3/3

Examiner Comments

Correct values for both x and y score 3 marks. This student has used a less commonly seen method but has carried it out without error.

Student Response B

25 Solve the simultaneous equations

$$(5 \times 4.5)$$

$$\begin{array}{r} 22.5 + y = 21 \\ -22.5 \quad -22.5 \end{array}$$

$$\frac{y}{y} + \frac{-1.5}{y}$$

$$\boxed{y = 1.5}$$

$$\begin{array}{r} 5x + y = 21 \quad \times 3 \\ x - 3y = 9 \quad \times 1 \\ \hline 15x + 3y = 63 \\ 1x - 3y = 9 \\ \hline 16x = 72 \\ \frac{16x}{16} = \frac{72}{16} \\ \boxed{x = 4.5} \end{array}$$

$$\begin{array}{r} 21x + 46x + 72 - 316x \\ \hline 63x + 64 - 08 - 316x \\ \hline 80 \end{array}$$

$$\begin{array}{r} 4.5 \\ 72.0 \\ \hline 24.5x \\ \hline 22.5 \\ \hline 2.0 \\ \hline 21.0 \\ \hline 0.5 \end{array}$$

$$\begin{array}{r} 1.5x \\ 3 \\ \hline 4.5 \\ \hline 4.5 - \\ \hline 0.5 \end{array}$$

$$x = 4.5$$

$$y = 1.5$$

(Total for Question 25 is 3 marks)

2/3

Examiner Comments

This student has used the more commonly seen method of multiplying the first equation by 3 before adding it to the second equation in order to find the value of x first. The student has worked accurately and has a correct value for x . After scoring this first mark, they then substituted this value into an appropriate equation to work out the value of y and so score the second mark. A sign error prevents the award of the final mark.

Student Response C

25 Solve the simultaneous equations

9, 18, 27, 36, 45

2 1/2 / 6/3

14, 28, 42, 54

$$\begin{array}{r} 5x + y = 21 \\ - (3x - 3y = 9) \\ \hline 2x + 4y = 12 \end{array}$$

$$\begin{array}{r} 3(5x + y) = 63 \\ - (3x - 3y) = 9 \\ \hline 14x + 0 = 54 \\ 14x = 54 \div 14 \\ \div 14 \\ \underline{x = 4} \end{array}$$

sub in ①

$$\begin{array}{r} 4 + y = 21 \\ -4 \quad -4 \\ \hline y = 17 \end{array}$$

$$\begin{array}{r} 4 + 3y = 63 \\ -4 \quad -4 \\ \hline 3y = 59 \div 3 \\ \div 3 \end{array}$$

$$\begin{array}{r} 19.2 \\ 3 \overline{)59} \end{array}$$

$$\begin{array}{l} x = 4 \\ y = 17 \end{array}$$

(Total for Question 25 is 3 marks)

0/3

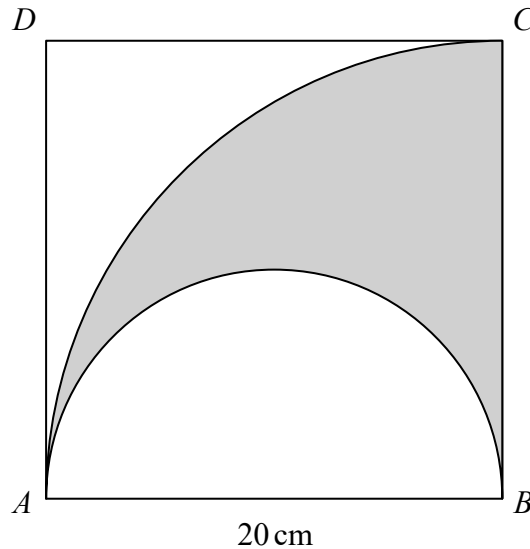
Examiner Comments

This student starts well and multiplies the first equation by 3. However they then chose to subtract instead of adding the equations so cannot score any marks. This use of an inappropriate operation is a process error and not an arithmetic error.

Exemplar Question 7

Paper 1F Question 26 (and Paper 1H Question 7)

- 26 The diagram shows a square $ABCD$ with sides of length 20 cm. It also shows a semicircle and an arc of a circle.



AB is the diameter of the semicircle.
 AC is an arc of a circle with centre B .

Show that
$$\frac{\text{area of shaded region}}{\text{area of square}} = \frac{\pi}{8}$$

(Total for Question 26 is 4 marks)

Examiner Comments

This question assesses the use of circle formulae to find areas in terms of π before forming a fraction to achieve the result stated in the question. Students are expected to find the area of the semicircle, radius 10 cm, and the area of the quarter circle, radius 20 cm, in order to find the area of the shaded region. They should then use this together with the area of the square of side 20 cm to form and simplify the fraction $\frac{\text{area of shaded region}}{\text{area of square}}$ as stated in the question. It is important that students write down all their working and clearly show the areas they are working with. Students taking this foundation paper may find it a challenge to work in terms of π as it requires some proficiency in algebraic manipulation.

Mark Scheme

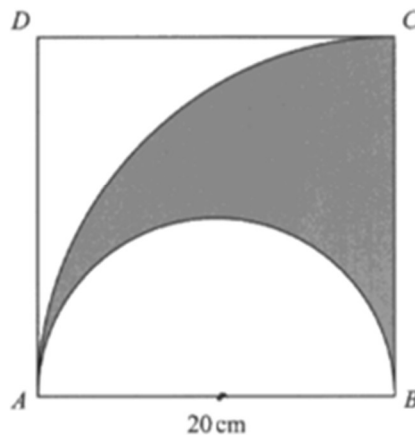
Question	Answer	Mark	Mark scheme	Additional guidance
26	shown	C1	for method to find area of semicircle, eg $\pi \times 10^2 \div 2 (= 50\pi)$	Can award first 3 marks if a value for π is used Working out to find the area of the shaded region must be shown
		C1	for method to find area of quarter circle, for $\pi \times 20^2 \div 4 (= 100\pi)$	
		C1	for a complete method to find area shaded and area of square, eg $\pi \times 20^2 \div 4 - \pi \times 10^2 \div 2$ and 20×20	
		C1	fully correct working leading to $\frac{\pi}{8}$	

Examiner Comments

The first 2 marks are given for correct expressions for the area of the semicircle and the area of the quarter circle. These need not be simplified at this stage. The third mark is for a correct expression for the area of the shaded region and the area of the square. Again, this might not be in simplified form. Students who have replaced π with a numerical value can earn these first 3 marks. The fourth mark is for forming the fraction required and showing that it simplifies to $\frac{\pi}{8}$. For the award of this mark, students must have exact and correct expressions in terms of π for the numerator and denominator of the fraction. Forming the fraction and showing that it simplifies to the given result is sufficient for the award of this final mark.

Student Response A

- 26 The diagram shows a square $ABCD$ with sides of length 20 cm. It also shows a semicircle and an arc of a circle.



AB is the diameter of the semicircle.
 AC is an arc of a circle with centre B .

Show that $\frac{\text{area of shaded region}}{\text{area of square}} = \frac{\pi}{8}$

$$\begin{aligned}
 \text{area of shaded region} &= \frac{2\pi \times 20^2}{4} - \frac{2\pi \times 10^2}{2} = \\
 &= 2\pi \times 5 - 2\pi \times 5 = 0 \\
 \text{area of shaded region} &= \frac{\pi 20^2}{4} - \frac{\pi 10^2}{2} = \\
 &= \frac{\pi \times 400}{4} - \frac{\pi \times 100}{2} = \pi \times 100 - \pi \times 50 = \cancel{50\pi} \\
 &= 50\pi \\
 \text{area of square} &= 20^2 = 400 \quad \left(\frac{50\pi}{8 \times 400} = \frac{\pi}{8} \right) \text{ True}
 \end{aligned}$$

(Total for Question 26 is 4 marks)

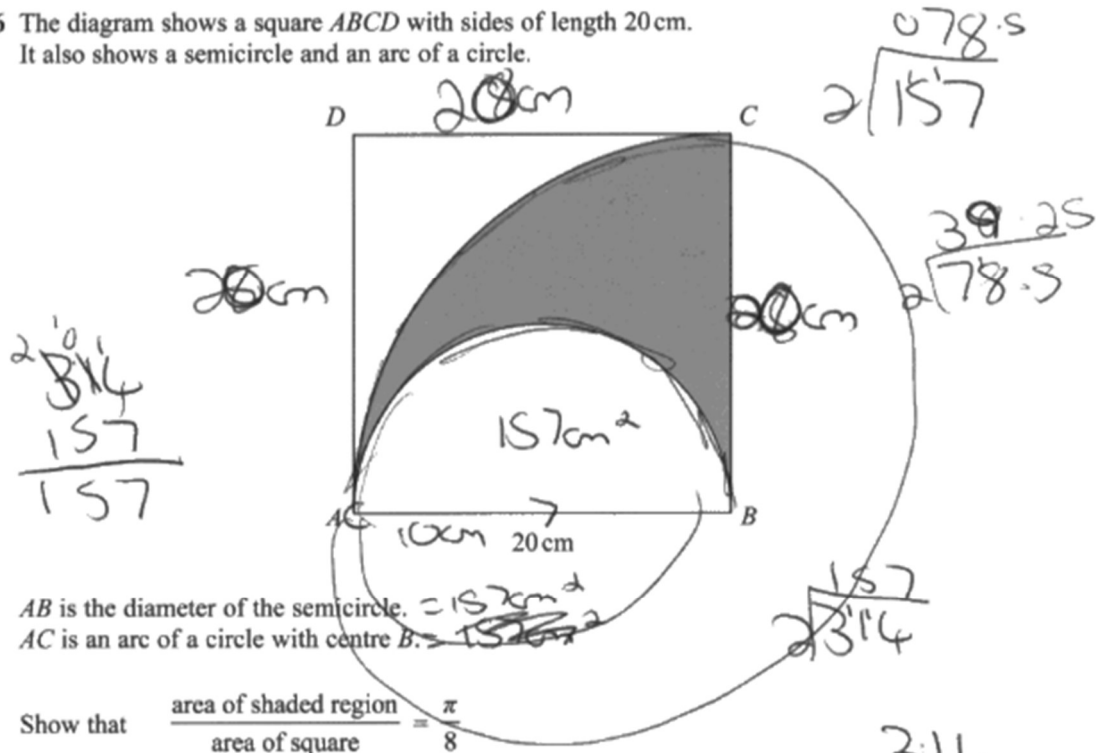
4/4

Examiner Comments

This student has given a correct unsimplified expression for the shaded area which clearly shows the difference between the area of the quarter circle and the area of the semicircle. As the area of the square is also given correctly, the first three marks can be awarded. The expression is then simplified to 50π , the area of the square is found, a fraction is then formed and it is simplified to the stated result. This is a convincing solution which gets full marks.

Student Response B

26 The diagram shows a square $ABCD$ with sides of length 20 cm. It also shows a semicircle and an arc of a circle.



AB is the diameter of the semicircle. $= 157 \text{ cm}^2$
 AC is an arc of a circle with centre B . $= 157 \text{ cm}^2$

Show that $\frac{\text{area of shaded region}}{\text{area of square}} = \frac{\pi}{8}$

~~$8 \times 8 = 64$~~ Radius = 10
 $20 \times 20 = 400 \text{ cm}^2$ $\pi \times 10^2 = 314$
 $20^2 \times \pi = 314 \div 2 = 157$
 $400 \times \pi = 1256 \text{ cm}^2$
 $1256 \div 4 = 314$
 $314 \div 157 = 157 \text{ cm}^2$
 Shaded circle = 157 cm^2
 $\frac{78.5 \text{ cm}^2}{200 \text{ cm}^2} = \frac{39.25}{100 \text{ cm}^2}$

(Total for Question 26 is 4 marks)

3/4

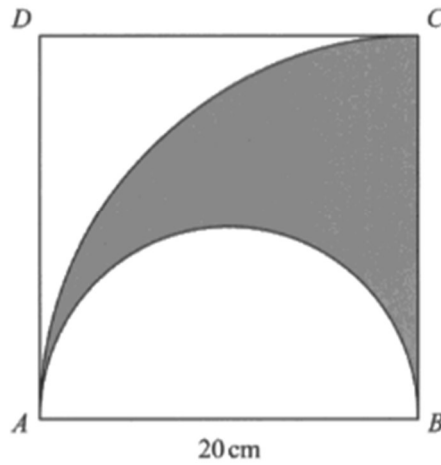
Examiner Comments

This student's working is a little disorganised. However, correct methods can be seen to work out the required areas and form the fraction. Three marks are awarded.

The student has used 3.14 for π so the final C1 mark cannot be awarded.

Student Response C

- 26 The diagram shows a square $ABCD$ with sides of length 20 cm. It also shows a semicircle and an arc of a circle.



AB is the diameter of the semicircle.
 AC is an arc of a circle with centre B .

