



National  
Qualifications  
2024

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## **2024 Mathematics**

### **National 5 - Paper 1**

#### **Question Paper Finalised Marking Instructions**

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## General marking principles for National 5 Mathematics

*Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.*

*For each question, the marking instructions are generally in two sections:*

*generic scheme – this indicates why each mark is awarded*

*illustrative scheme – this covers methods which are commonly seen throughout the marking*

*In general, you should use the illustrative scheme. Only use the generic scheme where a candidate has used a method not covered in the illustrative scheme.*

- (a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.
- (b) If you are uncertain how to assess a specific candidate response because it is not covered by the general marking principles or the detailed marking instructions, you must seek guidance from your team leader.
- (c) One mark is available for each ○. There are no half marks.
- (d) If a candidate's response contains an error, all working subsequent to this error must still be marked. Only award marks if the level of difficulty in their working is similar to the level of difficulty in the illustrative scheme.
- (e) Only award full marks where the solution contains appropriate working. A correct answer with no working receives no mark, unless specifically mentioned in the marking instructions.
- (f) Candidates may use any mathematically correct method to answer questions, except in cases where a particular method is specified or excluded.
- (g) If an error is trivial, casual or insignificant, for example  $6 \times 6 = 12$ , candidates lose the opportunity to gain a mark, except for instances such as the second example in point (h) below.

- (h) If a candidate makes a transcription error (question paper to script or within script), they lose the opportunity to gain the next process mark, for example

This is a transcription error and so the mark is not awarded.

This is no longer a solution of a quadratic equation, so the mark is not awarded.

$$x^2 + 5x + 7 = 9x + 4$$

$$x - 4x + 3 = 0$$

$$x = 1$$

The following example is an exception to the above

This error is not treated as a transcription error, as the candidate deals with the intended quadratic equation. The candidate has been given the benefit of the doubt and all marks awarded.

$$x^2 + 5x + 7 = 9x + 4$$

$$x - 4x + 3 = 0$$

$$(x - 3)(x - 1) = 0$$

$$x = 1 \text{ or } 3$$

(i) **Horizontal/vertical marking**

If a question results in two pairs of solutions, apply the following technique, but only if indicated in the detailed marking instructions for the question.

Example:

	$\bigcirc^5$	$\bigcirc^6$
$\bigcirc^5$	$x = 2$	$x = -4$
$\bigcirc^6$	$y = 5$	$y = -7$

Horizontal: $\bigcirc^5 x = 2$ and $x = -4$ $\bigcirc^6 y = 5$ and $y = -7$	Vertical: $\bigcirc^5 x = 2$ and $y = 5$ $\bigcirc^6 x = -4$ and $y = -7$
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You must choose whichever method benefits the candidate, **not** a combination of both.

- (j) In final answers, candidates should simplify numerical values as far as possible unless specifically mentioned in the detailed marking instruction. For example

$\frac{15}{12}$  must be simplified to  $\frac{5}{4}$  or  $1\frac{1}{4}$

$\frac{43}{1}$  must be simplified to 43

$\frac{15}{0.3}$  must be simplified to 50

$\frac{4\cancel{5}}{3}$  must be simplified to  $\frac{4}{15}$

$\sqrt{64}$  must be simplified to 8\*

\*The square root of perfect squares up to and including 144 must be known.

- (k) Commonly Observed Responses (COR) are shown in the marking instructions to help mark common and/or non-routine solutions. CORs may also be used as a guide when marking similar non-routine candidate responses.
- (l) Do not penalise candidates for any of the following, unless specifically mentioned in the detailed marking instructions:
- working subsequent to a correct answer
  - correct working in the wrong part of a question
  - legitimate variations in numerical answers/algebraic expressions, for example angles in degrees rounded to nearest degree
  - omission of units
  - bad form (bad form only becomes bad form if subsequent working is correct), for example

$$(x^3 + 2x^2 + 3x + 2)(2x + 1) \text{ written as}$$

$$(x^3 + 2x^2 + 3x + 2) \times 2x + 1$$

$$= 2x^4 + 5x^3 + 8x^2 + 7x + 2$$

gains full credit

- repeated error within a question, but not between questions or papers
- (m) In any ‘Show that...’ question, where candidates have to arrive at a required result, the last mark is not awarded as a follow-through from a previous error, unless specified in the detailed marking instructions.
- (n) You must check all working carefully, even where a fundamental misunderstanding is apparent early in a candidate’s response. You may still be able to award marks later in the question so you must refer continually to the marking instructions. The appearance of the correct answer does not necessarily indicate that you can award all the available marks to a candidate.
- (o) You should mark legible scored-out working that has not been replaced. However, if the scored-out working has been replaced, you must only mark the replacement working.
- (p) If candidates make multiple attempts using the same strategy and do not identify their final answer, mark all attempts and award the lowest mark. If candidates try different valid strategies, apply the above rule to attempts within each strategy and then award the highest mark.

