



National
Qualifications
2024

2024 Mathematics

National 5 - Paper 1

Question Paper Finalised Marking Instructions

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Marking Instructions for each question

Question		Generic scheme	Illustrative scheme	Max mark
1.		<ul style="list-style-type: none"> •¹ identify common denominator •² consistent answer 	<ul style="list-style-type: none"> •¹ $3\frac{\dots}{12} - 1\frac{\dots}{12}$ or $\frac{\dots}{12} - \frac{\dots}{12}$ •² $2\frac{5}{12}$ or $\frac{29}{12}$ 	2
<p>Notes:</p> <p>1. Correct answer without working award 0/2</p> <p>2. Do not penalise incorrect conversion of $\frac{29}{12}$ to a mixed number.</p> <p>3. Treat $2\left(\frac{8}{12} - \frac{3}{12}\right) = 2\left(\frac{5}{12}\right)$ as bad form award 2/2 However, see COR 2.</p>				
<p>Commonly Observed Responses:</p> <p>1. $\frac{11}{3} \times \frac{5}{4} = \frac{55}{12}$ award 0/2</p> <p>2. $2\left(\frac{8}{12} - \frac{3}{12}\right) = 2\left(\frac{5}{12}\right) = \frac{10}{12} = \frac{5}{6}$ award 1/2 ✓✗</p>				

Question		Generic scheme	Illustrative scheme	Max mark
2.		<ul style="list-style-type: none"> •¹ substitute into $f(x)$ •² evaluate $f(x)$ 	<ul style="list-style-type: none"> •¹ $(7+3)^2$ or equivalent •² 100 	2
Notes:				
1. Correct answer without working			award 2/2	
2. For subsequent incorrect working • ² is not available. eg $f(7) = (7+3)^2 \rightarrow f(7) = 100 \rightarrow f = \frac{100}{7}$			award 1/2	✓✗
Commonly Observed Responses:				
1. $(7+3)(7+3) = 49+21+21+9 = 100$			award 2/2	
2. $(7+3)^2 = 49+9 = 58$ (no working necessary)			award 1/2	✓✗
3. $(7+3)(7-3) = 40$			award 1/2	✗✓1
4. (a) $7+3^2 = 100$ (bad form)			award 2/2	
(b) $7+3^2 = 16$			award 0/2	
5. (a) $7 = (7+3)^2 \rightarrow 7 = 100$			award 2/2	
(b) $7 = (7+3)^2 \rightarrow 7 = 100 \rightarrow 93$			award 1/2	✓✗
(c) $7 = (7+3)^2 \rightarrow 7 = 100 \rightarrow \frac{100}{7}$			award 1/2	✓✗

Question		Generic scheme	Illustrative scheme	Max mark
3.		<ul style="list-style-type: none"> •¹ start to expand •² complete expansion •³ collect like terms (see Note 3) 	<ul style="list-style-type: none"> •¹ evidence of any 3 correct terms eg $x^3 - 4x^2 + 5x\dots$ •² $x^3 - 4x^2 + 5x + x^2 - 4x + 5$ •³ $x^3 - 3x^2 + x + 5$ 	3
<p>Notes:</p> <p>1. Correct answer without working award 3/3</p> <p>2. Accept:</p> <p>(a) $x^3 - 3x^2 + 1x + 5$ award 3/3</p> <p>(b) $x^3 + -3x^2 + 1x + 5$ award 3/3</p> <p>3. For the award of •³ the evidence at •² must include a term in x^3. At least one negative term must be collected with another term.</p> <p>4. Evidence for •¹ and •² may appear in a grid.</p> <p>5. For subsequent incorrect working, •³ is not available.</p>				
<p>Commonly Observed Responses:</p>				

Question		Generic scheme	Illustrative scheme	Max mark
4.		<ul style="list-style-type: none"> •¹ calculate $3a$ •² solution 	<ul style="list-style-type: none"> •¹ $\begin{pmatrix} 9 \\ 12 \\ -3 \end{pmatrix}$ •² $\begin{pmatrix} 14 \\ 15 \\ -1 \end{pmatrix}$ 	2

Notes:

1. Correct answer without working award 2/2

2. Do not award •² if

- (a) brackets are omitted from the answer
(omission of brackets should only be penalised once in Qu4, or Qu12(b) or Q12 (c))
- (b) the answer is given in coordinate form.

3. For subsequent invalid working •² is not available.

eg (a) $\begin{pmatrix} 14 \\ 15 \\ -1 \end{pmatrix} \rightarrow 14 + 15 - 1 = 28$ award 1/2 ✓✗

(b) $\begin{pmatrix} 14 \\ 15 \\ -1 \end{pmatrix} \rightarrow \sqrt{14^2 + 15^2 + (-1)^2} = \sqrt{422}$ award 1/2 ✓✗

Commonly Observed Responses:

1. $\begin{pmatrix} 9 \\ 12 \\ 3 \end{pmatrix} + \begin{pmatrix} 5 \\ 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 14 \\ 15 \\ 5 \end{pmatrix}$ award 1/2 ✗✓1

2. (a) $\begin{pmatrix} 3 \\ 4 \\ -1 \end{pmatrix} + \begin{pmatrix} 5 \\ 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 8 \\ 7 \\ 1 \end{pmatrix} \rightarrow \begin{pmatrix} 24 \\ 21 \\ 3 \end{pmatrix} [3(\mathbf{a} + \mathbf{b})]$ award 1/2 ✗✓1

(b) $\begin{pmatrix} 9 \\ 12 \\ -3 \end{pmatrix} + \begin{pmatrix} 15 \\ 9 \\ 6 \end{pmatrix} = \begin{pmatrix} 24 \\ 21 \\ 3 \end{pmatrix} [3\mathbf{a} + 3\mathbf{b}]$ award 1/2 ✓✗

3. $\begin{pmatrix} 3 \\ 4 \\ -1 \end{pmatrix} + \begin{pmatrix} 5 \\ 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 8 \\ 7 \\ 1 \end{pmatrix} [\mathbf{a} + \mathbf{b}]$ award 0/2

Question		Generic scheme	Illustrative scheme	Max mark
5.	(a)	<ul style="list-style-type: none"> •¹ correct median •² find quartiles •³ calculate IQR 	<ul style="list-style-type: none"> •¹ 200 •² 160, 230 •³ 70 	3
<p>Notes:</p> <p>1. (a) Correct median without working award •¹. (b) Correct IQR without working, do not award •² or •³.</p> <p>2. Accept quartiles indicated in the list or on a diagram for •².</p> <p>3. Where a candidate calculates the range, award marks as follows: (a) median = 200, quartiles = 160 and 230, IQR = 240 – 155 = 85 award 2/3 ✓✓x (b) median = 200, Q₁ = 155 and Q₃ = 240 (clearly labelled as Q₁ and Q₃) → IQR = 240 – 155 = 85 award 2/3 ✓x✓1 (c) median = 200, IQR = 240 – 155 = 85 award 1/3 ✓xx</p> <p>4. Where a candidate has calculated SIQR = 35, •³ can only be awarded where the candidate has explicitly stated “IQR = 70” eg (a) median = 200, quartiles = 160 and 230, IQR = 70, SIQR = 35 award 3/3 (b) median = 200, quartiles = 160 and 230 → (IQR =) 35 award 2/3 ✓✓x</p> <p>5. Where a candidate has calculated the IQR, but stated SIQR = 70, •³ is available eg median = 200, quartiles = 160 and 230, SIQR = 70 award 3/3</p> <p>Commonly Observed Responses:</p> <p>1. median = 200, IQR = 235 – 157.5 = 77.5(0) award 2/3 ✓x✓1</p>				

Question		Generic scheme	Illustrative scheme	Max mark
5.	(b)	<ul style="list-style-type: none"> •⁴ valid comment comparing medians •⁵ valid comment comparing IQRs 	<ul style="list-style-type: none"> •⁴ On average, the prices are lower on the website. •⁵ The prices in the shop are more consistent. 	2

Notes:

1. Answers must be consistent with answers to part (a).
2. Comments must clearly distinguish between the **prices** in the **shop** and on the **website** (or equivalent). Accept “**on display**” as evidence of the shop.
 - (a) Accept eg On average the **prices** on the **website** are lower and less consistent.
 - (b) Do not accept eg On average the prices are lower and less consistent.
3. For the award of •⁴
 - (a) Accept eg
 - On average the **prices** in the shop are more.
 - (b) Do not accept eg
 - The **median** price in the shop is higher.
 - The **prices** on the website are less (this implies that all prices are less).
 - On average the **results/scores/data** in the shop are more.
4. For the award of •⁵
 - (a) Accept eg
 - The **spread** of prices is **more** on the **website**.
 - The prices in the **shop** are **less varied**.
 - (b) Do not accept eg
 - The **IQR** in the shop is less.
 - The **range** of prices on the website is more.
 - **On average** the prices on the website are more varied.
 - The **IQR of the prices** in the shop is more consistent.
 - The **results/scores/data** in the shop are more consistent.
5. Numbers are not required for marks •⁴ and •⁵. However, where they appear they must be consistent with the statement.