Show that $\frac{\text{area of shaded region}}{\text{area of square}} = \frac{\pi}{8}$

$$\text{Area of } ABCD = 20 \times 20 = 400 \text{ cm}^2$$

$$\text{Area of semicircle} = \frac{\pi 10^2}{2} = 50\pi$$

$$\frac{50\pi}{400} = \frac{\pi}{8}$$

(Total for Question 26 is 4 marks)

1/4

Examiner Comments

This student has shown a correct expression for the area of the semicircle and scores 1 mark for this. Though they have also found the area of the square and formed a fraction which is then simplified to $\frac{\pi}{8}$, there is no working to show that the quarter circle and shaded region have been used. In this question the area of the semicircle and the area of the shaded region are both equal to 50π so examiners need to be careful to ensure students show a complete and correct process before they award due credit. This student cannot be awarded any further marks.

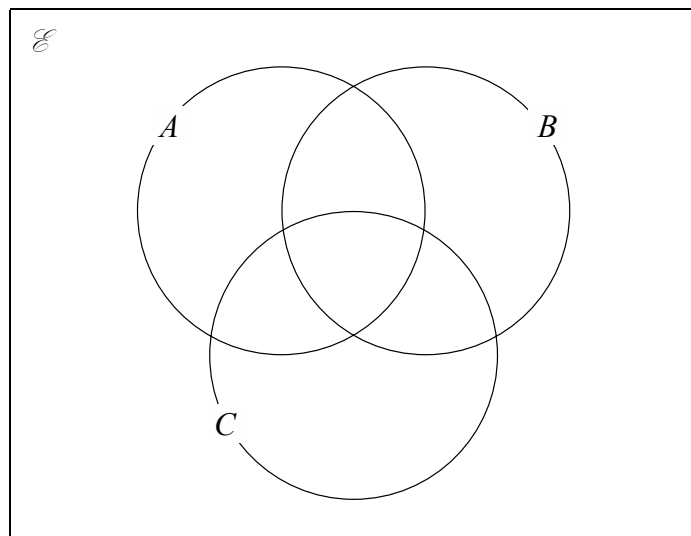
Paper 2F and Paper 2H (Calculator)

Exemplar Question 1

Paper 2F Question 20 (and Paper 2H Question 1)

- 20 $\mathcal{E} = \{\text{even numbers between 1 and 25}\}$
 $A = \{2, 8, 10, 14\}$
 $B = \{6, 8, 20\}$
 $C = \{8, 18, 20, 22\}$

(a) Complete the Venn diagram for this information.



(4)

A number is chosen at random from \mathcal{E} .

(b) Find the probability that the number is a member of $A \cap B$.

.....
(2)

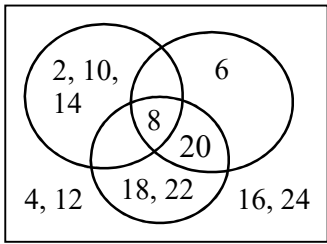
(Total for Question 20 is 6 marks)

Examiner Comments

In part (a) students are expected to use the information given to complete the Venn diagram. Students should check that each number in the universal set appears just once in their completed Venn diagram. Many students placed eight numbers correctly inside the circles and most mistakes were made completing the region outside the circles. It was very common to see either no numbers at all in this region or duplicates of numbers that had already been placed inside the circles or all numbers listed.

In part (b) students are expected to understand the notation for the intersection of two sets and work out a probability from their Venn diagram. Many students were not able to identify the region $A \cap B$.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
20 (a)	Venn diagram	C4 (C3 (C2 (C1	fully correct Venn diagram 7 of the 8 regions correct or for a diagram with only one number incorrectly placed) 5 or 6 of the 8 regions correct) 3 or 4 of the 8 regions correct)	
(b)	$\frac{1}{12}$	M1 A1	ft for identification of 1 or 12 eg from the diagram ft oe	Need not be written as a fraction or probability at this stage. eg could be a ratio 1:12 Acceptable equivalents are (eg, could ft) any fraction equivalent to $\frac{1}{12}$, 0.08(33..) or 8(.33..)%

Examiner Comments

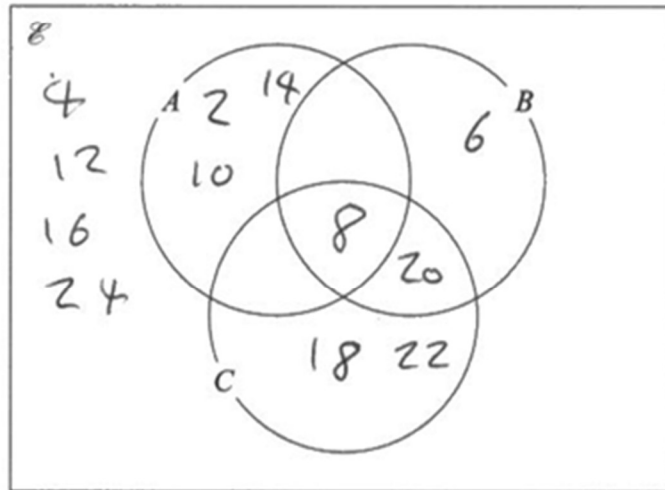
In part (a) each of the 12 numbers in the universal set needed to be correctly placed in one of the eight regions of the Venn diagram. Three marks are awarded if seven of the eight regions are correct or if the diagram has only one number incorrectly placed. If five or six of the eight regions are correct then two marks are awarded and if three or four of the eight regions are correct then one mark is awarded. A region is not correct if it contains a number repeated, e.g. there can be only one 8 in the region $A \cap B \cap C$.

When marking the probability in part (b) it is necessary to check for possible follow through from the Venn diagram. If the Venn diagram is not fully correct then M1A1 is awarded for either the correct answer of $\frac{1}{12}$ (the student may have started again) or for a correct probability following through from the diagram. Many students gained one mark (M1) for identifying either 1 or 12 or a value that followed through from their diagram. If the probability on the answer line is the result of cancelling then it is necessary to check the original fraction.

Student Response A

- 20 $\mathcal{E} = \{\text{even numbers between 1 and 25}\}$
 $A = \{2, 8, 10, 14\}$
 $B = \{6, 8, 20\}$
 $C = \{8, 18, 20, 22\}$

(a) Complete the Venn diagram for this information.



(4)

4/4

A number is chosen at random from \mathcal{E} .

(b) Find the probability that the number is a member of $A \cap B$.

$$\frac{1}{12}$$

(2)

2

$$\frac{50\pi}{400} = \frac{\pi}{8}$$

(Total for Question 26 is 4 marks)

2/2

Examiner Comments

This is a fully correct answer. In part (a) all 12 numbers have been correctly placed in the Venn diagram and the correct probability is given in part (b).

Student Response B

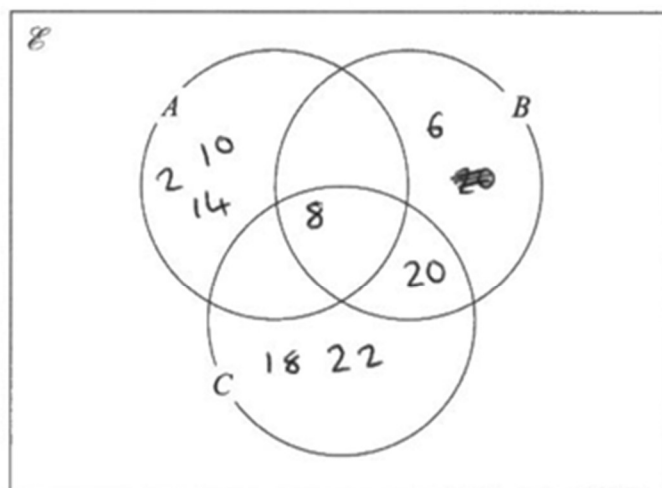
20 $\mathcal{E} = \{\text{even numbers between 1 and 25}\}$

$$A = \{2, 8, 10, 14\}$$

$$B = \{6, 8, 20\}$$

$$C = \{8, 18, 20, 22\}$$

(a) Complete the Venn diagram for this information.



(4)

3/4

A number is chosen at random from \mathcal{E} .

$$\frac{6}{8} = \frac{3}{4}$$

(b) Find the probability that the number is a member of $A \cap B$.

$$\frac{6}{8} = \frac{3}{4}$$

$$\frac{6}{8} = \frac{3}{4} \quad (2)$$

1/2

Examiner Comments

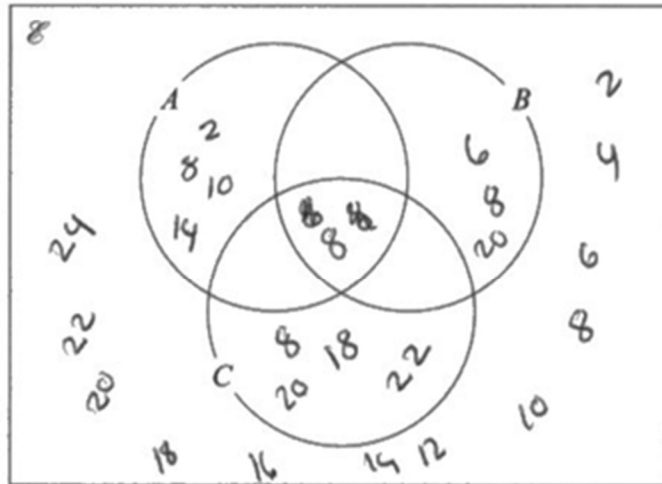
In part (a) no numbers have been placed in the region outside the circles – this was a common mistake. C3 is awarded as seven of the eight regions are correct.

In part (b) it can be seen that the probability on the answer line is the result of cancelling the fraction $\frac{6}{8}$. M1 is awarded for the denominator of 8 which follows through correctly from the diagram. The numerator is not correct. The student has given the probability that the number is a member of $A \cup B$, not the probability that it is a member of $A \cap B$.

Student Response C

- 20 $\mathcal{E} = \{\text{even numbers between 1 and 25}\}$
 $A = \{2, 8, 10, 14\}$
 $B = \{6, 8, 20\}$
 $C = \{8, 18, 20, 22\}$

(a) Complete the Venn diagram for this information.



(4)

1/4

A number is chosen at random from \mathcal{E} .

(b) Find the probability that the number is a member of $A \cap B$.

$$\frac{1}{25}$$

(2)

1/2

Examiner Comments

In part (a), 8 has been correctly placed in the intersection of all three sets but only that region and two of the blank regions are correct. C1 is awarded for three correct regions.

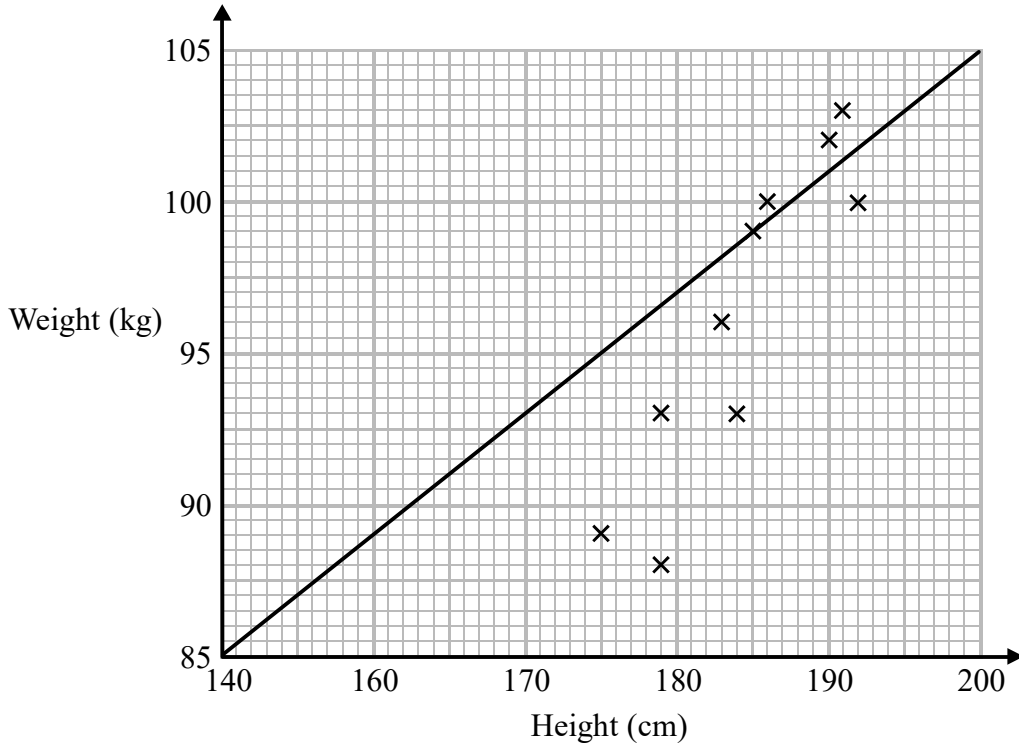
In part (b), M1 is awarded for the correct numerator. The denominator is not 12 and neither does it follow through correctly from the diagram. Note that an answer of either $\frac{1}{12}$ or $\frac{1}{24}$ would have scored full marks.