For example:

Strategy 1 attempt 1 is worth 3 marks.	Strategy 2 attempt 1 is worth 1 mark.
Strategy 1 attempt 2 is worth 4 marks.	Strategy 2 attempt 2 is worth 5 marks.
From the attempts using strategy 1, the resultant mark would be 3.	From the attempts using strategy 2, the resultant mark would be 1.

In this case, award 3 marks.

## Marking Instructions for each question

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

Question			Generic scheme	Illustrative scheme	Max mark
2.			<ul style="list-style-type: none"> <li>•<sup>1</sup> substitute into <math>f(x)</math></li> <li>•<sup>2</sup> evaluate <math>f(x)</math></li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>(7+3)^2</math> or equivalent</li> <li>•<sup>2</sup> 100</li> </ul>	2
<b>Notes:</b> 1. Correct answer without working award 2/2 2. For subsequent incorrect working • <sup>2</sup> is not available. eg $f(7) = (7+3)^2 \rightarrow f(7) = 100 \rightarrow f = \frac{100}{7}$ award 1/2 ✓✗					
<b>Commonly Observed Responses:</b> 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"> <li>•<sup>1</sup> start to expand</li> <li>•<sup>2</sup> complete expansion</li> <li>•<sup>3</sup> collect like terms (see Note 3)</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> evidence of any 3 correct terms eg <math>x^3 - 4x^2 + 5x \dots</math></li> <li>•<sup>2</sup> <math>x^3 - 4x^2 + 5x + x^2 - 4x + 5</math></li> <li>•<sup>3</sup> <math>x^3 - 3x^2 + x + 5</math></li> </ul>	3
<p><b>Notes:</b></p> <p>1. Correct answer without working <span style="float: right;">award 3/3</span></p> <p>2. Accept:</p> <p>(a) <math>x^3 - 3x^2 + 1x + 5</math> <span style="float: right;">award 3/3</span></p> <p>(b) <math>x^3 + -3x^2 + 1x + 5</math> <span style="float: right;">award 3/3</span></p> <p>3. For the award of •<sup>3</sup> the evidence at •<sup>2</sup> must include a term in <math>x^3</math>. At least one negative term must be collected with another term.</p> <p>4. Evidence for •<sup>1</sup> and •<sup>2</sup> may appear in a grid.</p> <p>5. For subsequent incorrect working, •<sup>3</sup> is not available.</p> <p><b>Commonly Observed Responses:</b></p>					

Question			Generic scheme	Illustrative scheme	Max mark
4.			<p>•<sup>1</sup> calculate 3a</p> <p>•<sup>2</sup> solution</p>	<p>•<sup>1</sup> <math>\begin{pmatrix} 9 \\ 12 \\ -3 \end{pmatrix}</math></p> <p>•<sup>2</sup> <math>\begin{pmatrix} 14 \\ 15 \\ -1 \end{pmatrix}</math></p>	2

**Notes:**

1. Correct answer without working award 2/2

2. Do not award •<sup>2</sup> 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 •<sup>2</sup> 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.	(b)		<ul style="list-style-type: none"> <li>•<sup>4</sup> valid comment comparing medians</li> <li>•<sup>5</sup> valid comment comparing IQRs</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>4</sup> On average, the prices are lower on the website.</li> <li>•<sup>5</sup> The prices in the shop are more consistent.</li> </ul>	2