eg (i) for answers in parts (a) and (b) award as follows:

- | | |
|--|---------------------|
| (a) median = 200, IQR = 230 – 160 = 70 | award 3/3 |
| (b) On average the prices are lower on the website as 70 < 73.
The prices in the shop are more consistent as 200 > 195. | award 0/2 xx |

(ii) for answers in parts (a) and (b) award as follows:

- | | |
|--|---------------------|
| (a) median = 200, IQR = 230 - 160 = 70 | award 3/3 |
| (b) On average the prices are lower on the website as 200 < 195.
The prices in the shop are more consistent as 70 > 73. | award 0/2 xx |

Commonly Observed Responses:

For answers in parts (a) and (b) award as follows:

- | | |
|--|---------------------|
| 1. (a) median = 200, IQR = 230 – 160 = 70 | award 3/3 |
| (b) On average the prices in the second shop were lower
The prices in the first shop were less varied | award 0/2 xx |

Question		Generic scheme	Illustrative scheme	Max mark
6.		<ul style="list-style-type: none"> •¹ simplify surd •² complete simplification 	<ul style="list-style-type: none"> •¹ $5\sqrt{3}$ •² $4\sqrt{3}$ 	2
Notes: 1. Correct answer without working award 0/2 2. For subsequent incorrect working • ² is not available.				
Commonly Observed Responses: 1. (a) $5\sqrt{3} - \sqrt{3} = 5$ award 1/2 ✓✗ (b) $\sqrt{25}\sqrt{3} - \sqrt{3} = \sqrt{25} = 5$ award 0/2 2. (a) $\sqrt{72} = 6\sqrt{2}$ award 1/2 ✓1✗ (b) $\sqrt{72} = 3\sqrt{8}$ award 0/2				

Question		Generic scheme	Illustrative scheme	Max mark
7.		<p>Method 1</p> <ul style="list-style-type: none"> •¹ correct scaling •² value for p •³ value for r <p>Method 2</p> <ul style="list-style-type: none"> •¹ correct scaling •² value for r •³ value for p 	<p>Method 1</p> <ul style="list-style-type: none"> •¹ $4p - 14r = 22$ $21p + 14r = 28$ •² $p = 2$ •³ $r = -1$ <p>Method 2</p> <ul style="list-style-type: none"> •¹ $6p - 21r = 33$ $6p + 4r = 8$ •² $r = -1$ •³ $p = 2$ 	3

Notes:

1. Correct answers without working award 0/3
2. For a solution obtained by repeated substitution award 0/3
3. Following an earlier error
 - (a) accept rounded answers given to at least 1 decimal place.
 - (b) for •³ do not penalise incorrect conversion of a fraction to a mixed number or decimal.
4. Where candidate uses separate scaling to obtain each variable, award •¹ if either is correct. See CORs 1 to 4.

Commonly Observed Responses:

- | | |
|--|---|
| <p>1. $4p - 14r = 20$ (incorrect scaling)
 $21p + 14r = 28$
 $p = \frac{48}{25}$ •³ ✗</p> | <p>$6p - 21r = 33$ (correct scaling)
 $6p + 4r = 8$ •¹ ✓
 $r = -1$ •² ✓</p> <p style="text-align: right;">award 2/3 ✓✓✗</p> |
| <p>2. $4p - 14r = 20$ (incorrect scaling)
 $21p + 14r = 28$
 $p = \frac{8}{17}$ •³ ✗</p> | <p>$6p - 21r = 33$ (correct scaling)
 $6p + 4r = 8$ •¹ ✓
 $r = -1$ •² ✓</p> <p style="text-align: right;">award 2/3 ✓✓✗</p> |
| <p>3. $4p - 14r = 20$ (incorrect scaling)
 $21p + 14r = 28$
 $p = \frac{48}{25}$ •³ ✗</p> | <p>$6p - 21r = 33$ (correct scaling)
 $6p + 4r = 8$ •¹ ✓
 $r = -\frac{41}{17}$ •² ✗</p> <p style="text-align: right;">award 1/3 ✓✗✗</p> |
| <p>4. $4p - 14r = 20$ (incorrect scaling)
 $21p + 14r = 28$
 $p = \frac{8}{17}$ •³ ✗</p> | <p>$6p - 21r = 33$ (incorrect scaling)
 $6p - 4r = 8$ •¹ ✗
 $r = -\frac{25}{17}$ •² ✓1</p> <p style="text-align: right;">award 1/3 ✗✓1✗</p> |

Question		Generic scheme	Illustrative scheme	Max mark
8.	(a)	• ¹ state value of a	• ¹ 7	1
Notes: 1. For $y = 7 \cos \dots x$ award 1/1 ✓ 2. For 7, -7 award 0/1 ✗				
Commonly Observed Responses:				
	(b)	• ² state value of b	• ² 2	1
Notes: 1. For $y = \dots \cos 2x$ award 1/1 ✓ 2. For $a = 2$ in (a) and $b = 7$ in (b) award 0/1 in (a) ✗ and award 1/1 in (b) ✓1				
Commonly Observed Responses:				

Question		Generic scheme	Illustrative scheme	Max mark
9.	(a)	<p>Method 1</p> <ul style="list-style-type: none"> •¹ find gradient •² substitute gradient and a point into $y - b = m(x - a)$ •³ state equation in terms of D and T in simplest form (remove brackets and collect constants) <p>Method 2</p> <ul style="list-style-type: none"> •¹ find gradient •² substitute gradient and a point into $y = mx + c$ •³ state equation in terms of D and T in simplest form (remove brackets and collect constants) 	<ul style="list-style-type: none"> •¹ -2 •² $y - 26 = -2(x - 3)$ or $y - 12 = -2(x - 10)$ •³ $D = -2T + 32$ or equivalent <ul style="list-style-type: none"> •¹ -2 •² $26 = -2 \times 3 + c$ or $12 = -2 \times 10 + c$ •³ $D = -2T + 32$ or equivalent 	3

Notes:

- Correct answer without working award 0/3
- (a) For the award of •¹ accept $-\frac{14}{7}$. However see Note 3(a).
 (b) BEWARE •¹ is not available for $\frac{26 - 12}{3 - 10} = \frac{-14}{7} = -2$ or $\frac{12 - 26}{10 - 3} = \frac{14}{-7} = -2$
- For an incorrect simplification of a gradient, a mark is not awarded at the point where the error occurs eg

(a) $-\frac{14}{7} = 2 \rightarrow 26 = 2 \times 3 + c \rightarrow D = 2T + 20$	award 2/3 x✓1✓1
(b) $-\frac{14}{7} \rightarrow 26 = 2 \times 3 + c \rightarrow D = 2T + 20$	award 2/3 ✓x✓1
(c) $-\frac{14}{7} \rightarrow 26 = -\frac{14}{7} \times 3 + c \rightarrow D = 2T + 20$	award 2/3 ✓✓x

Commonly Observed Responses:

Working must be shown

- $y = -2x + 32$ award 2/3 ✓✓✓2
- $D = -\frac{2}{1}T + 32$ award 2/3 ✓✓✓2
- $-\frac{7}{14} \rightarrow y - 26 = -\frac{7}{14}(x - 3) \rightarrow D = -\frac{1}{2}T + 27.5$ award 2/3 x✓1✓1
- $\frac{7}{14} \rightarrow y - 26 = \frac{7}{14}(x - 3) \rightarrow D = \frac{1}{2}T + 24.5$ award 2/3 x✓1✓1

Question		Generic scheme	Illustrative scheme	Max mark
9.	(b)	• ⁴ calculate distance remaining	• ⁴ 18 (km)	1
Notes:				
1. Consistent answer without working			award 1/1	
2. • ⁴ is not available if the gradient is ± 1 .				
Commonly Observed Responses:				
No working necessary				
1. $D = 2T - 8$ in part (a) leading to $2 \times 7 - 8 = 6$ (km)			award 1/1 ✓1	
2. (a) $D = -2T - 8$ in part (a) leading to $-2 \times 7 - 8 = -22$ (km)			award 1/1 ✓1	
(b) $D = -2T - 8$ in part (a) leading to $-2 \times 7 - 8 = -22 \rightarrow 22$ (km)			award 1/1 ✓1	
(c) $D = -2T - 8$ in part (a) leading to $-2 \times 7 - 8 = 22$ (km)			award 0/1 ✗	