Exemplar Question 2

Paper 2F Question 21 (and Paper 2H Question 2)

21 Sean has information about the height, in cm, and the weight, in kg, of each of ten rugby players. He is asked to draw a scatter graph and a line of best fit for this information.

Here is his answer.



Sean has plotted the points accurately.

Write down two things that are wrong with his answer.

1.....

.....

2.....

.....

(Total for Question 21 is 2 marks)

Examiner Comments

This question assesses the ability of students to evaluate critically a given way of presenting information within the context of statistics. Students need to use their knowledge of scatter graphs and lines of best fit to identify two things wrong with the diagram presented and then communicate these two things clearly and without contradiction.

There are only two things wrong with the diagram. Students were expected to recognise that the line of best fit is incorrect. They were also expected to identify the error in the scale on the horizontal axis.

A number of answers were given that received no credit. These included explanations that the scales should start at 0; that the axes are the wrong way round; that there is no x or y ; and that there is no title.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
21	statements	C1	for line of best fit (lobf) incorrect Acceptable examples lobf lobf does not suit all points/not a lobf lobf wrong since hits x axis/is inaccurate/should be amongst the crosses lobf goes through the origin/through one point Unacceptable examples no correlation/there is no title	
		C1	for height scale not linear Acceptable examples 150 missing height not linear / height numbers going up wrong Unacceptable examples 150 graph does not start at 140/graph does not start at 0 height should start at 170	

Examiner Comments

One mark is awarded for explaining that the line of best fit is incorrect and one mark is awarded for explaining that the scale on the height axis is not linear. The mark scheme gives examples of responses that are acceptable and examples of responses that are not acceptable for each of the two things that are wrong.

Student Response A

Sean has plotted the points accurately.

Write down two things that are wrong with his answer.

- 1 The line of best fit is in the wrong place.
- 2 The line that measures height starts with 140 goes up by 20 to 160 but then goes up in 10's for the rest of cm

(Total for Question 21 is 2 marks)

2/2

Examiner Comments

The student correctly identifies both things that are wrong with Sean's answer. The first statement refers to the line of best fit and the second statement explains that the scale on the height axis is not linear.

Student Response B

Sean has plotted the points accurately.

Write down two things that are wrong with his answer.

1 HIS line of best fit is wrong

2 He starts light at 140 when he could start at 170.

1/2

Examiner Comments

The first statement explains that the line of best fit is wrong and one mark is awarded.

Starting the scale on the height axis at 170, instead of at 140, might give a better scatter graph but the second statement does not identify something that is actually wrong with Sean's answer.

Student Response C

Sean has plotted the points accurately.

Write down two things that are wrong with his answer.

- 1 The x and y axis are supposed to start with a zero.
- 2 The height should be on y axis and weight on the x axis.

0/2

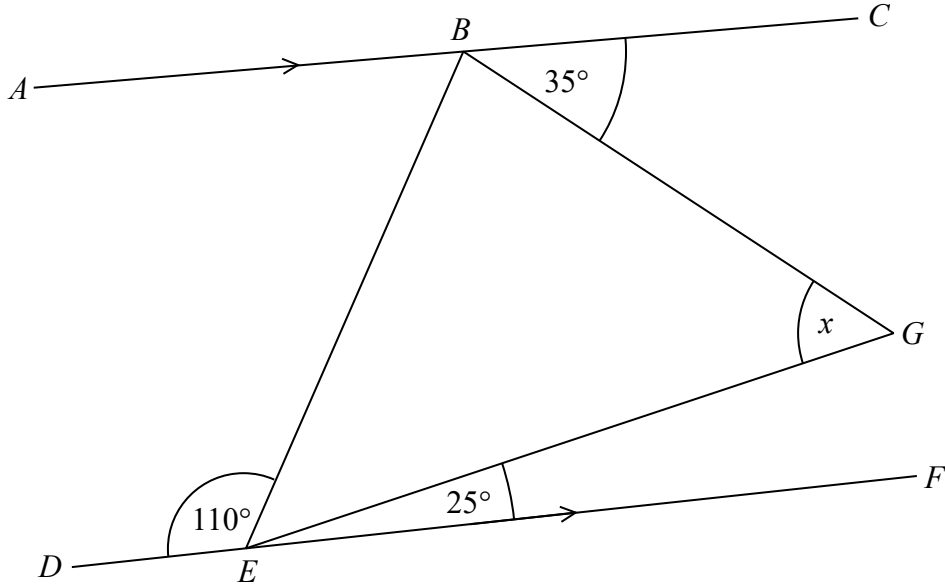
Examiner Comments

Neither statement identifies something that is wrong with Sean's answer. These were common incorrect answers.

Exemplar Question 3

Paper 2F Question 22 (and Paper 2H Question 3)

22 *BEG* is a triangle.



ABC and *DEF* are parallel lines.

Work out the size of angle *x*.

Give a reason for each stage of your working.

.....°

(Total for Question 22 is 4 marks)

Examiner Comments

This question assesses the ability of students to use angles on parallel lines to find the size of an angle and their ability to communicate reasons. Students should set their working out in a formal manner, showing the steps that are needed to find the size of angle *x*, and give correctly worded reasons linked to the appropriate method used.

It was common for students to make incorrect assumptions about other angles instead of using angles on parallel lines. When students did attempt to use angles on parallel lines they often incorrectly identified the angles that are equal.

The question required students to give reasons for each stage of their working. Some gave no reasons at all. When reasons were given they often did not include a reason linked to parallel lines or were incomplete, e.g. ‘triangle = 180’, with the word ‘angles’ omitted. Many students were not able to give clear statements relating to parallel lines with the correct naming of the types of angles.

Mark Scheme

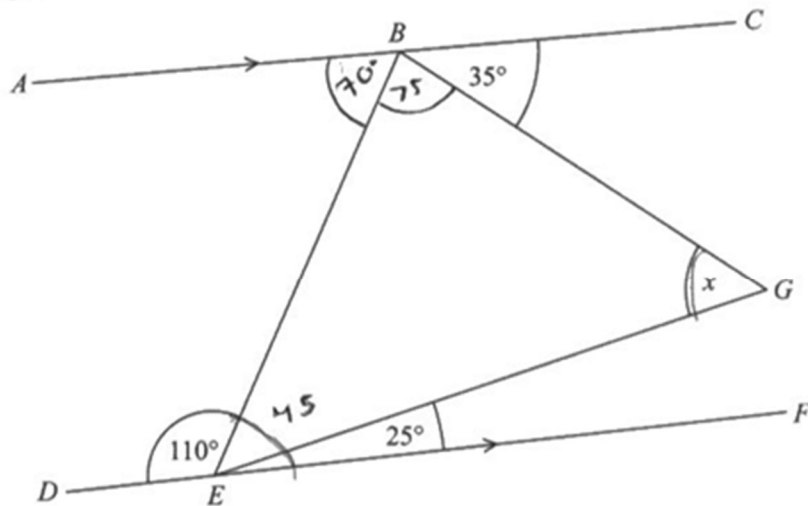
Question	Answer	Mark	Mark scheme	Additional guidance
22	60	M1	use of parallel lines to find an angle eg $ABE = 70$ or $EBG = 75$ or $EBC = 110$ or shows parts of x as 35 or 25	Parts of x should be identified on the diagram by the insertion of a dividing line through angle x (need not be identified or drawn parallel)
		M1	for a complete method to find angle x ; could be in working or on the diagram	Correct method can be implied from angles on the diagram if no ambiguity or contradiction.
		A1	for $x = 60$	
		C1	(dep on M1) for one reason linked to parallel lines and one other reason, supported by working taken from: <u>alternate</u> angles are equal, <u>allied</u> angles / <u>co-interior</u> angles add up to 180, <u>angles</u> on a straight <u>line</u> add up to 180, <u>angles</u> in a <u>triangle</u> add up to 180°	Underlined words need to be shown; reasons need to be linked to their method; any reasons not linked do not credit. There should be no incorrect reasons given.

Examiner Comments

In order to gain the first mark it is necessary to use parallel lines to find a missing angle, for example $ABE = 70^\circ$ or $EBG = 75^\circ$ or $EBC = 110^\circ$. This angle could be marked on the diagram. The second mark is awarded for a complete method to find angle x . This method could be implied from angles marked on the diagram, provided there is no ambiguity or contradiction.

Full reasons for the method used do not have to be given for the C mark to be awarded. It is sufficient to see one reason linked to parallel lines and one other reason. The reasons must be supported by working and include the words that are underlined in the mark scheme. This mark depends on M1.

Student Response A

22 BEG is a triangle. ABC and DEF are parallel lines.Work out the size of angle x .

Give a reason for each stage of your working.

Angle $BEF = 110^\circ + 25 = 135$ $180 - 135 = 45^\circ$
 Because angles on ^{straight} parallel lines can add up to 180° .

~~$EBE = 180^\circ$~~

$ABE =$ Co-interior angles add up to 180
 $180 - 110 = 70$

$EBG = 70 + 35 = 105$ $180 - 105 = 75$
 $\angle = 75^\circ$ because angles on straight lines add up to 180.

$45 + 75 = 120$ \rightarrow Because angles in a triangle add up to 180
 $180 - 120 = 60$
 $x = 60^\circ$

60 $^\circ$

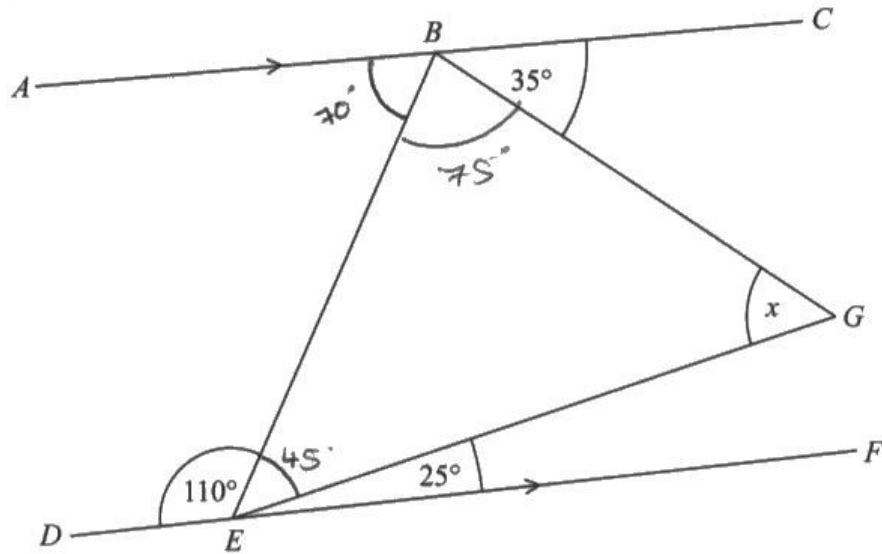
4/4

Examiner Comments

This is a fully correct answer with each stage of working shown. The angles found have been marked on the diagram to support the working. One reason linked to parallel lines and one other reason are sufficient for the C mark but this student gives full reasons for the method used and therefore gains full marks.

Student Response B

22 BEG is a triangle.



ABC and DEF are parallel lines.

Work out the size of angle x .

Give a reason for each stage of your working.

line DEF is a straight line
 angles 110° and 25° sum to 135°

$180^\circ - 135^\circ = 45^\circ$ Angles on a straight line sum to 180°

$$45 + 25 = 70^\circ$$

Angle found on line $ABE = 70^\circ$ corresponding angles are the same.

$$70 + 35 = 105^\circ$$

$180 - 105 = 75^\circ$ Angles on a straight line sum to 180°

$$75 + 45 = 120^\circ$$

$180 - 120 = 60^\circ$ Angles in a triangle sum to 180°

$$x = 60^\circ$$

40°

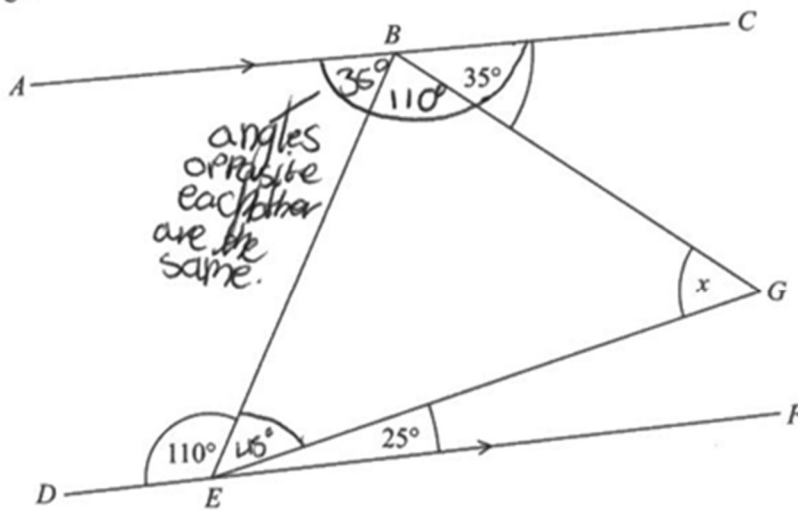
2/4

Examiner Comments

The first two marks are awarded for a complete method to find the size of angle x . There is an arithmetic error in the final calculation. This error, which ought to have been avoidable on a calculator paper, means that the accuracy mark is not awarded. The reason given to explain why angle $ABE = 70^\circ$ uses corresponding angles rather than alternate angles. Although the other three reasons are correct for the method used the C mark cannot be awarded because no correct reason linked to parallel lines is given.