#### Notes:

- Answers must be consistent with answers to part (a).
- Comments must clearly distinguish between the **prices** in the **shop** and on the **website** (or equivalent). Accept “**on display**” as evidence of the shop.
  - Accept eg On average the **prices** on the **website** are lower and less consistent.
  - Do not accept eg On average the prices are lower and less consistent.
- For the award of •<sup>4</sup>
  - Accept eg
    - On average the **prices** in the shop are more.
  - 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.
- For the award of •<sup>5</sup>
  - Accept eg
    - The **spread** of prices is **more** on the **website**.
    - The prices in the **shop** are **less varied**.
  - 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.
- Numbers are not required for marks •<sup>4</sup> and •<sup>5</sup>. 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.<br>The prices in the shop are more consistent as 200 > 195. | award 0/2 <b>xx</b> |

(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.<br>The prices in the shop are more consistent as 70 > 73. | award 0/2 <b>xx</b> |

#### 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 <b>second shop</b> were lower<br>The prices in the <b>first shop</b> were less varied | award 0/2 <b>xx</b> |

Question			Generic scheme	Illustrative scheme	Max mark
6.			<ul style="list-style-type: none"> <li>•<sup>1</sup> simplify surd</li> <li>•<sup>2</sup> complete simplification</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>5\sqrt{3}</math></li> <li>•<sup>2</sup> <math>4\sqrt{3}</math></li> </ul>	2
<b>Notes:</b> 1. Correct answer without working award 0/2 2. For subsequent incorrect working • <sup>2</sup> is not available.					
<b>Commonly Observed Responses:</b> 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.			<b>Method 1</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> correct scaling</li> <li>•<sup>2</sup> value for <math>p</math></li> <li>•<sup>3</sup> value for <math>r</math></li> </ul> <b>Method 2</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> correct scaling</li> <li>•<sup>2</sup> value for <math>r</math></li> <li>•<sup>3</sup> value for <math>p</math></li> </ul>	<b>Method 1</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> <math>4p - 14r = 22</math> <math>21p + 14r = 28</math></li> <li>•<sup>2</sup> <math>p = 2</math></li> <li>•<sup>3</sup> <math>r = -1</math></li> </ul> <b>Method 2</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> <math>6p - 21r = 33</math> <math>6p + 4r = 8</math></li> <li>•<sup>2</sup> <math>r = -1</math></li> <li>•<sup>3</sup> <math>p = 2</math></li> </ul>	3

**Notes:**

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

**Commonly Observed Responses:**

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

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

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

#### Notes:

1. Correct answer without working

award 0/3

2. (a) For the award of •<sup>1</sup> accept  $-\frac{14}{7}$ . However see Note 3(a).

(b) BEWARE •<sup>1</sup> is not available for  $\frac{26 - 12}{3 - 10} = \frac{-14}{7} = -2$  or  $\frac{12 - 26}{10 - 3} = \frac{14}{-7} = -2$

3. 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  $\times \checkmark 1 \checkmark 1$

(b)  $-\frac{14}{7} \rightarrow 26 = 2 \times 3 + c \rightarrow D = 2T + 20$

award 2/3  $\checkmark \times \checkmark 1$

(c)  $-\frac{14}{7} \rightarrow 26 = -\frac{14}{7} \times 3 + c \rightarrow D = 2T + 20$

award 2/3  $\checkmark \checkmark \times$

#### Commonly Observed Responses:

Working must be shown

1.  $y = -2x + 32$

award 2/3  $\checkmark \checkmark \checkmark 2$

2.  $D = -\frac{2}{1}T + 32$

award 2/3  $\checkmark \checkmark \checkmark 2$

3.  $-\frac{7}{14} \rightarrow y - 26 = -\frac{7}{14}(x - 3) \rightarrow D = -\frac{1}{2}T + 27.5$

award 2/3  $\times \checkmark 1 \checkmark 1$

4.  $\frac{7}{14} \rightarrow y - 26 = \frac{7}{14}(x - 3) \rightarrow D = \frac{1}{2}T + 24.5$