Question		Generic scheme	Illustrative scheme	Max mark
10.		<ul style="list-style-type: none"> •¹ calculate size of angle OFD •² calculate size of angle BOD or FED •³ calculate size of angle BCD 	<ul style="list-style-type: none"> •¹ 55 •² BOD = 110 or FED = 20 •³ 70 	3

Notes:

1. Correct answer without working award 0/3
2. Degree signs are not required
3. Full marks may be awarded for information marked on the diagram.
4. For the award of •² accept BAG = 20
5. Where information is not marked on the diagram then working must clearly attach calculations to **named** angles. The final answer must be **clearly** indicated.
6. Where a candidate marks an answer on the diagram but then writes a different answer outwith the diagram, award marks for the angles indicated on the diagram.
7. Disregard incorrect angles which are not on the valid pathway followed by the candidate.
8. For the award of •³ BCD must be less than 90.
9. Where angle BOD is assumed, •³ is not available.
eg BOD = 140 → BCD = 40 award 0/3

Commonly Observed Responses:

1. OFD = 55 → FOD = 55 → BOD = 125 → BCD = 55 award 2/3 ✓x✓1
2. OFD = 55 → FOD (= FDO) = 62.5 → BOD = 117.5 → BCD = 62.5 award 2/3 ✓x✓1
3. (a) OFD = FDO = FOD = 60 → BOD = 120 → BCD = 60 award 1/3 x✓2✓1
(b) OFD = FDO = FOD = 60 → FED = 30 → BCD = 60 award 1/3 x✓2✓1
4. (a) FDE = 27.5 → FDO = OFD = 62.5 → BOD = 125 → BCD = 55 award 2/3 x✓1✓1
(b) OFD = 55, FDE = 27.5 → FDO = 62.5 → BOD = 125 → BCD = 55 award 2/3 ✓x✓1
5. (a) FED = 27.5 → BCD = 62.5 award 1/3 xxx✓1
(b) OFD = 55, FED = 27.5 → BCD = 62.5 award 2/3 ✓x✓1

Question		Generic scheme	Illustrative scheme	Max mark
11.		<ul style="list-style-type: none"> •¹ isolate term in y or divide throughout by 4 •² state gradient explicitly 	<ul style="list-style-type: none"> •¹ eg $4y = -x + 24$ or $x - 24 = -4y$ or $\frac{1}{4}x + y - \frac{24}{4} = 0$ •² $-\frac{1}{4}$ or -0.25 	2
Notes:				
1. Correct answer without working				award 2/2
2. For the award of • ² :				
(a) accept $\frac{-1}{4}$ or $\frac{1}{-4}$				
(b) do not accept $x = -\frac{1}{4}$ or $y = -\frac{1}{4}$				
(c) do not penalise incorrect or no simplification of constant term				
eg (i) $4y = -x + 24 \rightarrow y = -\frac{1}{4}x + 8 \rightarrow -\frac{1}{4}$				award 2/2
(ii) $4y = -x + 24 \rightarrow y = -\frac{1}{4}x + 24 \rightarrow -\frac{1}{4}$				award 2/2
3. Where gradient formula is used with two points which				
(a) lie on the line $x + 4y - 24 = 0$,				
(i) award • ¹ for correct substitution into gradient formula.				
(ii) award • ² for correct calculation of gradient.				
(b) do not lie on the line $x + 4y - 24 = 0$				award 0/2
Commonly Observed Responses:				
1. $-\frac{1}{4}x$ or $-0.25x$				award 1/2 ✓x

Question		Generic scheme	Illustrative scheme	Max mark
12.	(a)	<ul style="list-style-type: none"> •¹ correct bracket with square •² complete process consistently 	<ul style="list-style-type: none"> •¹ $(x-3)^2 \dots$ •² $(x-3)^2 - 1$ 	2

Notes:

- | | |
|---|--|
| 1. Correct answer without working | award 2/2 |
| 2. Answer for • ² must be consistent with • ¹ | |
| eg (a) $(x+3)^2 - 1$ | award 1/2 x✓1 |
| (b) $(x \pm 6)^2 - 28$ | award 1/2 x✓1 |
| (c) $(x \pm 6)^2 - 1$ | award 0/2 |

Commonly Observed Responses:

No working necessary.

- | | |
|---|--|
| 1. Award 2/2 for | (a) $(x-3)^2 + -1$ or $(x-3)^2 + (-1)$ |
| | (b) $(x-3)(x-3) - 1$ |
| 2. Award 1/2 x✓1 for | (a) $(x^2 \pm 3) - 1$ |
| | (b) $(x^2 \pm 3)^2 - 1$ |
| | (c) $(x \pm 3x)^2 - 1$ |
| | (d) $(x^2 \pm 3x)^2 - 1$ |

	(b)	• ³ state coordinates of turning point	• ³ $(3, -1)$	1
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Notes:

1. Answer must be consistent with (a) unless candidate uses method in note 2.
2. Accept correct answer obtained by factorising, finding roots and using symmetry.
ie $x^2 - 6x + 8 = 0 \rightarrow (x-2)(x-4) = 0 \rightarrow x = 2, 4 \rightarrow x = 3$ (x coordinate of turning point) $\rightarrow y = -1$
3. Coordinates of turning point may appear on diagram or **clearly** labelled in part (c).
4. Accept $x = 3, y = -1$.
5. •³ is not available where brackets are omitted, unless answer is in the form shown in note 4 or omission of brackets has already been penalised in Qu4.

Commonly Observed Responses:

Question		Generic scheme	Illustrative scheme	Max mark
12.	(c)	<ul style="list-style-type: none"> •⁴ find x coordinate •⁵ find y coordinate 	<ul style="list-style-type: none"> •⁴ (6,...) •⁵ (... ,8) 	2

Notes:

1. Correct answer or answer consistent with part (b) without working award 2/2
2. Do not award •⁴ if:
 - (a) the x -coordinate in (b) and (c) are the same. However, see Note 3.
 - (b) the x -coordinate is less than the x -coordinate of the turning point.
3. For the award of •⁴ answer must be consistent with part (b) unless there is evidence of an alternative valid strategy in part (c)
eg finding roots and using symmetry: $x^2 - 6x + 8 = 0 \rightarrow (x-2)(x-4) = 0 \rightarrow x = 2, 4 \rightarrow x_Q = 6$
4. Do not award •⁵ if the y -coordinate in (b) and (c) are the same unless there is evidence of an alternative valid strategy in part (c)
eg $y_Q = 0^2 - 6 \times 0 + 8 = 8$
5. •⁵ is not available where brackets are omitted, unless answer is in the form shown in note 6 or omission of brackets has already been penalised in Qu4 or Qu12(b).
6. Accept answer in the form $x = \dots, y = \dots$
7. Coordinates of Q may appear on diagram.

Commonly Observed Responses:

1. (8, 6) (coordinates in wrong order but consistent with part (b)) award 1/2 ~~x~~✓1
2. For answers in parts (a), (b) and (c) award as follows:

(a) $(x-3)^2 - 1$	award 2/2 ✓✓
(b) (6, 8)	award 0/1 x
(c) (12, 8) in part (c) (no working)	award 1/2 ✓1 x
3. For answers in parts (a), (b) and (c) award as follows:

(a) $(x-6)^2 - 28$	award 1/2 x ✓1
(b) (6, 8)	award 0/1 x
(c) (12, 80) in part (c) (no working)	award 2/2 ✓1✓1
4. For answers in parts (a), (b) and (c) award as follows:

(a) $(x-6)^2 + 8$	award 0/2 x x
(b) (6, 8)	award 1/1 ✓1
(c) $y_Q = 0^2 - 6 \times 0 + 8 = 8 \rightarrow (6, 8)$	award 1/2 x ✓