Student Response C

22 BEG is a triangle.



ABC and DEF are parallel lines.

Work out the size of angle x .

Give a reason for each stage of your working.

$$110 + 25 = 135$$

$180 - 135 = 45$ because angles in a straight line add to 180°

$$35 + 35 = 70$$

$180 - 70 = 110$ because angles in a straight line add to 180°

$$45 + 110 = 155$$

$180 - 155 = 25$ because angles in a triangle add to 180°

25

0/4

Examiner Comments

The student made a correct start by using angles on a straight line to find that angle $BEG = 45^\circ$ and then, like many other students, failed to make any further correct progress. For the first method mark to be awarded it is necessary to use parallel lines to find an angle, e.g. angle $ABE = 70^\circ$. Instead of using angles on parallel lines many students made incorrect assumptions about other angles.

Exemplar Question 4

Paper 2F Question 23 (and Paper 2H Question 4)

- 23 Northern Bank has two types of account.
Both accounts pay compound interest.

<p>Cash savings account Interest 2.5% per annum</p>
--

<p>Shares account Interest 3.5% per annum</p>
--

Ali invests £2000 in the cash savings account.
Ben invests £1600 in the shares account.

- (a) Work out who will get the most interest by the end of 3 years.
You must show all your working.

(4)

In the 3rd year the rate of interest for the shares account is changed to 4% per annum.

- (b) Does this affect who will get the most interest by the end of 3 years?
Give a reason for your answer.

.....

.....

.....

(1)

(Total for Question 23 is 5 marks)

Examiner Comments

Part (a) is a problem-solving question that assesses students' understanding of compound interest. Students are expected to identify the processes that are necessary to work out who will get the most interest and to carry them out. Most students treated this as a simple interest question rather than a compound interest question and could score at most 1 of the 4 marks. Many of the students who did show a complete compound interest calculation for both accounts gave an incorrect conclusion because they based their decision on the total amount in each account instead of on the interest that each person received. Students need to ensure that they use the correct multiplier; a mistake made by some was using 1.25 instead of 1.025.

Part (b) is assessing whether students can identify how the solution may have been affected by assumptions made, i.e. does a change in an interest rate affect who will get the most interest?

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
23(a)	Ben (supported)	P1	shows how to work interest out for one year eg $2000 \times 0.025 (= 50)$ or $1600 \times 0.035 (= 56)$ or 150 or 168 or $2000 \times 1.025 (= 2050)$ or $1600 \times 1.035 (= 1656)$	Throughout accept figures ± 1 pence which do not need to be presented in money notation (to 2dp) or with monetary symbols.
		P1	shows compound interest calculation for one account eg $2050 \rightarrow 51.25$ or $2101.25 \rightarrow 52.53$ or $1656 \rightarrow 57.96$ or $1713.96 \rightarrow 59.99$ eg $2000 \times 1.025^3 (= 2153.78)$ or $1600 \times 1.035^3 (= 1773.95)$	Award mark for a correct process shown, for which these figures can be taken as implying the process.
		P1	shows complete compound interest calculation for both accounts eg $2000 \times 1.025^3 (= 2153.78)$ and $1600 \times 1.035^3 (= 1773.95)$ or one interest stated correctly eg 153.78 or 173.95	As above, award mark for both correct processes shown for both accounts, which these figures can be taken as implying the process.
		C1	Ben (shares) supported by 153.78 and 173.95	Accept an answer of "shares".
(b)	conclusion	C1	conclusion (ft) eg no change, shares now 182.5... Acceptable examples no since shares/Ben now 182.5 Still Ben since $182.5 > \text{Ali}$ No; he only gets 8.57 more No; he gets 68.56 instead of 59.98 (3rd year) No; Ben already gets more interest, he would just get even more Unacceptable examples no shares now 182.5 Still Ben since less than Ali $182.5 > 153.78$ no; he needs 20.17 more.	Conclusion needs to be supported. ft is from part (a); calculations carried out as part of (b) need to be correct for the comparison to be valid.

Examiner Comments

The first mark in part (a) is for a process to work out the interest for year one. Many students were able to gain this mark using one of the examples given in the mark scheme. To gain any more marks it is necessary to engage with compound interest. A compound interest calculation for one account, which could be for just year two, is needed for the second mark. The third mark is awarded for complete compound interest calculations for both accounts or for one interest stated correctly. The processes can be implied by the values given in the mark scheme. For the final mark a correct decision must be made and be supported by the values 153.78 and 173.95.

In part (b) the mark is awarded for a correct conclusion, following through from part (a). Students who had concluded in part (a) that Ben will get the most interest were in a position to answer this part without any further calculation. Any calculations carried out as part of (b) must be compound interest calculations and be correct for this mark to be awarded.

Student Response A

- 23 Northern Bank has two types of account.
Both accounts pay compound interest.

<p>Cash savings account Interest 2.5% per annum</p>
--

<p>Shares account Interest 3.5% per annum</p>
--

Ali invests £2000 in the cash savings account.
Ben invests £1600 in the shares account.

- (a) Work out who will get the most interest by the end of 3 years.
You must show all your working.

Cash Savings Ali
£2000 over 3 years
 $2000 \times 1.025^3 = 2153.78$
 $2153.78 - 2000 = 153.78$ (Ali)

Shares Account Ben
£1600 over 3 years
 $1600 \times 1.035^3 = 1773.95$
 $1773.95 - 1600 = \underline{\underline{173.95}}$

Ben makes the most interest (4)

In the 3rd year the rate of interest for the shares account is changed to 4% per annum.

- (b) Does this affect who will get the most interest by the end of 3 years?
Give a reason for your answer.

No because Ben already gets more
after 3 years. he will continue to get
more.

(1)

4/4

1/1

Examiner Comments

Part (a) is fully correct. This is an efficient method that uses multipliers. The student remembers to subtract the amounts invested in order to find the interest that each person gets and then states that Ben gets the most interest.

Students who had concluded in part (a) that Ben will get the most interest were in a position to answer part (b) without any further calculation, as exemplified by this response.

Student Response B

- 23 Northern Bank has two types of account.
Both accounts pay compound interest.

<p>Cash savings account Interest 2.5% per annum</p>
--

<p>Shares account Interest 3.5% per annum</p>
--

Ali invests £2000 in the cash savings account.
Ben invests £1600 in the shares account.

- (a) Work out who will get the most interest by the end of 3 years.
You must show all your working.

Cash savings	Shares account
$\begin{aligned} \text{Ali} = \\ \cancel{200} \quad 2.5 \times 100 = \frac{102.5}{100} \\ = 1.025 \\ 1.025^3 \times 2000 \\ = 2153.78 \end{aligned}$	$\begin{aligned} 3.5 \times 100 = \\ \frac{103.5}{100} \\ = 1.035 \\ 1.035^3 \times \\ 1600 \\ = 1773.95 \end{aligned}$
<p>Ali will get most interest</p>	<p>(4)</p>

3/4

In the 3rd year the rate of interest for the shares account is changed to 4% per annum.

- (b) Does this affect who will get the most interest by the end of 3 years?
Give a reason for your answer.

No it will not because Ali is still investing more than Ben. ~~£~~ but he will still get more interest. (1)

0/1

Examiner Comments

In part (a) a complete compound interest calculation is shown for each account and all three process marks can be awarded. The decision that Ali will get the most interest is incorrect because it has been based on the total amount of money in each account and not on the interest that each person gets. This was a common mistake.

In part (b) the wrong decision is made. Having concluded wrongly in part (a) that Ali will get the most interest this student was not in a position to give a correct conclusion in part (b) without carrying out further calculations to work out the effect of the change in the rate of interest.

Student Response C

- 23 Northern Bank has two types of account.
Both accounts pay compound interest.

Cash savings account
Interest
2.5% per annum

Shares account
Interest
3.5% per annum

Ali invests £2000 in the cash savings account.
Ben invests £1600 in the shares account.

- (a) Work out who will get the most interest by the end of 3 years.
You must show all your working.

2.5% per annum
£2000

$$0.025 \times 2000 = 50$$

$$2.5 \times 2000 \div 100 = 50$$

£50 interest
 $50 \times 3 = £150$

3.5% per annum.
£1600

$$1600 \times 3.5 = \frac{5600}{100} = £56$$

$$£56 \times 3 = £168$$

Ben will get the most interest.

(4)

1/4

In the 3rd year the rate of interest for the shares account is changed to 4% per annum.

- (b) Does this affect who will get the most interest by the end of 3 years?
Give a reason for your answer.

$$\frac{1600 \times 4}{100} = \frac{6400}{100} = 64$$

it doesn't affect it because the shares
interest is greater than the cash savings

account interest

(1)

0/1

Examiner Comments

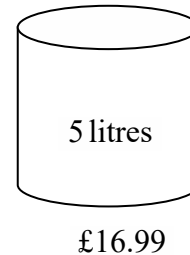
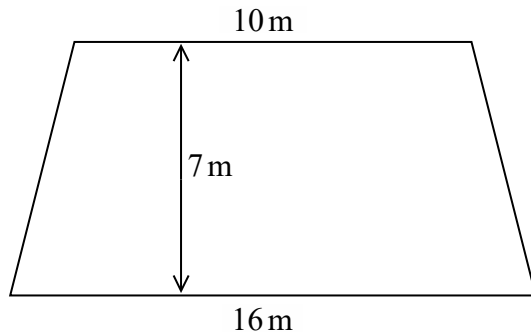
In part (a) the student works out the interest for one year and gains the first mark. Unfortunately the student then treats this as a simple interest question and no further marks can be awarded. This was a very common error.

The decision made in part (b) is correct but it is supported by yet another simple interest calculation. Any calculations carried out as part of (b) need to be correct for the comparison to be valid.

Exemplar Question 5

Paper 2F Question 24 (and Paper 2H Question 5)

- 24 The diagram shows a floor in the shape of a trapezium.



John is going to paint the floor.

Each 5 litre tin of paint costs £16.99

1 litre of paint covers an area of 2 m^2 .

John has £160 to spend on paint.

Has John got enough money to buy all the paint he needs?

You must show how you get your answer.

(Total for Question 24 is 5 marks)

Examiner Comments

This question assesses the ability of students to solve a problem by breaking it down into a series of mathematical processes. This is within the context of geometry and ratio. Students must work with the area of the trapezium and consider the coverage per litre, the cost per 5 litre tin and the money that John has to spend.

Many students did not know how to find the area of a trapezium but even so they were still able to access three of the process marks. A common mistake was to divide the area by 2 or by 5 but not by both. Some students used a divisor of 4 instead of 2 for paint coverage because they misunderstood the notation 2 m^2 . After a process to find the number of tins some students went on to multiply £16.99 by a non-integer value and lost a process mark. The best responses generally came from students who worked logically and structured their answer.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
24	No (supported)	P1	calculates area of trapezium eg $\frac{1}{2} \times 7 \times (10 + 16)$ (= 91)	[area of trapezium] needs to be clearly stated if the process of finding the area is not clear
		P1	for division by coverage eg $\div 2$ or [area of trapezium] $\div 2$ (= 45.5) or process to find coverage per tin eg 5×2 (= 10) or for process to find number of tins bought eg $160 \div 16.99 = 9$ tins	
		P1	for division to find the number of tins eg $\div 5$ or “45.5” $\div 5$ (= 9.1) or [area of trapezium] \div “10” (= 9.1) or for using whole no. of tins to find total litres eg 9×5 (= 45)	
		P1	(dep on at least P2) for a process to multiply a whole number of tins (rounded up) by 16.99 or (dep on at least P2) for a process to find the total coverage eg “45” $\times 2$ (= 90)	
		C1	for ‘No’ supported by correct figures eg 169.9 or 90 and 91	
				There must be a conclusion (“No” or equivalent wording) including the figure 169.9 and working showing processes followed.

Examiner Comments

Students who fail to gain the first process mark because they are unable to find the area of the trapezium are still able to access the other three process marks.