award 2/3  $\times \checkmark 1 \checkmark 1$

Question			Generic scheme	Illustrative scheme	Max mark
9.	(b)		• <sup>4</sup> calculate distance remaining	• <sup>4</sup> 18 (km)	1
<b>Notes:</b> 1. Consistent answer without working award 1/1 2. • <sup>4</sup> is not available if the gradient is $\pm 1$ .					
<b>Commonly Observed Responses:</b> 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"> <li>•<sup>1</sup> calculate size of angle OFD</li> <li>•<sup>2</sup> calculate size of angle BOD or FED</li> <li>•<sup>3</sup> calculate size of angle BCD</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> 55</li> <li>•<sup>2</sup> BOD = 110 or FED = 20</li> <li>•<sup>3</sup> 70</li> </ul>	3
<p><b>Notes:</b></p> <p>1. Correct answer without working award 0/3</p> <p>2. Degree signs are not required</p> <p>3. Full marks may be awarded for information marked on the diagram.</p> <p>4. For the award of •<sup>2</sup> accept BAG = 20</p> <p>5. Where information is not marked on the diagram then working must clearly attach calculations to <b>named</b> angles. The final answer must be <b>clearly</b> indicated.</p> <p>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.</p> <p>7. Disregard incorrect angles which are not on the valid pathway followed by the candidate.</p> <p>8. For the award of •<sup>3</sup> BCD must be less than 90.</p> <p>9. Where angle BOD is assumed, •<sup>3</sup> is not available. eg BOD = 140 → BCD = 40 award 0/3</p>					
<p><b>Commonly Observed Responses:</b></p> <p>1. OFD = 55 → FOD = 55 → BOD = 125 → BCD = 55 award 2/3 ✓x✓1</p> <p>2. OFD = 55 → FOD (= FDO) = 62.5 → BOD = 117.5 → BCD = 62.5 award 2/3 ✓x✓1</p> <p>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</p> <p>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</p> <p>5. (a) FED = 27.5 → BCD = 62.5 award 1/3 xx✓1 (b) OFD = 55, FED = 27.5 → BCD = 62.5 award 2/3 ✓x✓1</p>					



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



Question			Generic scheme	Illustrative scheme	Max mark
12.	(c)		<ul style="list-style-type: none"> <li>•<sup>4</sup> find <math>x</math> coordinate</li> <li>•<sup>5</sup> find <math>y</math> coordinate</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>4</sup> (6,...)</li> <li>•<sup>5</sup> (... ,8)</li> </ul>	2
<b>Notes:</b> <ol style="list-style-type: none"> <li>Correct answer or answer consistent with part (b) without working award 2/2</li> <li>Do not award •<sup>4</sup> if: <ul style="list-style-type: none"> <li>(a) the <math>x</math>-coordinate in (b) and (c) are the same. However, see Note 3.</li> <li>(b) the <math>x</math>-coordinate is less than the <math>x</math>-coordinate of the turning point.</li> </ul> </li> <li>For the award of •<sup>4</sup> 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: <math>x^2 - 6x + 8 = 0 \rightarrow (x-2)(x-4) = 0 \rightarrow x = 2, 4 \rightarrow x_Q = 6</math></li> <li>Do not award •<sup>5</sup> if the <math>y</math>-coordinate in (b) and (c) are the same unless there is evidence of an alternative valid strategy in part (c) eg <math>y_Q = 0^2 - 6 \times 0 + 8 = 8</math></li> <li>•<sup>5</sup> 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).</li> <li>Accept answer in the form <math>x = \dots, y = \dots</math>.</li> <li>Coordinates of Q may appear on diagram.</li> </ol>					
<b>Commonly Observed Responses:</b> <ol style="list-style-type: none"> <li>(8, 6) (coordinates in wrong order but consistent with part (b)) award 1/2 <del>x</del>✓1</li> <li>For answers in parts (a), (b) and (c) award as follows: <ul style="list-style-type: none"> <li>(a) <math>(x-3)^2 - 1</math> award 2/2 ✓✓</li> <li>(b) (6, 8) award 0/1 <del>x</del></li> <li>(c) (12, 8) in part (c) (no working) award 1/2 ✓1<del>x</del></li> </ul> </li> <li>For answers in parts (a), (b) and (c) award as follows: <ul style="list-style-type: none"> <li>(a) <math>(x-6)^2 - 28</math> award 1/2 <del>x</del>✓1</li> <li>(b) (6, 8) award 0/1 <del>x</del></li> <li>(c) (12, 80) in part (c) (no working) award 2/2 ✓1✓1</li> </ul> </li> <li>For answers in parts (a), (b) and (c) award as follows: <ul style="list-style-type: none"> <li>(a) <math>(x-6)^2 + 8</math> award 0/2 <del>x</del><del>x</del></li> <li>(b) (6, 8) award 1/1 ✓1</li> <li>(c) <math>y_Q = 0^2 - 6 \times 0 + 8 = 8 \rightarrow (6, 8)</math> award 1/2 <del>x</del>✓</li> </ul> </li> </ol>					

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

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

**Notes:**

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

- (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
- $10.5 - 3 = 7.5$  (cm) award 0/3

[END OF MARKING INSTRUCTIONS]



National  
Qualifications  
2024

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## **2024 Mathematics**

### **National 5 - Paper 2**

#### **Question Paper Finalised Marking Instructions**

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These marking instructions have been prepared by examination teams for use by SQA appointed markers when marking external course assessments.