Question		Generic scheme	Illustrative scheme	Max mark
13.		<ul style="list-style-type: none"> •¹ apply $x \times x^{\frac{m}{n}}$ or $x \times x^{-1}$ •² apply $x \times x^{\frac{m}{n}}$ and $x \times x^{-1}$ and simplify 	<ul style="list-style-type: none"> •¹ $x^{\frac{3}{2}} \dots$ or $\dots + x^0$ (or $\dots + 1$) •² $x^{\frac{3}{2}} + 1$ 	2
<p>Notes:</p> <p>1. Correct answer without working award 2/2</p> <p>2. Accept $x^{\frac{1}{2}} + 1$ or $x^{1.5} + 1$ as bad form.</p> <p>3. Accept $\sqrt{x^3} + 1$.</p> <p>4. (a) For subsequent incorrect working •² is not available. eg $x^{\frac{3}{2}} + 1 = 2x^{\frac{3}{2}}$ award 1/2 ✓x</p> <p>(b) However, do not penalise $x^{\frac{3}{2}} + 1 = \sqrt[3]{x^2} + 1$ award 2/2</p> <p>5. Where terms in the brackets have been reduced to one term, •¹ is not available for subsequently applying the rule $x \times x^{\frac{m}{n}}$. eg $x \left(x^{-\frac{1}{2}} \right) = x^{\frac{1}{2}}$ award 0/2</p>				
<p>Commonly Observed Responses:</p> <p>1. $x^{\frac{3}{2}} + x^0$ award 1/2 ✓✓2</p> <p>2. $x^{\frac{3}{2}} + x = \sqrt[3]{x^2} + x$ award 1/2 ✓x</p> <p>3. $x(x^{-2}) = x^{-1}$ award 0/2</p>				

Question		Generic scheme	Illustrative scheme	Max mark
14.		<ul style="list-style-type: none"> •¹ valid scale factor •² consistent scaling of AD •³ calculate BD 	<ul style="list-style-type: none"> •¹ $\frac{3}{7}$ or $\frac{7}{3}$ •² 4.5 stated or implied by •³ •³ 6 (cm) 	3

Notes:

1. Correct answer without working award 0/3
2. For the award of •¹ accept $\frac{10.5}{7} \times 3$ or $\frac{AB}{3} = \frac{10.5}{7}$.
3. For an incorrect calculation of AB leading to a negative length for BD, •³ is not available
eg $10.5 \times \frac{7}{3} = 24.5 \rightarrow 10.5 - 24.5 = -14$ (cm) award 1/3 ✓xx
4. For a rounded decimal approximation to $\frac{3}{7}$ or $\frac{7}{3}$, •² is not available
eg (a) $\frac{3}{7} = 0.43 \rightarrow 0.43 \times 10.5 = 4.515 \rightarrow 10.5 - 4.515 = 5.985$ (cm) award 2/3 ✓x✓1
(b) $\frac{3}{7} = 0.4 \rightarrow 0.4 \times 10.5 = 4.2 \rightarrow 10.5 - 4.2 = 6.3$ (cm) award 2/3 ✓x✓1
5. •³ is only available for subtracting AB from 10.5 where AB is calculated within a valid strategy and AB is less than 10.5.
6. For the award of •² disregard mislabelling of AB as BD
eg $BD = \frac{3}{7} \times 10.5 = 4.5$ award 2/3 ✓✓^
7. Where an incorrect scale factor is a unitary fraction, •² is not available
eg scale factor = $\frac{1}{4} \rightarrow 10.5 \times \frac{1}{4} = 2.625 \rightarrow 10.5 - 2.625 = 7.875$ award 1/3 xx✓1

Commonly Observed Responses:

1. (a) $10.5 \times \frac{7}{3} = 24.5 \rightarrow 24.5 - 10.5 = 14$ (cm) award 1/3 ✓xx
(b) $10.5 \div \frac{7}{3} = 4.5 \rightarrow 10.5 - 4.5 = 6$ (cm) award 3/3
2. $10.5 - 3 = 7.5$ (cm) award 0/3

[END OF MARKING INSTRUCTIONS]



National
Qualifications
2024

2024 Mathematics

National 5 - Paper 2

Question Paper Finalised Marking Instructions

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Marking Instructions for each question

Question		Generic scheme	Illustrative scheme	Max mark
1.		<ul style="list-style-type: none"> •¹ know how to decrease by 26% •² know how to calculate value •³ evaluate 	<ul style="list-style-type: none"> •¹ $\times 0.74$ •² 460×0.74^3 •³ (£) 186.40 	3
Notes:				
1. Correct answer without working			award 3/3	
2. For the award of • ³ accept 186. However, do not accept 186.4 or 190.				
3. For a year-by-year approach, accept				
eg $460 \times 0.74 = 340.4(0) \rightarrow 340.4 \times 0.74 = 251.9(0)$				
$\rightarrow 251.90 \times 0.74 (= 186.406) = 186.41$ or 186.40 or 186			award 3/3	
4. Disregard rounding subsequent to the correct answer.				
5. Where an incorrect percentage is used, the working must be followed through to give the possibility of awarding 2/3.				
eg $460 \times 1.26^3 = 920.17$ or 920			award 2/3 x✓1✓1	
6. Where an incorrect power (≥ 2) is used, the working must be followed through to give the possibility of awarding 2/3.				
eg $460 \times 0.74^2 = 251.90$ or 252			award 2/3 ✓x✓1	
7. • ³ is unavailable for incorrect working subsequent to correct answer				
eg $460 \times 0.74^3 = 186.40 \rightarrow 460 - 186.40 = 273.60$			award 2/3 ✓✓x	
8. Where division is used:				
(a) along with 0.74^3 • ¹ is not available.				
eg $460 \div 0.74^3 = 1135.17$ or 1135			award 2/3 x✓1✓1	
(b) along with an incorrect percentage • ¹ and • ² are not available.				
eg $460 \div 1.26^3 = 229.96$ or 230			award 1/3 xx✓1	
Commonly Observed Responses:				
1. (a) $460 \times 0.74^3 = 186.40304$			award 2/3 ✓✓✓2	
(b) $460 \times 0.74^3 = 186.403$			award 2/3 ✓✓x	
2. $460 \times 0.74 = 340.40$ or 340			award 1/3 ✓x✓2	
3. $460 \times 0.74 \times 3 = 1021.20$ or 1021			award 1/3 ✓x✓2	
4. (a) $460 \times 0.26 = 119.60 \rightarrow 460 - 3 \times 119.60 = 101.20$			award 1/3 ✓x✓2	
(b) $460 \times 0.26 = 120 \rightarrow 460 - 3 \times 120 = 100$			award 1/3 ✓x✓2	
5. $460 \times 0.26 \times 3 = 358.80$ or 359			award 0/3 xx✓2	

Question		Generic scheme	Illustrative scheme	Max mark
2.		<ul style="list-style-type: none"> •¹ correct method •² evaluate and write in scientific notation 	<ul style="list-style-type: none"> •¹ $1.22 \times 10^6 \times 250$ or equivalent •² 3.05×10^8 	2
Notes:				
1. Correct answer without working			award 2/2	
2. (a) For 305 000 000			award 1/2 ✓✓2	
(b) For 305×10^6			award 1/2 ✓x	
3. For the award of • ²				
(a) $(1.22 \times 10^6 \times 250 =) 3.05 \times 10^8 = 3.1 \times 10^8$ or 3×10^8			award 2/2	
(b) $(1.22 \times 10^6 \times 250 =) 3.1 \times 10^8$ or 3×10^8			award 1/2 ✓x	
4. For subsequent incorrect working, • ² is not available.				
eg $250 \div (1.22 \times 10^6) = 2.049180328 \times 10^{-4} = 2.05 \times 10^{-9}$			award 0/2 xx	
Commonly Observed Responses:				
1. $1.22 \times 10^6 \div 250 = 4.88 \times 10^3$			award 1/2 xv1	
2. (a) $250 \div (1.22 \times 10^6) = 2.05 \times 10^{-4}$ or $2.049 \dots \times 10^{-4}$			award 1/2 xv1	
(b) $250 \div (1.22 \times 10^6) = 2.05 \times 10^8$ or $2.049 \dots \times 10^8$			award 0/2 xx	

Question		Generic scheme	Illustrative scheme	Max mark
3.		<ul style="list-style-type: none"> •¹ correct substitution into cosine rule •² evaluate $\cos A$ •³ calculate angle 	<ul style="list-style-type: none"> •¹ $\frac{18^2 + 25^2 - 34^2}{2 \times 18 \times 25}$ stated or implied by •² •² $-\frac{23}{100}$ or $-\frac{207}{900}$ or -0.23 •³ $103(.29\dots)$ 	3

Notes:

1. Correct answer without working award 0/3
2. Degree sign is not required.
3. For the award of •¹ accept eg $34^2 = 18^2 + 25^2 - 2 \times 18 \times 25 \times \cos A$
4. For the award of •³ accept $\cos A = 103(.29\dots)$
5. Where wrong angle has been calculated correctly