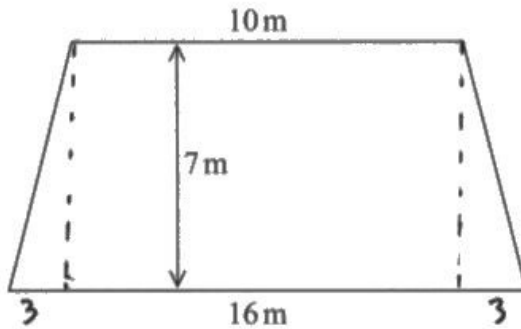
After finding the floor area, the most common approach was to work out the number of tins needed and the cost of those tins. The alternative method caters for those students who worked out the number of tins that John can buy with £160 and the area of floor that could be painted. In both methods the fourth process mark depends on two process marks having been awarded.

Other methods were seen where students worked up from the area of the floor, down from the £160, with an attempt to arrive at two comparable values such as coverage, or number of tins needed.

For the final mark the correct decision of “No” must be supported by correct figures.

Student Response A

24 The diagram shows a floor in the shape of a trapezium.



John is going to paint the floor.

Each 5 litre tin of paint costs £16.99

1 litre of paint covers an area of 2m^2

John has £160 to spend on paint.

Has John got enough money to buy all the paint he needs?

You must show how you get your answer.

$$\begin{array}{r} 7 \times 10 = 70 \\ 3 \times 7 = \frac{21}{91} \end{array}$$

$$91 \div 2\text{m}^2 = 45.5$$

$$45.5 \div 5 = 9.1$$

9.1 tins needed (10)

$$16.99 \times 10 = \cancel{169.90}$$

No he need £9.90 more

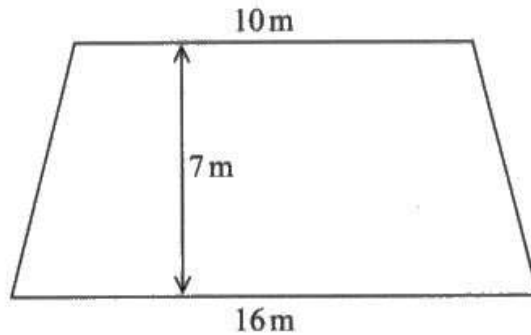
5/5

Examiner Comments

This is a fully correct and well structured answer with each step in the solution clearly shown. In the conclusion the student states “No, he needs £9.90 more” but just “No” would have been sufficient.

Student Response B

24 The diagram shows a floor in the shape of a trapezium.



John is going to paint the floor.

Each 5 litre tin of paint costs £16.99

1 litre of paint covers an area of 2m^2

John has £160 to spend on paint.

Has John got enough money to buy all the paint he needs?

You must show how you get your answer.

$$10 \times 7 = 112\text{m}^2$$

$$112 \div 2 = 56\text{m}^2$$

$$56 \div 2 = 28\text{m}^2 \text{ covered}$$

$$28 \div 5 = 5.6 \text{ tins needed.}$$

Rounded to 6 tins.

$$6 \times £16.99 = £101.94.$$

Yes, he has enough money to buy all the paint he needs.

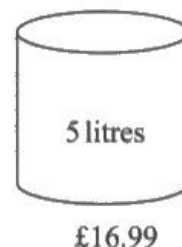
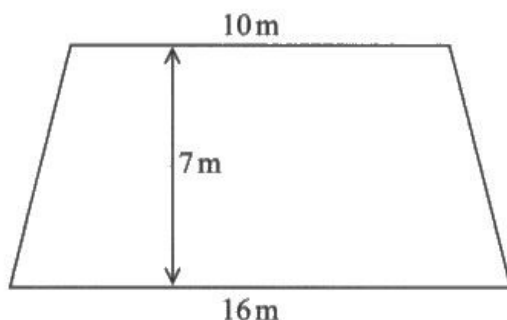
3/5

Examiner Comments

The first mark is not awarded because the student is unable to find the area of a trapezium but the processes that follow are all correct. The second mark is awarded for dividing the area of 56 m^2 by 2 to find the number of litres needed. Dividing the number of litres by 5 to find the number of tins needed gains the third mark. The student rounds up the number of tins to 6 and works out 6×16.99 to find the total cost of the paint. This gains the fourth mark. The student does write litres instead of tins in two places but this can be ignored as the intention is clear. The final mark cannot be awarded because a correct decision of “No” supported by correct figures is needed for this mark.

Student Response C

24 The diagram shows a floor in the shape of a trapezium.



John is going to paint the floor.

Each 5 litre tin of paint costs £16.99
1 litre of paint covers an area of 2 m^2

John has £160 to spend on paint.

Has John got enough money to buy all the paint he needs?
You must show how you get your answer.

5 litre paint costs = £16.99

1 litre = 2 m^2

Floor = 75 m^2

$75 \div 5 = 15$

$15 \times 16.99 = 254.85$

$254.85 - 160 = 94.85$

no john has not because he needs
£94.85 more

1/5

Examiner Comments

A process to find the area of the trapezium is not shown but the student clearly states that the area is 75 m^2 . As this area is incorrect the first mark is not awarded. Neither is the second mark as there is no division by 2 to find the number of litres needed. The student does, however, divide by 5 to find what they believe is the number of tins needed and this earns the third mark. Although the student multiplies a whole number of tins by 16.99 the fourth mark cannot be awarded as it depends on at least P2. A correct decision is made but it is not supported by correct figures.

Exemplar Question 6

Paper 2F Question 25 (and Paper 2H Question 6)

- 25 A is the point with coordinates $(5, 9)$
 B is the point with coordinates $(d, 15)$

The gradient of the line AB is 3

Work out the value of d .

.....
 (Total for Question 25 is 3 marks)

Examiner Comments

This problem assesses the understanding and use of gradient in a coordinate geometry setting.

Most students were not able to work out the value of d . Those that made an attempt often started by finding the increase in the y coordinate from A to B but it was rare to see any further correct progress. A common failing was not using the gradient of 3 at all.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
25	7	P1	process to use gradient eg $y = 3x + c$ or $c = -6$ or $\frac{15-9}{d-5}$ or $(15 - 9) \div 3$ or $(6, 12)$	Condone use of a letter other than d , for d
		P1 (dep)	full process to rearrange equation formed to isolate d eg rearrangement of $15 = 3d - 6$ or $3 = \frac{15-9}{d-5}$ or for $5 + \frac{15-9}{3}$	Must show processes to get as far as $d =$ Award P2 for an answer of $(7, 15)$
		A1	cao	

Examiner Comments

The first mark is awarded for a process to use the gradient and the mark scheme gives several ways in which students might choose to use the gradient of 3. The second mark depends on the first mark.

Student Response A

- 25 A is the point with coordinates $(5, 9)$
 B is the point with coordinates $(d, 15)$

The gradient of the line AB is 3

Work out the value of d .

$$y = 3x + c$$

$$y = 3x - 6$$

$$15 = 3d - 6$$

+6
+3

$$21 = 3d$$

$$7 = d$$

$$x = 5 \quad y = 9$$

$$9 = 3(5) + c$$

$$9 = 15 + c$$

$$-6 = c$$

$$d = 7$$

(Total for Question 25 is 3 marks)

3/3

Examiner Comments

This is not the most efficient way to solve the problem but nevertheless a complete method leads to the correct value of d . The student starts by using the gradient of 3 in $y = mx + c$ and then substitutes $x = 5$ and $y = 9$ to find the value of c . The process is completed by substituting $x = d$ and $y = 15$ in $y = 3x - 6$ and solving the resulting equation.

Student Response B

- 25 A is the point with coordinates $(5, 9)$
 B is the point with coordinates $(d, 15)$

The gradient of the line AB is 3

Work out the value of d .

gradient =
 $\frac{\text{change in } y}{\text{change in } x}$

x	y
$(5, 9)$	
$(3, 15)$	
2	6

$\frac{6}{2} = 3$ 3

(Total for Question 25 is 3 marks)

1/3

Examiner Comments

The student finds the change in the y coordinate from A to B and uses this change and the gradient of 3 to find that the change in the x coordinate is 2. This gains the first mark. Unfortunately, the change in the x coordinate is subtracted from 5 instead of being added to 5 and no further marks can be awarded.

Student Response C

- 25 A is the point with coordinates $(5, 9)$
 B is the point with coordinates $(d, 15)$

The gradient of the line AB is 3

Work out the value of d .

$$9 - 5 = 4$$

$$15 - 4 = 11$$

$$15 - 9 = 6$$

$$5 + 6 = 11$$

11

(Total for Question 25 is 3 marks)

0/3

Examiner Comments

The student works out the increase in the y coordinate from A to B as 6. However, instead of linking 6 with the gradient of 3 to find the increase in the x coordinate the student simply adds 6 to the x coordinate of A . This was a very common incorrect method.

Paper 3F and Paper 3H (Calculator)

Exemplar Question 1

Paper 3F Question 20 (and Paper 3H Question 1)

- 20 (a) Write 7357 correct to 3 significant figures.

.....
(1)

(b) Work out $\frac{\sqrt{17+4^2}}{7.3^2}$

Write down all the figures on your calculator display.

.....
(2)
(3 marks)

Examiner Comments

This question uses a familiar style which students should recognise.

In part (a) students are looking to gain a single mark for being able to round 7357 to 3 significant figures. Students typically struggle with this concept and many will either round to 1 or 2 significant figures, or will lose the magnitude of the number, giving an answer of 736 or 735 rather than 7360.

The second part to the question is assessing student's use of their calculator and an understanding of the order of operations. A common error will in this case be where a student takes the square root of the whole fraction, rather than just the denominator. Some students will also lose a mark by not following the instruction given to write all figures from their calculator display, or round incorrectly in some way without showing working.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
20(a)	7360	B1	cao	
20(b)	0.107798 1356	B2 (B1	for 0.1077(981...) for 5.74(45626...) or 53.29 or 0.11 or 0.107 or 0.108)	Answer must be given to at least 4 decimal places rounded or truncated Accept a clear indication of the decimal point. Check first four decimal places only

Examiner Comments

In part (a) B1 is awarded for a correct answer only.

In part (b) students needed to state the correct answer, either rounded or truncated, to at least 4 decimal places to be awarded B2. If this was not the case a B1 could be awarded for correct evaluation of either the numerator or denominator, or for the correct answer given rounded to 2 decimal places, or rounded or truncated to 3 decimal places. If the correct answer (for B2) is shown in working and then rounded incorrectly on the answer line, examiners can still give the full marks.

Student Response A

20 (a) Write 7357 correct to 3 significant figures.

7357

7360

$$\frac{\cancel{7350} 7360}{(1)}$$

1/1

(b) Work out $\frac{\sqrt{17+4^2}}{7.3^2}$

Write down all the figures on your calculator display.

$$17 + 4^2 = 33 \quad \sqrt{33} = 5.744562647$$

7.3²

$$\frac{5.744562647}{7.3^2} = 0.1077981356$$

$$\frac{0.1077981356}{(2)}$$

2/2

Examiner Comments

Part (a) gets 1 mark for the correct answer.

In part (b), the student works correctly in steps, showing the intermediate values that would gain the B1 and then going on to write the correct answer to at least 4 decimal places.

Student Response B

20 (a) Write 7357 correct to 3 significant figures.

$$\frac{7350}{(1)}$$

0/1

(b) Work out $\frac{\sqrt{17+4^2}}{7.3^2}$

Write down all the figures on your calculator display.

$$\frac{\sqrt{17+16}}{53.29} = \frac{\sqrt{33}}{53.29} = \frac{5.74}{53.29} =$$

$$\frac{0.107}{(2)}$$

1/2

Examiner Comments

Part (a) is incorrect.

In part (b) this student has clearly shown their working and found the intermediate steps. Unfortunately they have not heeded the instruction in the question and have truncated their final answer to 3 decimal places. This is not sufficient to gain B2.

It is worth noting that had the student written the full answer out and then truncated the value on the answer line B2 would have been awarded as in this question the examiner would be able to ignore subsequent working.

Student Response C

20 (a) Write 7357 correct to 3 significant figures.

$$\underline{7360} \quad (1)$$

1/1

(b) Work out $\frac{\sqrt{17+4^2}}{7.3^2}$

Write down all the figures on your calculator display.

$$\frac{\sqrt{17+16}}{53.29} = 17.07506099$$

$$\underline{17.07506099} \quad (2)$$

1/2

Examiner Comments

In part (a) the answer is correct for B1.

In part (b) this student seems to understand the order of operations and starts to work out the numerator and denominator separately. Getting 53.29 on the denominator is worthy of B1. However, at this stage they have then inputted the calculation into their calculator incorrectly and gained the wrong answer so the B2 cannot be awarded.

Exemplar Question 2

Paper 3F Question 21 (and Paper 3H Question 2)

- 21 Last year Jo paid £245 for her car insurance.
This year she has to pay £883 for her car insurance.
Work out the percentage increase in the cost of her car insurance.

.....%

(Total for Question 21 is 3 marks)

Examiner Comments

This question is assessing percentage change. Again it should be a familiar style of question, but caused some problems due to the size of the percentage increase. A significant minority of students were put off by the increase being greater than 100% and after the first step of working they were not sure how to proceed.