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## General marking principles for National 5 Mathematics

*Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.*

*For each question, the marking instructions are generally in two sections:*

*generic scheme – this indicates why each mark is awarded*

*illustrative scheme – this covers methods which are commonly seen throughout the marking*

*In general, you should use the illustrative scheme. Only use the generic scheme where a candidate has used a method not covered in the illustrative scheme.*

- (a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.
- (b) If you are uncertain how to assess a specific candidate response because it is not covered by the general marking principles or the detailed marking instructions, you must seek guidance from your team leader.
- (c) One mark is available for each ○. There are no half marks.
- (d) If a candidate's response contains an error, all working subsequent to this error must still be marked. Only award marks if the level of difficulty in their working is similar to the level of difficulty in the illustrative scheme.
- (e) Only award full marks where the solution contains appropriate working. A correct answer with no working receives no mark, unless specifically mentioned in the marking instructions.
- (f) Candidates may use any mathematically correct method to answer questions, except in cases where a particular method is specified or excluded.
- (g) If an error is trivial, casual or insignificant, for example  $6 \times 6 = 12$ , candidates lose the opportunity to gain a mark, except for instances such as the second example in point (h) below.

- (h) If a candidate makes a transcription error (question paper to script or within script), they lose the opportunity to gain the next process mark, for example

This is a transcription error and so the mark is not awarded.

This is no longer a solution of a quadratic equation, so the mark is not awarded.

$$x^2 + 5x + 7 = 9x + 4$$

$$x - 4x + 3 = 0$$

$$x = 1$$

The following example is an exception to the above

This error is not treated as a transcription error, as the candidate deals with the intended quadratic equation. The candidate has been given the benefit of the doubt and all marks awarded.

$$x^2 + 5x + 7 = 9x + 4$$

$$x - 4x + 3 = 0$$

$$(x - 3)(x - 1) = 0$$

$$x = 1 \text{ or } 3$$

(i) **Horizontal/vertical marking**

If a question results in two pairs of solutions, apply the following technique, but only if indicated in the detailed marking instructions for the question.

Example:

	$\bigcirc^5$	$\bigcirc^6$
$\bigcirc^5$	$x = 2$	$x = -4$
$\bigcirc^6$	$y = 5$	$y = -7$

Horizontal: $\bigcirc^5 x = 2$ and $x = -4$	Vertical: $\bigcirc^5 x = 2$ and $y = 5$
$\bigcirc^6 y = 5$ and $y = -7$	$\bigcirc^6 x = -4$ and $y = -7$

You must choose whichever method benefits the candidate, **not** a combination of both.

- (j) In final answers, candidates should simplify numerical values as far as possible unless specifically mentioned in the detailed marking instruction. For example

$\frac{15}{12}$  must be simplified to  $\frac{5}{4}$  or  $1\frac{1}{4}$

$\frac{43}{1}$  must be simplified to 43

$\frac{15}{0.3}$  must be simplified to 50

$\frac{4\cancel{5}}{3}$  must be simplified to  $\frac{4}{15}$

$\sqrt{64}$  must be simplified to 8\*

\*The square root of perfect squares up to and including 144 must be known.