(a) $\frac{34^2 + 25^2 - 18^2}{2 \times 34 \times 25} = \frac{1457}{1700} \rightarrow 31(.01\dots)$	award 2/3 x✓1✓1
(b) $\frac{34^2 + 18^2 - 25^2}{2 \times 34 \times 18} = \frac{855}{1224} \rightarrow 46$ or $45.69\dots$	award 2/3 x✓1✓1
6. **BEWARE** $180 - (18 + 25 + 34) = 103$ award 0/3
7. Where more than one **final** angle is stated, •³ is not available
eg $\frac{18^2 + 25^2 - 34^2}{2 \times 18 \times 25} \rightarrow -0.23 \rightarrow 103.3$ **and** 256.7 award 2/3 ✓✓x
8. Inappropriate use of RAD or GRAD should only be penalised once in Qu3, Qu11 or Qu13
 - (a) 2 or 1.80... RAD
 - (b) 115 or 114.77... GRAD

Commonly Observed Responses:

1. $\frac{18^2 + 25^2 - 34^2}{2 \times 18 \times 25} \rightarrow -0.23 \rightarrow \cos^{-1}(0.23) = 76.7 \rightarrow 180 - 76.7 = 103.3$ award 3/3

Question		Generic scheme	Illustrative scheme	Max mark
4.		<ul style="list-style-type: none"> •¹ start to process left hand side •² rearrange (collect constants on one side and variables on the other side) •³ solve for x 	<ul style="list-style-type: none"> •¹ $5x - 10 + 4$ •² $-14 < 2x$ or $-2x < 14$ •³ $-7 < x$ or $x > -7$ 	3
Notes:				
1. Correct answer without valid working award 0/3 Treat repeated substitution as invalid working.				
2. (a) There must be evidence that the candidate has dealt with the negative coefficient of x on the LHS of the inequation by either:				
(i) reversing the direction of the inequality sign at • ³				
eg $5x - 10 + 4 < 7x + 8 \rightarrow -2x < 22 \rightarrow x > -11$ award 2/3 ✓×✓1				
OR (ii) collecting the x term(s) on the RHS of the inequation at • ²				
eg $5x - 10 + 4 < 7x + 8 \rightarrow 2 < 2x \rightarrow 1 < x$ award 2/3 ✓×✓1				
(b) Where a candidate requires to do neither of the above, then • ³ is not available				
eg $5x - 10 + 4 < 7x + 8 \rightarrow 2x < 14 \rightarrow x < 7$ award 1/3 ✓××				
3. For subsequent incorrect working, • ³ is not available.				
eg (a) $-7 < x \rightarrow x < -7$ award 2/3 ✓✓×				
(b) $-7 < x \rightarrow x = -7$ award 2/3 ✓✓×				
Commonly Observed Responses:				
1. $5x - 2 + 4 < 7x + 8 \rightarrow -2x < 6 \rightarrow x > -3$ award 2/3 ×✓1✓1				
2. (a) $5x - 10 + 4 = 7x + 8 \rightarrow -2x = 14 \rightarrow x = -7 \rightarrow x > -7$ award 3/3				
(b) $5x - 10 + 4 = 7x + 8 \rightarrow -2x = 14 \rightarrow x = -7$ award 2/3 ✓✓×				

Question		Generic scheme	Illustrative scheme	Max mark
5.		<ul style="list-style-type: none"> •¹ know that $116\% = 278.40$ •² begin valid strategy •³ complete calculation within valid strategy 	<ul style="list-style-type: none"> •¹ $116\% = 278.40$ •² eg $(1\% =) \frac{278.40}{116}$ •³ (£) 240 	3
Notes:				
1. Correct answer without working			award 3/3	
2. (a) $116\% = 278.40 \rightarrow 16\%$ of $278.40 = 44.54$			award 1/3 ✓xx	
(b) 16% of $278.40 = 44.54$			award 0/3	
3. (a) $116\% = 278.40 \rightarrow 116\%$ of $278.40 = 322.94$			award 1/3 ✓xx	
(b) 116% of $278.40 = 322.94$			award 0/3	
4. (a) $116\% = 278.40 \rightarrow 84\%$ of $278.40 = 233.86$			award 1/3 ✓xx	
(b) 84% of $278.40 = 233.86$			award 0/3	
Commonly Observed Responses:				
1. $\frac{278.40}{1.16} = 240$			award 3/3	
2. $\frac{278.40}{84} = 3.31428\dots \rightarrow 331.43$			award 2/3 x✓1✓1	

Question		Generic scheme	Illustrative scheme	Max mark
6.	(a)	• ¹ factorise	• ¹ $y(y-6)$	1
Notes: 1. If part (a) is not attempted, accept correct answer to part (a) in part (b) (see COR 1).				
Commonly Observed Responses: 1. $(y-6)(y\pm 0)$ award 0/1 ✓2 2. See CORs in part (b).				
	(b)	• ² factorise denominator • ³ simplify	• ² $(y-6)(y+3)$ • ³ $\frac{y}{y+3}$	2
Notes: 1. Correct answer without working award 2/2 2. For subsequent incorrect working • ³ is not available eg $\frac{\cancel{y}}{y+3} = \frac{1}{1+3} = \frac{1}{4}$ award 1/2 ✓✗ 3. • ³ is only available when both the numerator and denominator have at least two factors. 4. Do not penalise the use of $(y-6)(y\pm 0)$ in part (b) if already penalised in part (a) ie (a) $(y-6)(y\pm 0)$ (b) $\frac{(y-6)(y\pm 0)}{(y-6)(y+3)} = \frac{y\pm 0}{y+3}$ award 0/1 in (a) ✓2 and award 2/2 in (b) ✓✓1 5. Where the answer to part (a) and the numerator in part (b) are different, see CORs below.				
Commonly Observed Responses: For answers in parts (a) and (b) award as follows:				
1.	(a) No response	(b) $\frac{y(y-6)}{(y-6)(y+3)} = \frac{y}{y+3}$	award 1/1 in (a) ✓ and award 2/2 in (b) ✓✓	
2.	(a) $y(y-6)$	(b) $\frac{(y-3)(y+3)}{(y-6)(y+3)} = \frac{y-3}{y-6}$	award 1/1 in (a) ✓ and award 1/2 in (b) ✓✗	
3.	(a) $(y-3)(y+3)$	(b) $\frac{y(y-6)}{(y-6)(y+3)} = \frac{y}{y+3}$	award 0/1 in (a) ✗ and award 2/2 in (b) ✓✓	
4.	(a) $(y-3)(y+3)$	(b) $\frac{(y-3)(y+3)}{(y-6)(y+3)} = \frac{y-3}{y-6}$	award 0/1 in (a) ✗ and award 2/2 in (b) ✓✓1	
5.	(a) $(y-3)(y+3)$	(b) $\frac{(y-6)(y\pm 0)}{(y-6)(y+3)} = \frac{y\pm 0}{y+3}$	award 0/1 in (a) ✗ and award 1/2 in (b) ✓✗	
6.	(a) $(y-6)(y+2y)$	(b) $\frac{(y-6)(y+2y)}{(y-6)(y+3)} = \frac{y+2y}{y+3}$	award 0/1 in (a) ✗ and award 1/2 in (b) ✓✓2	

Question		Generic scheme	Illustrative scheme	Max mark
7.		<ul style="list-style-type: none"> •¹ correct substitution into volume of sphere formula •² correct substitution into volume of cuboid formula and know to subtract volume of hemisphere from volume of cuboid •³ consistent calculation (see Note 3) •⁴ round final answer to 2 significant figures and state correct units 	<ul style="list-style-type: none"> •¹ $\frac{4}{3} \times \pi \times 3^3$ •² $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3$ (= 196 – 56.54...) •³ 139.45... •⁴ 140 cm³ 	4

Notes:

1. Correct answer without working award 0/4
2. For the award of •³, the calculation must involve the sum or difference of a calculation involving a fraction, π and a power, and a calculation of a product of at least two numbers.
3. Accept variations in π to at least two decimal places
eg $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times 3.14 \times 3^3 = 139.48 = 140 \text{ cm}^3$
4. Disregard errors due to premature rounding provided there is evidence. However do not accept rounding of $\frac{4}{3}$ to fewer than 2 decimal places
eg (a) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 = 196 - 0.5 \times 1.33 \times 3.14 \times 3^3 = 196 - 56.38 = 139.62 \rightarrow 140 \text{ cm}^3$
award 4/4
(b) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 = 196 - 0.5 \times 1.3 \times 3.14 \times 3^3 = 196 - 55.1 = 140.9 \rightarrow 140 \text{ cm}^3$
award 3/4 ✓✓x✓1
(c) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 = 196 - 56.38 = 139.62 \rightarrow 140 \text{ cm}^3$
award 3/4 ✓✓x✓1
5. (a) In awarding •³ answers to intermediate calculations which are **whole numbers** should not be rounded
eg (i) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 = 196 - 57 = 139 \rightarrow 140 \text{ cm}^3$ award 4/4
(ii) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 = 200 - 57 = 143 \rightarrow 140 \text{ cm}^3$ award 3/4 ✓✓x✓1
(b) In awarding •⁴ intermediate calculations need not be shown
eg $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 = 140 \text{ cm}^3$ award 4/4
6. •⁴ is only available where the final answer requires rounding
eg $7 \times 7 \times 4 - \frac{4}{3} \times \pi \times 3^3 = 196 - 113 = 83 \text{ cm}^3$ award 2/4 ✓x✓1x