This suggests that students might not have completely understood the method that they had been taught. After finding the change, many simply divided the smallest value by the biggest, rather than dividing the “change” by the “original”. It is important that students practice calculating percentage changes that are greater than 100%.

It was also not uncommon to find students using a “build up” approach. Although this could gain credit if a fully correct solution was found, it should be discouraged, as many provided either an incomplete method, or their solution had a greater capacity for errors to be made.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
21	260 to 260.5	M1 M1 A1	for $883 - 245 (= 638)$ or $883 \div 245 (= 3.60..)$ or $883 \div 245 \times 100$ $(= 360(.408..))$ oe for a complete method to find the percentage increase eg " $638 \div 245 \times 100$ $(= 260(.408..))$ or $883 \div 245 \times 100 - 100$ $(= 260(.408..))$ oe Accept answers in the range 260 to 260.5	

Examiner Comments

This 3 mark question allowed 2 method marks to be awarded for a partial or complete method. The most common correct response was to find the difference, then divide it by the original value and multiply by 100.

Some students did work with the new value and the original, dividing these leads to 3.6 or 360%. This is a perfectly correct start to the method and gained M1. Many who used this method then did not know how to complete the method, and 3.6 or 360 were commonly seen as final answers.

Student Response A

- 21 Last year Jo paid £245 for her car insurance.
This year she has to pay £883 for her car insurance.

Work out the percentage increase in the cost of her-car insurance.

$$\text{Percentage change} = \frac{\text{change}}{\text{original}} \times 100$$

$$\frac{(883 - 245)}{245} \times 100 = 260.408$$

260.41
260.....%

3/3

Examiner Comments

Here we have a perfect response. The student has found the difference (on the numerator) which gains M1, they have then completed their method by dividing by 245 and multiplying by 100. Here we see this as one complete step, but it is very common to see this broken into two or even three steps. Providing the steps are clearly stated, it will not make any difference to the number of marks gained.

Finally the correct answer is given and so all 3 marks are awarded.

Student Response B

- 21) Last year Jo paid £245 for her car insurance.
This year she has to pay £883 for her car insurance.

Work out the percentage increase in the cost of her car insurance.

$$\begin{array}{r} 883 \\ - 245 \\ \hline 638 \end{array}$$

£638 increase

$$\frac{638}{245} = 2.6$$

$$245 - 107 = 24.5$$

$$638 \div 245 = 2.604081$$

.....
2.6 %

1/3

Examiner Comments

This student has correctly found the difference to gain the first M1. They have then divided the difference by the original amount to get 2.60... However, they have failed to multiply by 100, and hence their method is incomplete, so the second M1 cannot be awarded.

Only 1 mark is therefore awarded.

Student Response C

- 21 Last year Jo paid £245 for her car insurance.
This year she has to pay £883 for her car insurance.

Work out the percentage increase in the cost of her car insurance.

$$883 - 245 = 638$$

$$638 \div 883 \times 100 = 77\%$$

77%
.....%

1/3

Examiner Comments

Here we have a student who correctly knows to find the difference as a first step and gains M1. However, that is all they gain as they then make two mistakes. They use the new amount (883) instead of the original amount (245) and carry out their division the wrong way round, so no further marks are awarded.

Exemplar Question 3

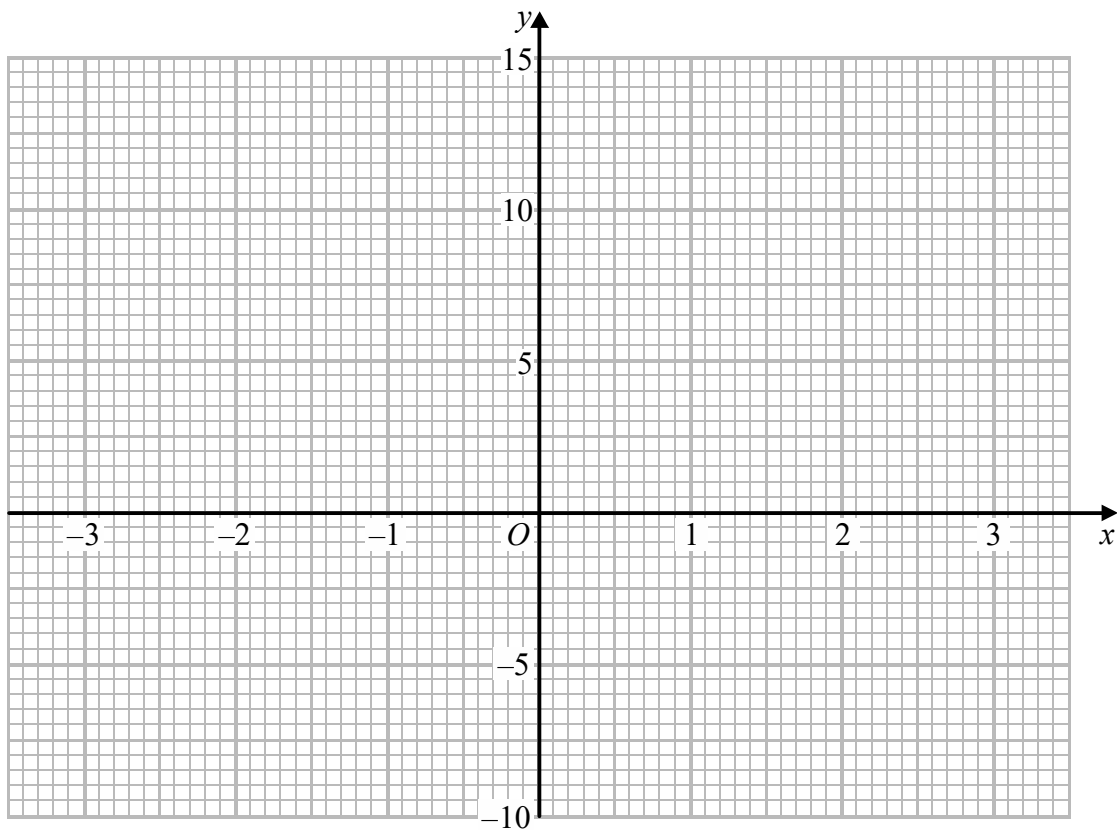
Paper 3F Question 22 (and Paper 3H Question 3)

22 (a) Complete this table of values for $y = x^2 + x - 4$

x	-3	-2	-1	0	1	2	3
y		-2	-4		-2		

(2)

(b) On the grid, draw the graph of $y = x^2 + x - 4$ for values of x from -3 to 3



(2)

(c) Use the graph to estimate a solution to $x^2 + x - 4 = 0$

.....
(1)

(Total for Question 22 is 5 marks)

Examiner Comments

In part (a) many are able to gain one mark for 2 or 3 correct values, but typically struggle with the substitution of a negative x value into the quadratic.

The scale proved the biggest obstacle for students in part (b) with many unable to gain the M1 for plotting their points. Very few were able to gain both marks, but this was often down to failings in part (a).

Part (c) proved to be a challenge to the majority of students with few showing they knew how to solve a quadratic graphically.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
22(a)	2, -4, 2, 8	B2 (B1	all 4 values correct for 2 or 3 correct values)	
(b)	Graph	M1 (dep B1) A1	for at least 5 points plotted correctly ft from part a for a fully correct curve drawn	Accept freehand curves drawn that are not line segments; there must be some attempt to draw the minimum point below $y =$ -4 .
(c)	-2.6 or 1.6	B1	for 1 correct value, ft a non-linear graph	Award for -2.6 or 1.6 or both values but do not award the mark if a correct value is given with an incorrect value. Accept 1.56 or -2.56 Note for ft to be applied the graph may be joined by line segments.

Examiner Comments

This type of mark scheme should be familiar to centres.

In part (a) students can either gain B2 for all 4 correct values in the table, or B1 for 2 or 3 correct.

Credit can be gained in part (b) as long as at least B1 is scored in part (a). In this case the M1 is gained for plotting at least 5 points correctly. These can follow through from the table in part (a) providing B1 was scored. To gain the A1 the graph must be fully correct, so there is no follow through from a table with some incorrect values in (a) for the A mark. Free hand curves were allowed in part (b) to gain both marks, as were feathered curves when the intention was clear and the graph had a minimum below $y = -4$

In part (c) students could gain the mark for either stating one of the two correct values (irrespective of the graph drawn in (b)) or the examiner could follow through the intersection of their graph in (b) with the x -axis providing the graph was non-linear.

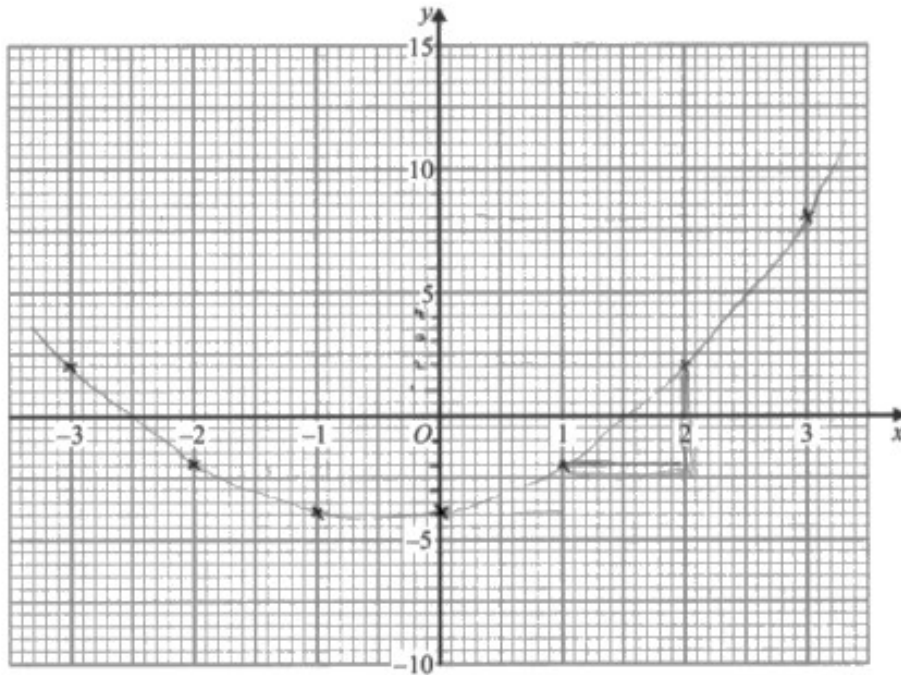
Student Response A

22 (a) Complete this table of values for $y = x^2 + x - 4$

x	-3	-2	-1	0	1	2	3
y	2	-2	-4	-4	-2	2	2

2/2

(b) On the grid, draw the graph of $y = x^2 + x - 4$ for values of x from -3 to 3



(2)

2/2

(c) Use the graph to estimate a solution to $x^2 + x - 4 = 0$

1.5
.....
(1)

1/1

Examiner Comments

In part (a), the table has been completed correctly so both marks are awarded.

The graph in part (b) is fully correct and there is clear intention for the curve to go below $y = -4$ so again both marks are awarded.

In part (c), the answer of 1.5 is an acceptable follow through from their graph which is non-linear, so 1 mark scored.

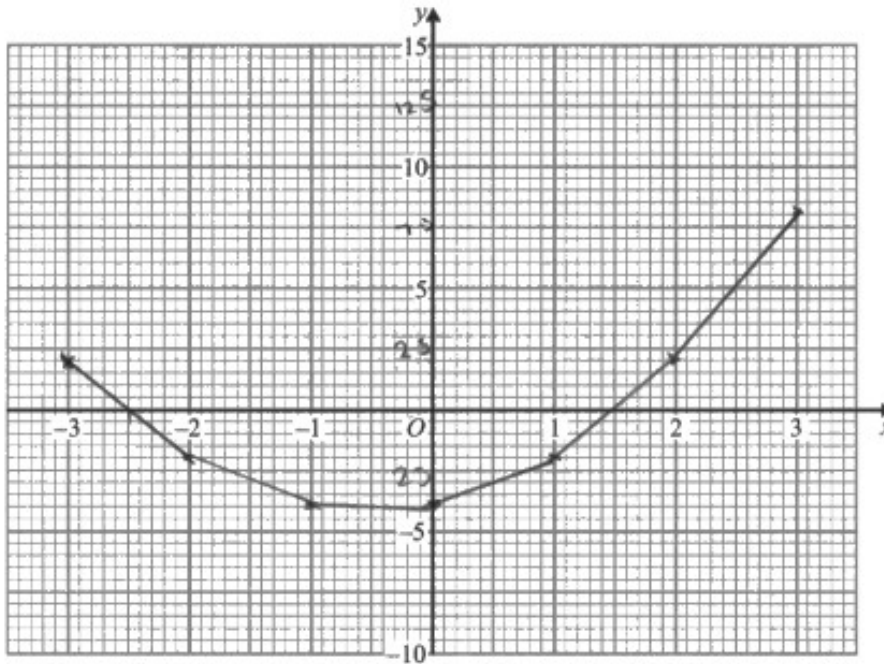
Student Response B

22 (a) Complete this table of values for $y = x^2 + x - 4$

x	-3	-2	-1	0	1	2	3
y	2	-2	-4	-4	-2	2	8

2/2

(b) On the grid, draw the graph of $y = x^2 + x - 4$ for values of x from -3 to 3



(2)

1/2

(c) Use the graph to estimate a solution to $x^2 + x - 4 = 0$

$$\frac{-2.5}{(1)}$$

1/1

Examiner Comments

This response is almost fully correct.