- (k) Commonly Observed Responses (COR) are shown in the marking instructions to help mark common and/or non-routine solutions. CORs may also be used as a guide when marking similar non-routine candidate responses.
- (l) Do not penalise candidates for any of the following, unless specifically mentioned in the detailed marking instructions:
- working subsequent to a correct answer
  - correct working in the wrong part of a question
  - legitimate variations in numerical answers/algebraic expressions, for example angles in degrees rounded to nearest degree
  - omission of units
  - bad form (bad form only becomes bad form if subsequent working is correct), for example

$$(x^3 + 2x^2 + 3x + 2)(2x + 1) \text{ written as}$$

$$(x^3 + 2x^2 + 3x + 2) \times 2x + 1$$

$$= 2x^4 + 5x^3 + 8x^2 + 7x + 2$$

gains full credit

- repeated error within a question, but not between questions or papers
- (m) In any ‘Show that...’ question, where candidates have to arrive at a required result, the last mark is not awarded as a follow-through from a previous error, unless specified in the detailed marking instructions.
- (n) You must check all working carefully, even where a fundamental misunderstanding is apparent early in a candidate’s response. You may still be able to award marks later in the question so you must refer continually to the marking instructions. The appearance of the correct answer does not necessarily indicate that you can award all the available marks to a candidate.
- (o) You should mark legible scored-out working that has not been replaced. However, if the scored-out working has been replaced, you must only mark the replacement working.
- (p) If candidates make multiple attempts using the same strategy and do not identify their final answer, mark all attempts and award the lowest mark. If candidates try different valid strategies, apply the above rule to attempts within each strategy and then award the highest mark.

For example:

Strategy 1 attempt 1 is worth 3 marks.	Strategy 2 attempt 1 is worth 1 mark.
Strategy 1 attempt 2 is worth 4 marks.	Strategy 2 attempt 2 is worth 5 marks.
From the attempts using strategy 1, the resultant mark would be 3.	From the attempts using strategy 2, the resultant mark would be 1.

In this case, award 3 marks.

## Marking Instructions for each question

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

Question			Generic scheme	Illustrative scheme	Max mark
2.			<ul style="list-style-type: none"> <li>•<sup>1</sup> correct method</li> <li>•<sup>2</sup> evaluate and write in scientific notation</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>1.22 \times 10^6 \times 250</math> or equivalent</li> <li>•<sup>2</sup> <math>3.05 \times 10^8</math></li> </ul>	2
<b>Notes:</b> 1. Correct answer without working award 2/2 2. (a) For 305 000 000 award 1/2 ✓✓2 (b) For $305 \times 10^6$ award 1/2 ✓x 3. For the award of • <sup>2</sup> (a) $(1.22 \times 10^6 \times 250 =) 3.05 \times 10^8 = 3.1 \times 10^8$ or $3 \times 10^8$ award 2/2 (b) $(1.22 \times 10^6 \times 250 =) 3.1 \times 10^8$ or $3 \times 10^8$ award 1/2 ✓x 4. For subsequent incorrect working, • <sup>2</sup> 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					
<b>Commonly Observed Responses:</b> 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 $2.049... \times 10^{-4}$ award 1/2 xv1 (b) $250 \div (1.22 \times 10^6) = 2.05 \times 10^8$ or $2.049... \times 10^8$ award 0/2 xx					

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

**Notes:**

1. Correct answer without working award 0/3

2. Degree sign is not required.

3. For the award of •<sup>1</sup> accept eg  $34^2 = 18^2 + 25^2 - 2 \times 18 \times 25 \times \cos A$

4. For the award of •<sup>3</sup> 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)  $\frac{34^2 + 18^2 - 25^2}{2 \times 34 \times 18} = \frac{855}{1224} \rightarrow 46 \text{ or } 45.69\dots$

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, •<sup>3</sup> is not available

eg  $\frac{18^2 + 25^2 - 34^2}{2 \times 18 \times 25} \rightarrow -0.23 \rightarrow 103.3 \text{ and } 256.7$