Question	Generic scheme	Illustrative scheme	Max mark
7. (continued)			
Commonly Observed Responses:			
1. $7 \times 7 \times 4 - \frac{4}{3} \times \pi \times 3^3 = 82.902\dots = 83 \text{ cm}^3$		award 3/4 ✓×✓1✓1	
2. (a) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3 = -256.389\dots = -260 \text{ cm}^3$		award 2/4 ×✓1✓1×	
(b) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3 = 256.389\dots = 260 \text{ cm}^3$		award 2/4 ×✓1×✓1	
(c) $\frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3 - 7 \times 7 \times 4 = 256.389\dots = 260 \text{ cm}^3$		award 2/4 × ×✓1✓1	
3. (a) $7 \times 7 \times 4 + \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 = 252.5\dots = 250 \text{ cm}^3$		award 3/4 ✓×✓1✓1	
(b) $7 \times 7 \times 4 + \frac{4}{3} \times \pi \times 3^3 = 309.09\dots = 310 \text{ cm}^3$		award 3/4 ✓×✓1✓1	
(c) $7 \times 7 \times 4 + \frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3 = 648.389\dots = 650 \text{ cm}^3$		award 2/4 ××✓1✓1	
4. (a) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^2 = 177.15\dots = 180 \text{ cm}^3$		award 3/4 ×✓✓1✓1	
(b) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 = 177.15\dots = 180 \text{ cm}^3$		award 3/4 ✓✓×✓1	
(c) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3 = 189.71\dots = 190 \text{ cm}^3$		award 2/4 ×✓✓2✓1	
5. (a) $\frac{4}{3} \times \pi \times 3^3 = 110 \text{ cm}^3$		award 2/4 ✓×✓2✓1	
(b) $\frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 = 57 \text{ cm}^3$		award 2/4 ✓×✓2✓1	
6. (a) $\frac{4}{3} \times \pi \times 6^3 = 900 \text{ cm}^3$		award 1/4 × ×✓2✓1	
(b) $\frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3 = 450 \text{ cm}^3$		award 1/4 ××✓2✓1	
7. $7 \times 7 \times 4 = 200 \text{ cm}^3$		award 1/4 ××✓2✓1	

Question	Generic scheme	Illustrative scheme	Max mark
8.	<ul style="list-style-type: none"> •¹ correct substitution into quadratic formula •² evaluate discriminant •³ calculate both roots correct to two decimal places 	<ul style="list-style-type: none"> •¹ $\frac{-8 \pm \sqrt{8^2 - 4 \times 3 \times 1}}{2 \times 3}$ •² 52 (stated or implied by •³) •³ -0.13, -2.54 	3

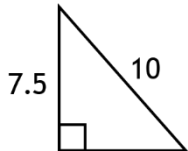
Notes:

1. Correct answer without working award 0/3
2. For a solution obtained by repeated substitution award 0/3
3. •² is available for $\frac{-4 \pm \sqrt{13}}{3}$
4. For the award of •² accept $\pm 0.131\dots$ or $\pm 2.535\dots$ (or rounded to two decimal places) as evidence of the discriminant.
5. •³ is only available when $b^2 - 4ac > 0$ and the roots require rounding.
6. For subsequent incorrect working •³ is not available
eg $\frac{-8 \pm \sqrt{8^2 - 4 \times 3 \times 1}}{2 \times 3} \rightarrow -0.13, -2.54 \rightarrow 0.13, -2.54$ award 2/3 ✓✓x

Commonly Observed Responses:

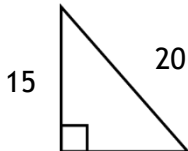
1. 52 ($b^2 - 4ac$) award 1/3 x✓x
2. (a) $-8 \pm \frac{\sqrt{8^2 - 4 \times 3 \times 1}}{2 \times 3} \rightarrow -8 \pm \frac{\sqrt{52}}{6} \rightarrow -0.13, -2.54$ award 3/3
 (b) $-8 \pm \frac{\sqrt{8^2 - 4 \times 3 \times 1}}{2 \times 3} \rightarrow -8 \pm \frac{\sqrt{52}}{6} \rightarrow -6.80, -9.20$ award 2/3 x✓✓1
3. (a) $\frac{-3 \pm \sqrt{3^2 - 4 \times 8 \times 1}}{2 \times 8} \rightarrow \frac{-3 \pm \sqrt{-23}}{2 \times 8} \rightarrow 0.11, -0.49$ award 1/3 x✓1x
 (b) $\frac{-3 \pm \sqrt{3^2 - 4 \times 8 \times 1}}{2 \times 8} \rightarrow \frac{-3 \pm \sqrt{23}}{2 \times 8} \rightarrow 0.11, -0.49$ award 0/3 xxx
 (c) $\frac{-8 \pm \sqrt{8 - 4 \times 3 \times 1}}{2 \times 3} \rightarrow \frac{-8 \pm \sqrt{-4}}{6} \rightarrow -1.00, -1.67$ award 0/3 x✓2x

Question		Generic scheme	Illustrative scheme	Max mark
9.		<ul style="list-style-type: none"> •¹ multiply by e •² subtract 3 •³ divide by 2 	<ul style="list-style-type: none"> •¹ $ef = 2d + 3$ •² $ef - 3 = 2d$ •³ $d = \frac{ef - 3}{2}$ 	3
<p>Notes:</p> <p>1. For a correct answer without working award 0/3</p> <p>2. For the award of •³ accept $d = \frac{e \times f - 3}{2}$ or $d = (ef - 3) \div 2$ or $d = \frac{ef}{2} - \frac{3}{2}$</p> <p>3. BEWARE $ef = 2d + 3 \rightarrow \frac{ef}{2} = d + 3 \rightarrow d = \frac{ef - 3}{2}$ award 1/3 ✓xx</p>				
<p>Commonly Observed Responses:</p> <p>1. $ef = 2d + 3 \rightarrow ef - 3 = 2d \rightarrow d = ef - 3 \div 2$ award 2/3 ✓✓x</p> <p>2. $ef = 2d + 3 \rightarrow 3ef = 2d \rightarrow \frac{3ef}{2} = d$ award 1/3 ✓xx✓2</p>				

Question		Generic scheme	Illustrative scheme	Max mark
10.		<ul style="list-style-type: none"> •¹ marshal facts and recognise right-angled triangle (diagram must include right angle) •² consistent Pythagoras statement •³ calculate third side •⁴ calculate width 	<ul style="list-style-type: none"> •¹  •² $10^2 - 7.5^2$ •³ 6.6... •⁴ 33.2(...cm) 	4

Notes:

1. Correct answer without working award 0/4
2. In the absence of a diagram or diagram with no right angle marked accept $10^2 - 7.5^2$ or $20^2 - 15^2$ as evidence for the award of •¹ and •².
3. For the award of •² accept $10^2 = x^2 + 7.5^2$ or $20^2 = x^2 + 15^2$.
4. **BEWARE**
 - (a) Where a diagram is shown, working must be consistent with the diagram.
 - (b) •² is not available for an incorrect diagram leading to $10^2 - 7.5^2$.
5. •⁴ is only available following a Pythagoras or trigonometric calculation within a **valid** right-angled triangle using side lengths of either 10 and 7.5 or 20 and 15.
6. Alternative method:

• ¹	
• ²	$20^2 - 15^2$
• ³	13.2...
• ⁴	33.2(...cm)

Commonly Observed Responses:

1. $10^2 + 7.5^2 \rightarrow 12.5 \rightarrow 45$
 - (a) working inconsistent with correct diagram award 3/4 x x ✓ 1 ✓ 1
 - (b) working consistent with candidate's diagram (cosine rule may be used to calculate third side) award 3/4 x x ✓ 1 ✓ 1 ✓ 1
 - (c) no diagram or diagram with no right angle marked award 2/4 x x x ✓ 1 ✓ 1
2. $15^2 - 10^2 \rightarrow 11.18... \rightarrow 42.36$ (see Note 5)
 - (a) working consistent with candidate's diagram award 2/4 x x ✓ 1 ✓ 1 x
 - (b) no diagram or diagram with no right angle marked award 1/4 x x x ✓ 1 x

Question	Generic scheme	Illustrative scheme	Max mark
11.	<ul style="list-style-type: none"> •¹ re-arrange equation •² find one value of x •³ find second value of x 	<ul style="list-style-type: none"> •¹ $\sin x = \frac{8}{17}$ •² 28(.07...) •³ 151.9(2...) or 152 	3

Notes:

1. Correct answers

(a) without working

award 1/3 ~~xx~~✓1

(b) by repeated substitution

award 1/3 ~~xx~~✓1

2. Degree signs are not required.

3. Do not penalise premature or incorrect rounding provided given answers round to 28 and 152.

4. Where more than two **final** values are stated, •³ is not available

eg $\sin x = \frac{8}{17} \rightarrow 28, 152, 208$

award 2/3 ✓✓x

5. Inappropriate use of RAD or GRAD should only be penalised once in Qu3, Qu11 or Qu13

(a) $\sin^{-1}\left(\frac{8}{17}\right) = 0.4899... \rightarrow 0.5, 179.5$ (RAD)

(b) $\sin^{-1}\left(\frac{8}{17}\right) = 31.19... \rightarrow 31, 149$ (GRAD)

Commonly Observed Responses:

1. If $\sin x < 0$, •² and •³ are only available for consistent 3rd and 4th quadrant angles

eg $\sin x = -\frac{8}{17} \rightarrow 208, 332$

award 2/3 ~~x~~✓1✓1

2. (a) $\sin x = \frac{10}{17} \rightarrow x = 36.03, 143.97$ ($\rightarrow 36, 144$)

award 2/3 ~~x~~✓1✓1

(b) $\sin x = \frac{10}{17} \rightarrow \sin x = 0.59 \rightarrow x = 36.16, 143.84$ ($\rightarrow 36, 144$)

award 2/3 ~~x~~✓1✓1

(c) $\sin x = \frac{10}{17} \rightarrow \sin x = 0.58 \rightarrow x = 35.45, 144.55$ ($\rightarrow 35, 145$)

award 1/3 ~~xx~~✓1

Question	Generic scheme	Illustrative scheme	Max mark
12.	<ul style="list-style-type: none"> •¹ correct denominator •² correct numerator(s). •³ express in simplest form (remove brackets in numerator and collect like terms) 	<ul style="list-style-type: none"> •¹ $(x+5)(x-4)$ •² $2(x-4)+3(x+5)$ •³ $\frac{5x+7}{(x+5)(x-4)}$ 	3

Notes:

1. Correct answer without working.

award 3/3

2. Accept $\frac{2(x-4)}{(x+5)(x-4)} + \frac{3(x+5)}{(x+5)(x-4)}$ for the award of •¹ and •²

3. Do not accept $x+5(x-4)$ or $(x+5)x-4$ or $x+5 \times x-4$ for the award •¹ unless the correct expansion or the brackets appear in the final answer.

(a) $\frac{2(x-4)}{x+5 \times x-4} + \frac{3(x+5)}{x+5 \times x-4} \rightarrow \frac{5x+7}{x^2+x-20}$ or $\frac{5x+7}{(x+5)(x-4)}$

award 3/3

(b) $\frac{2(x-4)}{x+5 \times x-4} + \frac{3(x+5)}{x+5 \times x-4} \rightarrow \frac{5x+7}{x+5 \times x-4}$

award 2/3 x✓✓1

4. Where a candidate chooses to expand the brackets in the denominator, then •³ is only available for a consistent expansion (unless incorrect expansion already appears at •¹)

eg

(a) $\frac{2(x-4)}{(x+5)(x-4)} + \frac{3(x+5)}{(x+5)(x-4)} = \frac{5x+7}{x^2+x-20}$

award 3/3

(b) $\frac{2(x-4)}{(x+5)(x-4)} + \frac{3(x+5)}{(x+5)(x-4)} = \frac{5x+7}{x^2-20}$

award 2/3 ✓✓x

(c) $\frac{2(x-4)}{x^2-20} + \frac{3(x+5)}{x^2-20} = \frac{5x+7}{x^2-20}$

award 2/3 x✓✓1

5. For subsequent incorrect working, •³ is not available

eg

$$\frac{2(x-4)}{(x+5)(x-4)} + \frac{3(x+5)}{(x+5)(x-4)} = \frac{5x+7}{x^2+x-20} = \frac{5+7}{x^2-20} = \frac{12}{x^2-20}$$

award 2/3 ✓✓x

Commonly Observed Responses:

1. $\frac{2x-8}{(x+5)(x-4)} + \frac{3x+15}{(x+5)(x-4)} = \frac{5x-23}{(x+5)(x-4)}$

award 2/3 ✓✓x

2. $\frac{2x-4}{(x+5)(x-4)} + \frac{3x+5}{(x+5)(x-4)} = \frac{5x+1}{(x+5)(x-4)}$

award 1/3 ✓xx

Question	Generic scheme	Illustrative scheme	Max mark
13.	<p>Method 1</p> <ul style="list-style-type: none"> •¹ correct substitution into sine rule •² re-arrange formula •³ calculate BC •⁴ consistent substitution into appropriate trig formula •⁵ calculate BD <p>Method 2</p> <ul style="list-style-type: none"> •¹ correct substitution into sine rule •² re-arrange formula •³ calculate AB •⁴ consistent substitution into appropriate trig formula •⁵ calculate BD 	<ul style="list-style-type: none"> •¹ $\frac{BC}{\sin 40} = \frac{22}{\sin 110}$ •² $\frac{22\sin 40}{\sin 110}$ •³ 15.0... •⁴ $\sin 30 = \frac{BD}{15.0\dots}$ or $\frac{BD}{\sin 30} = \frac{15.0\dots}{\sin 90}$ •⁵ 7.5 (cm) <ul style="list-style-type: none"> •¹ $\frac{AB}{\sin 30} = \frac{22}{\sin 110}$ •² $\frac{22\sin 30}{\sin 110}$ •³ 11.7... •⁴ $\sin 40 = \frac{BD}{11.7\dots}$ or $\frac{BD}{\sin 40} = \frac{11.7\dots}{\sin 90}$ •⁵ 7.5 (cm) 	5

Question	Generic scheme	Illustrative scheme	Max mark
13. (continued)			
<p>Notes:</p> <p>1. Correct answer without working award 0/5</p> <p>2. Do not penalise omission of degree signs.</p> <p>3. Disregard errors due to premature rounding provided there is evidence. However, do not accept sin40 or sin110 rounded to less than 2 decimal places. eg $BC = \frac{22\sin 40}{\sin 110} = \frac{22 \times 0.6}{0.9} = \frac{13.2}{0.9} = 14.7 \rightarrow BD = 14.7 \sin 30 = 7.35$ award 4/5 ✓✓x✓1✓1</p> <p>4. (a) Where both AB and BC are calculated correctly and there is no further working award 3/5 ✓✓✓xx (b) Where both AB and BC are calculated but one is calculated incorrectly, if there is: (i) further working, then apply the MIs based on the length used to calculate BD (ii) no further working, disregard incorrect length ie award 3/5 ✓✓✓xx</p> <p>5. Alternative strategies for ●⁴ eg (a) ●⁴ $\sin 60 = \frac{DC}{15.0\dots}$ (DC = 12.99...) $\rightarrow \sqrt{(15.0\dots)^2 - DC^2}$ (b) ●⁴ $\text{Area} = \frac{1}{2} \times 22 \times 15(.048\dots) \times \sin 30$ (Area = 82.768 ...) $\rightarrow \frac{1}{2} \times 22 \times BD = \text{Area}$</p> <p>6. Inappropriate use of GRAD or RAD should only be penalised once in Qu3, Qu11 or Qu13 (a) 6 or 5.9(4...) (GRAD) (b) (RAD) (i) AB = 491 \rightarrow BD = 366 (ii) BC = ±371 \rightarrow BD = 366 but ●³ is not available due to the negative length of BC</p>			
Commonly Observed Responses:			
<p>1. (a) $\frac{x}{\sin 40} = \frac{22}{\sin 30} \rightarrow x = 28$ award 2/5 x✓1✓1^^</p> <p>(b) $\frac{x}{\sin 30} = \frac{22}{\sin 40} \rightarrow x = 17$ award 2/5 x✓1✓1^^</p> <p>2. eg $\frac{AB}{30} = \frac{22}{110} \rightarrow AB = 6 \rightarrow BD = 6 \times \sin 40 = 3.9$ or 4 award 2/5 xxx✓1✓1</p>			