In part (a), the table is complete and correct and scores B2.

In part (b) all points are correctly plotted but they have clearly been drawn with line segments rather than a curve so as a result only award one mark can be awarded.

In part (c) we have a rare example of a student choosing to state the negative solution. The value of -2.5 is an acceptable follow through from their graph in (b) which is clearly non-linear, and so B1 is awarded.

Student Response C

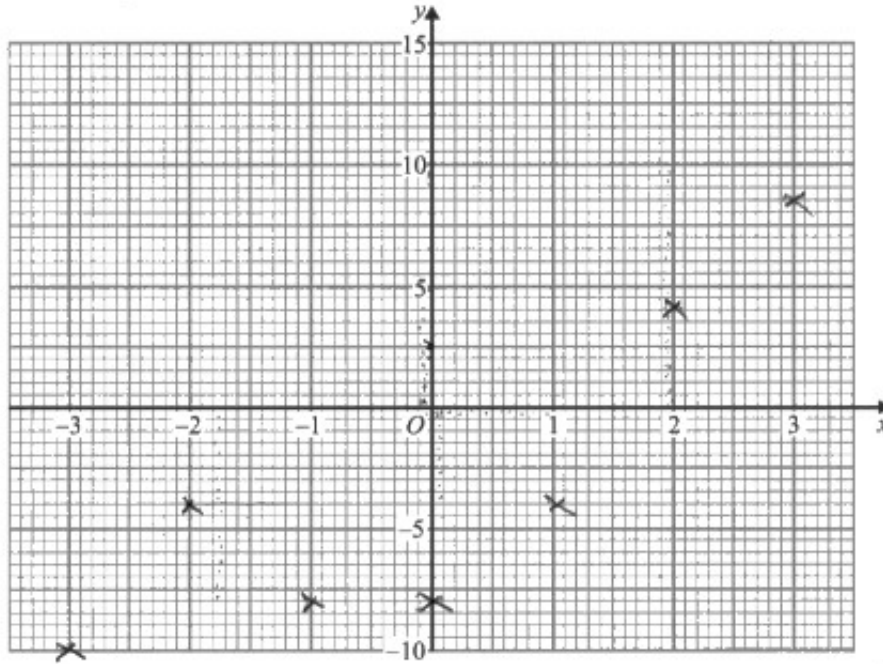
22 (a) Complete this table of values for $y = x^2 + x - 4$

x	-3	-2	-1	0	1	2	3
y	-10	-2	-4	-4	-2	2	8

1/2

(b) On the grid, draw the graph of $y = x^2 + x - 4$ for values of x from -3 to 3

0 = 0.25



(2)

0/2

(c) Use the graph to estimate a solution to $x^2 + x - 4 = 0$

0.5
(1)

0/1

Examiner Comments

Part (a) shows a quite common response. In the table, three values are correct, with the value for $x = -3$ being incorrect. This is very common response.

Part (b) is a disappointment as the student has not been able to interpret the scale correctly and in fact only one point $(-3, -10)$ is plotted correctly. Interpreting scales that are not unitary is a general weakness.

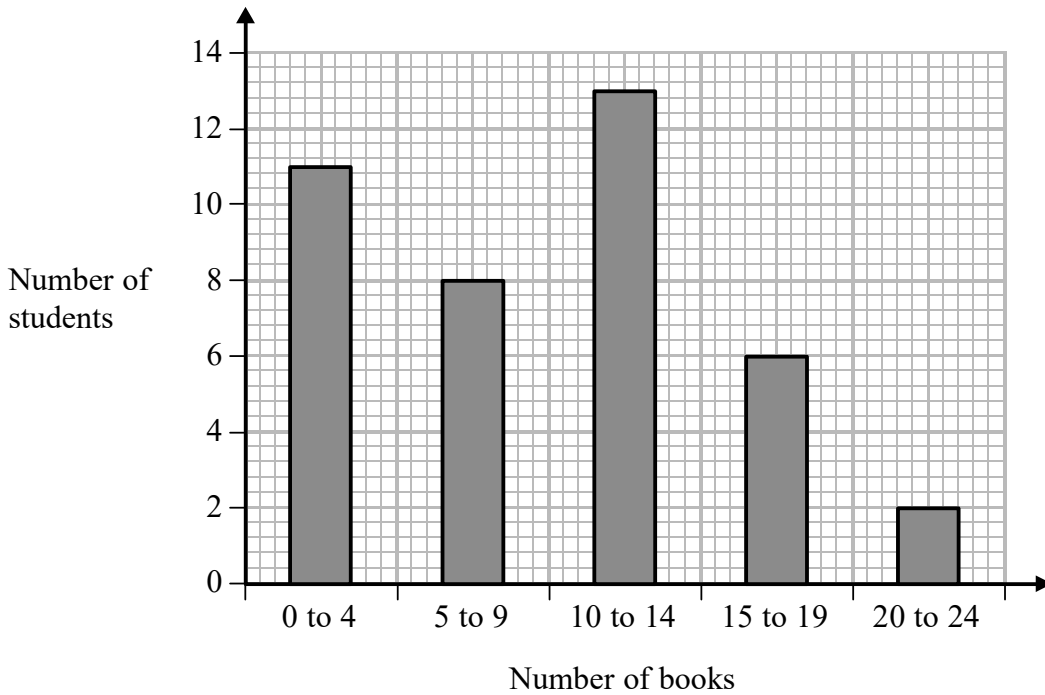
There is no graph present so no mark can be awarded.

Exemplar Question 4

Paper 3F Question 23 (and Paper 3H Question 4)

23 Fran asks each of 40 students how many books they bought last year.

The chart below shows information about the number of books bought by each of the 40 students.



(a) Work out the percentage of these students who bought 20 or more books.

.....%

(2)

(b) Show that an estimate for the mean number of books bought is 9.5
You must show all your working.

(4)

(Total for Question 23 is 6 marks)

Examiner Comments

This question requires students to apply the understanding of a topic to an unfamiliar situation. This question requires the student to understand what information is needed to answer the question, and then extract that from the chart.

In part (a) the student had to understand that “20 or more” related to the last bar only, find the frequency related to that bar, and then find the percentage of the total population that represents. Students often struggled to understand what they needed to do to find the percentage and in many cases scored 0.

Finding an estimated mean should be familiar to students even when presented with a grouped frequency table. In this question students needed to understand how to find an estimated mean, and also extract the information required. For many reading the frequencies was the only thing done that was worthy of credit.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
23(a)	5	M1	“2” $\div 40 \times 100$	“2” comes from their reading of the height of the 20 to 24 column
		A1	cao	
(b)	9.5 shown	M1	for frequencies of 11, 8, 13, 6 and 2 (allow one error) or for midpoints 2, 7, 12, 17 and 22	May be seen on chart
		M1	for finding at least 4 products fx consistently within interval (including end points)	
		M1	for $\Sigma“fx“ \div (“11” + “8” + “13” + “6” + “2”)$ or $(11 \times 2 + 8 \times 7 + 13 \times 12 + 6 \times 17 + 2 \times 22) \div 40$ OR $\Sigma“fx” (=380) \text{ and } 9.5 \times (“11” + “8” + “13” + “6” + “2”)$ $(= 380)$	Evidence of two different calculations that should lead to 380 are required for this mark
		C1	for correct figures showing the answer or accurate figures to compare from correct working eg 380 from two calculations	

Examiner Comments

The method mark in part (a) requires a complete process to find the percentage. Most students scored 0 or 2. Those who did gain 1 mark, usually read the height of the final bar incorrectly, but then used it correctly to find the percentage.

In part (b) the first mark could be awarded for reading off the frequencies correctly. In this case they were allowed to make one error, and so have 4 out of 5 correct. Alternatively, this mark could be awarded to a student who correctly states all 5 midpoints.

The second mark is for finding at least 4 products fx correctly, with x being used consistently within the interval.

The third mark is for the complete method, either by dividing the sum of their fx by 40, or by the sum of their frequencies, or, as it is a show that question and they have the answer, they could show that the sum of fx is 380 and so is 9.5 multiplied by the sum of their frequencies. The 380 must come from two different calculations to gain this mark. At this point the one incorrect frequency allowed in the first M1 can be carried though.

The final mark is for a complete method with correct figures.

Student Response A

(a) Work out the percentage of these students who bought 20 or more books.

$$20 \text{ to } 24 = 2 \text{ students}$$

$$\frac{2}{40} \text{ bought 20 or more} = \frac{1}{20} = 0.05 = 5\%$$

$$\frac{38}{40} \text{ didn't} = \frac{19}{20} = 0.95 = 95\%$$

$$\frac{5}{(2)} \%$$

2/2

(b) Show that an estimate for the mean number of books bought is 9.5

You must show all your working.

$$0 \text{ to } 4 = 11 \times 2 = 22$$

$$5 \text{ to } 9 = 8 \times 7 = 56$$

$$10 \text{ to } 14 = 13 \times 12 = 156$$

$$15 \text{ to } 19 = 6 \times 17 = 102$$

$$20 \text{ to } 24 = 2 \times 22 = 44$$

$$\begin{array}{r} 22 \\ 56 \\ 156 \\ 102 \\ 44 \\ \hline 380 \end{array} \text{ estimated books}$$

$$\div 40 = \underline{9.5} \text{ books bought}$$

4/4

Examiner Comments

A clear fully correct response. The student has correctly identified the frequency of 2 for “20 or more”. They have then written this as a fraction and converted it to a percentage correctly and thus scores both marks in part (a).

In part (b), all five correct products for fx are shown clearly, which in itself would score M1M1. They then clearly show they sum to 380 and divide by 40 to get 9.5 and therefore gain full marks.

Student Response B

(a) Work out the percentage of these students who bought 20 or more books.

2 Students over 20 books

10% of 40 = 4 students

So 5% of 40 = 2 students

$\frac{5}{(2)}\%$

2/2

(b) Show that an estimate for the mean number of books bought is 9.5
You must show all your working.

$$11 \times 4 = 44$$

$$9 \times 8 = 72$$

$$13 \times 14 = 182$$

$$19 \times 6 = 114$$

$$24 \times 2 = 48$$

460

$$\frac{460}{40} = 11.5$$

3/4

Examiner Comments

A good response with only a single error.

In part (a) they have correctly identified the number of students who bought 20 or more books. They have then worked with the 40 to find that 2 is equal to 5% and thus gain both marks.

Their response in part (b) is almost perfect. They have all the correct frequencies but have used the upper end point rather than the midpoint, but they have been consistent in the value used from the intervals.

Once they have calculated their fx they have divided by 40 to get the wrong answer. As the only mistake is in using the end values, they can be awarded all 3 method marks but are penalised for this error in the accuracy mark.

Student Response C

(a) Work out the percentage of these students who bought 20 or more books.

$$\begin{aligned} & \text{then } 100 \div 40 = 2.5 \\ & \frac{2}{40} \times 2.5 = \frac{5}{100} = 5\% \end{aligned}$$

5 %
(2)

2/2

(b) Show that an estimate for the mean number of books bought is 9.5
You must show all your working.

$$\begin{aligned} 0-4 &= 2 & 60 \div 40 &= 1.5 \\ 5-9 &= 7 \\ 10-14 &= 12 \\ 15-19 &= 17 \\ 20-24 &= 22 \\ & \underline{\quad} & & \\ & 60 & & \end{aligned}$$

1/4

Examiner Comments

Another well answered part (a) with the student writing the proportion as a fraction and scaling it up to a fraction out of 100 to find the percentage. This scores 2 marks.

In part (b) however, this student gets lost quite quickly. They have found the correct midpoints for each interval and in doing so gain M1. Unfortunately they then sum these and divide by 40 and do not use the frequencies, and so no further marks can be awarded.

Exemplar Question 5

Paper 3F Question 24 (and Paper 3H Question 5)

24 Lara is a skier.

She completed a ski race in 1 minute 54 seconds.
The race was 475 m in length.

Lara assumes that her average speed is the same for each race.

- (a) Using this assumption, work out how long Lara should take to complete a 700 m race.
Give your answer in minutes and seconds.

..... minutes seconds
(3)

Lara's average speed actually increases the further she goes.