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"> <li>•<sup>1</sup> start to process left hand side</li> <li>•<sup>2</sup> rearrange (collect constants on one side and variables on the other side)</li> <li>•<sup>3</sup> solve for <math>x</math></li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>5x - 10 + 4</math></li> <li>•<sup>2</sup> <math>-14 &lt; 2x</math> or <math>-2x &lt; 14</math></li> <li>•<sup>3</sup> <math>-7 &lt; x</math> or <math>x &gt; -7</math></li> </ul>	3
<b>Notes:</b> 1. Correct answer without valid working Treat repeated substitution as invalid working. award 0/3  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 • <sup>3</sup> eg $5x - 10 + 4 < 7x + 8 \rightarrow -2x < 22 \rightarrow x > -11$ award 2/3 ✓✗✓1 <b>OR</b> (ii) collecting the $x$ term(s) on the RHS of the inequation at • <sup>2</sup> 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 • <sup>3</sup> is not available eg $5x - 10 + 4 < 7x + 8 \rightarrow 2x < 14 \rightarrow x < 7$ award 1/3 ✓✗✗  3. For subsequent incorrect working, • <sup>3</sup> is not available. eg (a) $-7 < x \rightarrow x < -7$ award 2/3 ✓✓✗ (b) $-7 < x \rightarrow x = -7$ award 2/3 ✓✓✗					
<b>Commonly Observed Responses:</b> 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"> <li>•<sup>1</sup> know that <math>116\% = 278.40</math></li> <li>•<sup>2</sup> begin valid strategy</li> <li>•<sup>3</sup> complete calculation within valid strategy</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>116\% = 278.40</math></li> <li>•<sup>2</sup> eg <math>(1\% =) \frac{278.40}{116}</math></li> <li>•<sup>3</sup> (£) 240</li> </ul>	3
<b>Notes:</b> 1. Correct answer without working award 3/3 2. (a) $116\% = 278.40 \rightarrow 16\% \text{ of } 278.40 = 44.54$ award 1/3 ✓xx (b) $16\% \text{ of } 278.40 = 44.54$ award 0/3 3. (a) $116\% = 278.40 \rightarrow 116\% \text{ of } 278.40 = 322.94$ award 1/3 ✓xx (b) $116\% \text{ of } 278.40 = 322.94$ award 0/3 4. (a) $116\% = 278.40 \rightarrow 84\% \text{ of } 278.40 = 233.86$ award 1/3 ✓xx (b) $84\% \text{ of } 278.40 = 233.86$ award 0/3					
<b>Commonly Observed Responses:</b> 1. $\frac{278.40}{1.16} = 240$ award 3/3 2. $\frac{278.40}{84} = 3.31428... \rightarrow 331.43$ award 2/3 xx✓1✓1					

Question			Generic scheme	Illustrative scheme	Max mark
6.	(a)		• <sup>1</sup> factorise	• <sup>1</sup> $y(y-6)$	1
<b>Notes:</b> 1. If part (a) is not attempted, accept correct answer to part (a) in part (b) (see COR 1).					
<b>Commonly Observed Responses:</b> 1. $(y-6)(y\pm 0)$ award 0/1 ✓2 2. See CORs in part (b).					
	(b)		• <sup>2</sup> factorise denominator • <sup>3</sup> simplify	• <sup>2</sup> $(y-6)(y+3)$ • <sup>3</sup> $\frac{y}{y+3}$	2
<b>Notes:</b> 1. Correct answer without working award 2/2 2. For subsequent incorrect working • <sup>3</sup> is not available eg $\frac{\cancel{y}}{\cancel{y}+3} = \frac{1}{1+3} = \frac{1}{4}$ award 1/2 ✓✗ 3. • <sup>3</sup> 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.					
<b>Commonly Observed Responses:</b> 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"> <li>•<sup>1</sup> correct substitution into volume of <b>sphere</b> formula</li> <li>•<sup>2</sup> correct substitution into volume of cuboid formula and know to subtract volume of <b>hemisphere</b> from volume of cuboid</li> <li>•<sup>3</sup> consistent calculation (see Note 3)</li> <li>•<sup>4</sup> round final answer to 2 significant figures <b>and</b> state correct units</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\frac{4}{3} \times \pi \times 3^3</math></li> <li>•<sup>2</sup> <math>7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3</math> (= 196 – 56.54...)</li> <li>•<sup>3</sup> 139.45...</li> <li>•<sup>4</sup> 140 cm<sup>3</sup></li> </ul>	4

### Notes:

- Correct answer without working award 0/4
- For the award of •<sup>3</sup>, the calculation must involve the sum or difference of a calculation involving a fraction,  $\pi$  and a power, and a calculation of a product of at least two numbers.
- Accept variations in  $\pi$  to at least two decimal places  
eg  $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times 3.14 \times 3^3 = 139.48 = 140 \text{ cm}^3$
- 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 ✓✓×✓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 ✓✓×✓1
- (a) In awarding •<sup>3</sup> 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 ✓✓×✓1  
(b) In awarding •<sup>4</sup> 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
- <sup>4</sup> 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 ✓×✓1×