Question		Generic scheme	Illustrative scheme	Max mark
14.	(a)	• ¹ state vector	• ¹ $\mathbf{b} - \mathbf{a}$ or $-\mathbf{a} + \mathbf{b}$	1

Notes:

1. For the award of •¹ accept $\mathbf{b} + -\mathbf{a}$.

Commonly Observed Responses:

	(b)	<p>•² valid pathway</p> <p>•³ Express $\overline{\mathbf{WM}}$ in terms of \mathbf{a} and \mathbf{b} in simplest form</p>	<p>•² $\mathbf{b} - \mathbf{a} - \frac{1}{2}\mathbf{a}$</p> <p>OR $\overline{\mathbf{WX}} + \frac{1}{2}\overline{\mathbf{XY}}$ or equivalent</p> <p>•³ $\mathbf{b} - \frac{3}{2}\mathbf{a}$</p>	2
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Notes:

1. Correct answer with no working award 2/2

2. $\overline{\mathbf{WX}} + \overline{\mathbf{XM}}$ or $\overline{\mathbf{WZ}} + \overline{\mathbf{ZX}} + \overline{\mathbf{XM}}$ is not enough for the award of •²

3. For the award of •² accept:

(a) $\overline{\mathbf{WZ}} + \overline{\mathbf{ZX}} + \frac{1}{2}\overline{\mathbf{XY}}$

(b) $\overline{\mathbf{WZ}} + \overline{\mathbf{ZY}} + \frac{1}{2}\overline{\mathbf{YX}}$

4. For the award of •³ accept $\mathbf{b} + -\frac{3}{2}\mathbf{a}$, $\mathbf{b} - 1\frac{1}{2}\mathbf{a}$ or $\mathbf{b} - 1.5\mathbf{a}$.

5. Answer must be consistent with part (a) except in the case of Note 6.

eg (i) (a) $\mathbf{a} - \mathbf{b}$ (b) $\mathbf{a} - \mathbf{b} + \frac{1}{2}\mathbf{a} = \frac{3}{2}\mathbf{a} - \mathbf{b}$ award 0/1 in (a) ✗ and award 2/2 in (b) ✓✓

(ii) (a) $\mathbf{a} - \mathbf{b}$ (b) $\mathbf{a} - \mathbf{b} - \frac{1}{2}\mathbf{a} = \frac{1}{2}\mathbf{a} - \mathbf{b}$ award 0/1 in (a) ✗ and award 1/2 in (b) ✗✓

(iii) (a) $\mathbf{a} + \mathbf{b}$ (b) $\mathbf{a} + \mathbf{b} + \frac{1}{2}\mathbf{a} = \frac{3}{2}\mathbf{a} + \mathbf{b}$ award 0/1 in (a) ✗ and award 2/2 in (b) ✓✓

(iv) (a) $\mathbf{a} + \mathbf{b}$ (b) $\mathbf{a} + \mathbf{b} - \frac{1}{2}\mathbf{a} = \frac{1}{2}\mathbf{a} + \mathbf{b}$ award 0/1 in (a) ✗ and award 1/2 in (b) ✗✓

6. An answer in part (b) which has been clearly found independently of part (a) may gain full or partial credit in part (b).

eg (a) $\mathbf{a} - \mathbf{b}$ (b) $\mathbf{b} - \mathbf{a} - \frac{1}{2}\mathbf{a} = \mathbf{b} - \frac{3}{2}\mathbf{a}$ award 0/1 in (a) ✗ and award 2/2 in (b) ✓✓

Commonly Observed Responses:

For answer in parts (a) and (b) award as follows:

1. (a) $\mathbf{b} - \mathbf{a}$ (b) $\mathbf{b} - \mathbf{a} + \frac{1}{2}\mathbf{a} = \mathbf{b} - \frac{1}{2}\mathbf{a}$ award 1/1 in (a) ✓ and award 1/2 in (b) ✗✓

Question		Generic scheme	Illustrative scheme	Max mark
15.		<p>Method 1</p> <ul style="list-style-type: none"> •¹ correct fraction •² know how to calculate sector area •³ calculate sector area <p>Method 2</p> <ul style="list-style-type: none"> •¹ start strategy for finding angle •² know how to calculate sector area •³ calculate sector area 	<p>Method 1</p> <ul style="list-style-type: none"> •¹ $\frac{15}{\pi \times 24}$ (= 0.198...) •² $\frac{15}{\pi \times 24} \times \pi \times 12^2$ •³ 90 (cm²) <p>Method 2</p> <ul style="list-style-type: none"> •¹ $15 = \frac{\text{angle}}{360} \times \pi \times 24$ •² $\frac{15}{\pi \times 24} \times 360 = \text{angle}$ $\rightarrow (\text{area} =) \frac{\text{angle}}{360} \times \pi \times 12^2$ •³ 90 (cm²) 	3

Notes:

- Correct answer without working award 0/3
- ² is not available for simply calculating the angle at the centre of the sector
 ie $\frac{15}{\pi \times 24} \times 360 = 71.6197...$ award 1/3 ✓✓2^
- Accept variations and inconsistencies in the use of π provided there is evidence.
- Do not penalise premature or incorrect rounding provided given answer rounds to 90 to the nearest whole number. However, see Note 5.
- Where method 2 is used, accept angle calculations rounded to the nearest degree
 e.g. $\frac{15}{\pi \times 24} \times 360 = 72 \rightarrow \frac{72}{360} \times \pi \times 12^2 = 90.47... \text{ or } 90.5 \text{ (cm}^2\text{)}$ award 3/3
- Where an angle is assumed or calculated using an invalid strategy (eg cosine rule), •³ is not available
 eg $\frac{73}{360} \times \pi \times 12^2 = 91.7... \text{ (cm}^2\text{)}$ award 0/3
 However, see CORs 1 and 2 for special cases.
- For subsequent incorrect working, the final mark is not available
 e.g. $\pi \times 12^2 - \frac{15 \times \pi \times 12^2}{\pi \times 24} = 362(.38....)$ award 2/3 ✓✓x

Question	Generic scheme	Illustrative scheme	Max mark
15. (continued)			
Commonly Observed Responses:			
1. $\frac{15}{\pi \times 12^2} \times 360 = 11.9... \rightarrow \frac{11.9...}{360} \times \pi \times 24 = 2.5 \text{ (cm}^2\text{)}$		award 2/3 x ✓1✓1	
2. $\frac{15}{\pi \times 12^2} \times 360 = 11.9... \rightarrow \frac{11.9...}{360} \times \pi \times 12^2 = 15 \text{ (cm}^2\text{)}$		award 1/3 x x ✓1	
3. (a) $\frac{15}{360} \times \pi \times 24 = 3.14... \text{ (cm}^2\text{)}$		award 0/3	
(b) $\frac{15}{360} \times \pi \times 12^2 = 18.8... \text{ (cm}^2\text{)}$		award 0/3	
16.	<ul style="list-style-type: none"> •¹ valid substitution •² express in the form $a + b \sin^2 x^\circ$ 	<ul style="list-style-type: none"> •¹ eg $3(1 - \sin^2 x) - 1$ •² $2 - 3 \sin^2 x$ 	2
Notes:			
1. Correct answer without working		award 0/2	
2. Do not penalise omission of degree signs.			
3. Accept $-3 \sin^2 x + 2$		award 2/2	
4. Do not accept $\sin x^2$ eg $3(1 - \sin x^2) - 1 = 2 - 3 \sin x^2$		award 1/2 x ✓1	
5. • ¹ is not available if there are no variables eg $3(1 - \sin^2) - 1 = 2 - 3 \sin^2$		award 1/2 x ✓1	
6. • ¹ is not available if the candidate simply states eg $\cos^2 x = 1 - \sin^2 x$ then proceeds no further.			
7. • ² is not available if there is invalid subsequent working.			
Commonly Observed Responses:			
1. (a) $3 \cos^2 x - (\sin^2 x + \cos^2 x) = 2 \cos^2 x - \sin^2 x$		award 0/2 ✓2 ^	
(b) $3 \cos^2 x - (\sin^2 x + \cos^2 x) = 2 \cos^2 x - \sin^2 x = 2(1 - \sin^2 x) - \sin^2 x$		award 1/2 ✓ ^	

[END OF MARKING INSTRUCTIONS]