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

.....
.....
(1)

(Total for Question 24 is 4 marks)

Examiner Comments

This problem question required students to be able to use the relationship between speed, distance and time as well as being able to work confidently with time, including parts of an hour. Alternatively some students worked with proportion and were able to gain full credit.

Part (b) required students to understand the effect increased speed has on time. Many students were unable to communicate their response clearly and so struggled to gain credit.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
24	2 mins 48 secs	P1	for an appropriate first step eg $700 \div 475 (= 1.47..)$ or $475 \div [\text{time}] (= 4.16.. \text{ m/s})$ or $[\text{time}] \div 475 (= 0.24 \text{ s/m})$	[time] what student indicates as time of first race Units are not needed and can be ignored if given
		P1	for a complete process to find the required time eg $700 \div 475 \times [\text{time}] (= 168)$ or $700 \div (475 \div [\text{time}]) (= 168)$ or $[\text{time}] \div 475 \times 700 (= 168)$	Allow calculation in stages and appropriate rounding.
		A1	cao	
	Statement	C1	eg takes less time Acceptable examples quicker time faster time reduces my answer to part (a) Unacceptable examples it is an underestimate the amount of time could/may increase Laura goes faster	

Examiner Comments

The main thing to consider when looking at the mark scheme for part (a) was the use of the square brackets. In this question [time] referred to whatever value the student believed to be the time for the initial race. Common values were 154, 1.54, 114 and 1.14, all of which were allowed for in the two process marks, as was any other value if clearly stated as the time by the student. This way, the student who cannot convert 1 minute 54 seconds correctly, but understands how to answer the question, will only lose 1 mark.

The mark scheme has 2 process marks, one for a suitable first step, with three possible processes stated, and the second for taking these first steps on to get the correct time in seconds. In all cases, any units stated were not needed so could be ignored, and it was acceptable to have calculations broken down into multiple steps.

The final mark was for the correct answer only and included the change from seconds into minutes and seconds.

In part (b) the student had to be clear that the time taken was decreasing, so “a faster time” was acceptable. However those who only talked about “faster” didn’t gain the mark as it was ambiguous as to whether that referred to time or to speed.

Student Response A

- (a) Using this assumption, work out how long Lara should take to complete a 700 m race.
Give your answer in minutes and seconds.

$$1 \text{ m } 54 \text{ sec} = 475 \text{ m}$$

$$60 + 54 = 114 \text{ sec}$$

$$114 \rightarrow 475$$

$$\begin{array}{r} \div 475 \\ 1 \\ \hline 475 \\ \hline 0 \end{array}$$

$$\begin{array}{r} \div 475 \\ 1 \\ \hline 475 \\ \hline 0 \end{array}$$

$$\begin{array}{r} \times 700 \\ 1 \\ \hline 700 \\ \hline 168 \end{array}$$

$$168 \div 60 = 2.8$$

$$2 \text{ min } 48$$

$$120 - 168 - 120 = 48$$

2 minutes 48 seconds
(3)

3/3

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

as the speed increases the time will decrease.

(1)

1/1

Examiner Comments

This is a perfect solution. In part (a) the student changes the time into seconds as a first step. They then start to work with proportion. They first find the time taken to travel 1 metre by dividing by 475, this gains the first P1. Their second step is to then use this to find the time taken to travel 700 metres by multiplying by 700, this scores the second P1.

This leads them to 168 seconds. To gain the A mark they must correctly convert this time into minutes and seconds which they do and so the third mark is awarded.

The explanation in part (b) is clear in stating the time will decrease and so C1 is awarded.

Student Response B

- (a) Using this assumption, work out how long Lara should take to complete a 700 m race.
Give your answer in minutes and seconds.

$$475 \div 1.54 = 308.4$$

$$700 \div 308.4 = 2 \text{ min } 27 \text{ sec}$$

2 minutes 27 seconds
(3)

2/3

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

She will take less time to complete
the race.
(1)

1/1

Examiner Comments

A good attempt at the question. This student has used the speed distance time relationship. They find the speed of the first race using distance divided by [time] and then find the time for the second race using distance divided by speed. Since their method is clear and the time used is a recognisable time we can award both P marks. Unfortunately this student has used 1.54 as their [time] which is incorrect and leads to an incorrect answer, so they lose the A mark at the end.

As with Student Response A, there is a clear explanation relating to less time, and C1 is awarded.

Student Response C

- (a) Using this assumption, work out how long Lara should take to complete a 700 m race.
Give your answer in minutes and seconds.

237.5

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

$$\frac{475\text{m}}{1.54\text{s}} = 308.44$$

$$\text{Speed} = 308.44$$

$$308.44 \times 700 = 215908$$

3 minutes 38 seconds
(3)

1/3

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

~~The time taken would increase too~~
That means the further she goes the faster she travels. However this will not affect the answer to part (a). (1)
(Total for Question 24 is 4 marks)

0/1

Examiner Comments

Like Student B, this student has started by finding the speed for the first race, and has also used 1.54 as [time]. This first step is fine for P1.

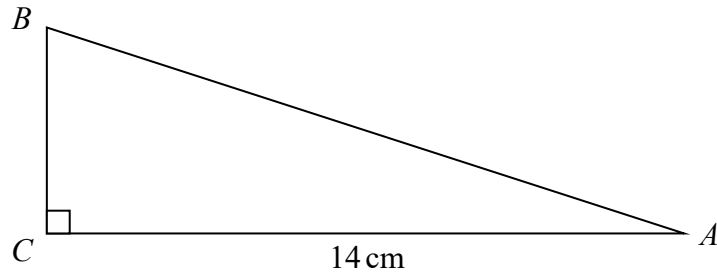
Their second step, however, is not correct. They have calculated speed \times distance which doesn't get time and so the second P1 cannot be awarded and therefore neither can the A1. 1 mark only.

The response given here for part (b) is also incorrect. They have stated that part (a) would not be affected which is clearly wrong, and so no mark is awarded.

Exemplar Question 6

Paper 3F Question 25 (and Paper 3H Question 6)

25 ABC is a right-angled triangle.



$AC = 14$ cm.
Angle $C = 90^\circ$

size of angle B : size of angle $A = 3 : 2$

Work out the length of AB .
Give your answer correct to 3 significant figures.

.....cm

(Total for Question 25 is 4 marks)

Examiner Comments

This question combines sharing in a ratio alongside the topic of trigonometry. Students had to understand that angles A and B sum to 90° and then share 90° in the ratio $3 : 2$. Once this is complete they then have a right-angled triangle with enough information to apply either the sine or cosine ratio and find the missing length.

For some students, particularly on the Foundation paper, it was clear that lack of understanding of trigonometry was evident and very few students were able to get beyond dealing with the ratio.

Mark Scheme

Question	Answer	Mark	Mark scheme	Additional guidance
25	17.3	P1	for full process to find either angle eg $(180 - 90) \div (2 + 3) \times 2$ or for 36 or 54 seen as an angle	May be seen on diagram Condone correct values if incorrectly placed.
		P1	for a correct equation using trigonometry eg $\cos [A] = 14 \div AB$	This must be shown as an equation with all four elements (eg \cos , $[A]$, 14, AB) present. $[A]$ could be 36 or any angle clearly and unambiguously identified as A . This also applies to $[B]$ with Sine.
		P1	(dep previous P mark) for rearranging their trigonometry equation to make AB the subject eg $(AB =) "14 \div \cos 36"$	
		A1	for an answer in the range 17.3 to 17.4	If an answer is shown in the range in working and then incorrectly rounded award full marks.

Examiner Comments

The first process mark was for dealing with the ratio to find either A or B . It could be gained for the process seen or for either 36 or 54 seen as an angle. This may be on the diagram or identified as such in working, eg $A = 36$. If on the diagram, it was acceptable for these angles to be reversed, and that could be carried through into the second and third P1 marks.

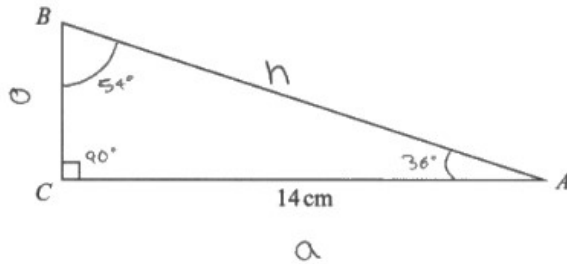
The second mark was for a correct trigonometric statement that included four elements; AB , 14, \cos or \sin and 36 and 54. The \cos or \sin must be the correct one for the angle they are using to gain the credit.

To gain the third mark they need to have first gained the second P1 due to the dependency, and then correctly rearrange their statement to make AB the subject. In this mark the AB may be missing, so for example, $14 \div \cos 36$ would be sufficient.

A1 was awarded for an answer in the range given. Subsequent working can be ignored if the correct answer is stated and then rounded incorrectly.

Student Response A

25 ABC is a right-angled triangle.



$AC = 14 \text{ cm}$.
Angle $C = 90^\circ$

size of angle B : size of angle $A = 3 : 2$

Work out the length of AB .

Give your answer correct to 3 significant figures.

trig and pythagoras.

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

~~sch~~ sch ant oa

$$3 + 2 = 5$$

$$180 - 90 = 90.$$

$$90 \div 5 = 18.$$

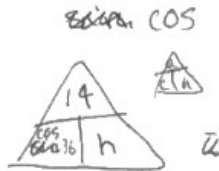
$$3 \times 18 = 54$$

$$2 \times 18 = 36$$

$$54 + 36 = 90$$

$$\text{angle } B = 54^\circ$$

$$\text{angle } A = 36^\circ.$$



$$14 \div \cos(36) = 17.30495168.$$

$$= 17.305.$$

..... 17.305 cm

4/4

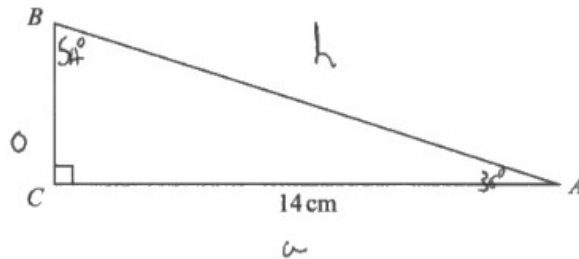
Examiner Comments

This student has clearly understood the problem fully. They clearly address the ratio on the left-hand side of the page leading to “angle $B = 54$, angle $A = 36$ ” and so score the first P1.

They then gain the next two P marks in one line as they use the formula triangle to rearrange the formula and state $14 \div \cos(36)$. They then state the correct answer to 3 decimal places which is more than sufficient to gain the A mark.

Student Response B

25 ABC is a right-angled triangle.



$AC = 14$ cm.
Angle $C = 90^\circ$

size of angle B : size of angle $A = 3 : 2$

Work out the length of AB .
Give your answer correct to 3 significant figures.

Step 1

	B	A	
	3	2	$3+2=5$

Step 2

$180^\circ - 90^\circ = 90^\circ$ $90 \div 5 = 18$

Calc $\frac{14}{h}$ $18 \times 3 = 54 = B$

$\cos(36) = \frac{14}{h}$ $18 \times 2 = 36 = A$

$54 + 36 = 90^\circ$

$\cos 36 \times 14 = 11.32623792$

11.330 cm

2/4

Examiner Comments

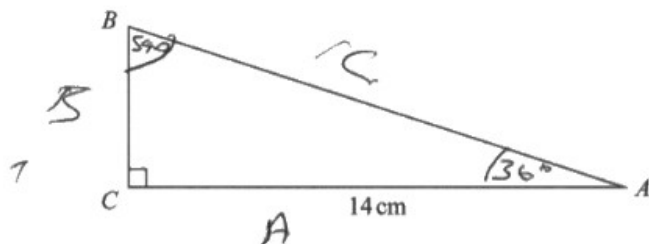
Again, this student deals with the ratio clearly and correctly and we can see the two angles marked correctly on the diagram. It is worth noting that this alone, without the working given here, would still score the first P1.

In their step 2 they write a correct trig statement linking the four required elements; in this case we have $\cos 36 = \frac{14}{h}$. This gains the second P1.

Unfortunately they make a mistake with the rearrangement ending in $\cos 36 \times 14$ rather than $14 \div \cos 36$ and so the third mark is not awarded. The answer is now incorrect and the A mark is not given.

Student Response C

25 ABC is a right-angled triangle.



$AC = 14$ cm.

Angle $C = 90^\circ$

size of angle B : size of angle $A = 3:2 = 5$

Work out the length of AB .

Give your answer correct to 3 significant figures.

$$180^\circ - 90 = 90$$

$$90 \div 5 = 18$$

$$B = 18 \times 3 = 54$$

$$A = 18 \times 2 = 36$$

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

.....cm

1/4

Examiner Comments

This was a very typical response from many students. They have dealt correctly with the ratio and the angles can then be correctly seen on the diagram. P1 is scored.

At this point, this student, like very many others, is unsure how to proceed. They state Pythagoras' theorem but realise without BC they can go no further.