Question	Generic scheme	Illustrative scheme	Max mark
<b>7. (continued)</b>			
<b>Commonly Observed Responses:</b>			
1. $7 \times 7 \times 4 - \frac{4}{3} \times \pi \times 3^3 = 82.902... = 83 \text{ cm}^3$		award 3/4 ✓×✓1✓1	
2. (a) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3 = -256.389... = -260 \text{ cm}^3$		award 2/4 ×✓1✓1×	
(b) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3 = 256.389... = 260 \text{ cm}^3$		award 2/4 ×✓1×✓1	
(c) $\frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3 - 7 \times 7 \times 4 = 256.389... = 260 \text{ cm}^3$		award 2/4 × ×✓1✓1	
3. (a) $7 \times 7 \times 4 + \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 = 252.5... = 250 \text{ cm}^3$		award 3/4 ✓×✓1✓1	
(b) $7 \times 7 \times 4 + \frac{4}{3} \times \pi \times 3^3 = 309.09... = 310 \text{ cm}^3$		award 3/4 ✓×✓1✓1	
(c) $7 \times 7 \times 4 + \frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3 = 648.389... = 650 \text{ cm}^3$		award 2/4 ××✓1✓1	
4. (a) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^2 = 177.15... = 180 \text{ cm}^3$		award 3/4 ××✓1✓1	
(b) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 = 177.15... = 180 \text{ cm}^3$		award 3/4 ✓✓×✓1	
(c) $7 \times 7 \times 4 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3 = 189.71... = 190 \text{ cm}^3$		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"> <li>•<sup>1</sup> correct substitution into quadratic formula</li> <li>•<sup>2</sup> evaluate discriminant</li> <li>•<sup>3</sup> calculate both roots correct to two decimal places</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\frac{-8 \pm \sqrt{8^2 - 4 \times 3 \times 1}}{2 \times 3}</math></li> <li>•<sup>2</sup> 52 (stated or implied by •<sup>3</sup>)</li> <li>•<sup>3</sup> -0.13, -2.54</li> </ul>	3

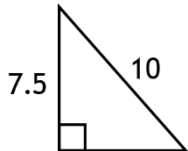
#### Notes:

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

#### Commonly Observed Responses:

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

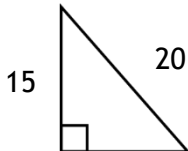
Question			Generic scheme	Illustrative scheme	Max mark
9.			<ul style="list-style-type: none"> <li>•<sup>1</sup> multiply by <math>e</math></li> <li>•<sup>2</sup> subtract 3</li> <li>•<sup>3</sup> divide by 2</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>ef = 2d + 3</math></li>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

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

#### Notes:

- Correct answer without working award 0/4
- 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 •<sup>1</sup> and •<sup>2</sup>.
- For the award of •<sup>2</sup> accept  $10^2 = x^2 + 7.5^2$  or  $20^2 = x^2 + 15^2$ .
- BEWARE**
  - Where a diagram is shown, working must be consistent with the diagram.
  - <sup>2</sup> is not available for an incorrect diagram leading to  $10^2 - 7.5^2$ .
- <sup>4</sup> 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.
- Alternative method:
 

- <sup>1</sup>
  - <sup>2</sup>
  - <sup>3</sup>
  - <sup>4</sup>



- $20^2 - 15^2$
  - 13.2...
  - 33.2(...cm)

#### Commonly Observed Responses:

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

Question			Generic scheme	Illustrative scheme	Max mark
11.			<ul style="list-style-type: none"> <li>•<sup>1</sup> re-arrange equation</li> <li>•<sup>2</sup> find one value of <math>x</math></li> <li>•<sup>3</sup> find second value of <math>x</math></li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\sin x = \frac{8}{17}</math></li> <li>•<sup>2</sup> <math>28(.07\dots)</math></li> <li>•<sup>3</sup> <math>151.9(2\dots)</math> or 152</li> </ul>	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, •<sup>3</sup> 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)  $\sin^{-1}\left(\frac{8}{17}\right) = 0.4899\dots \rightarrow 0.5, 179.5$  (RAD)

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

#### Commonly Observed Responses:

##### 1. If $\sin x < 0$ , •<sup>2</sup> and •<sup>3</sup> are only available for consistent 3<sup>rd</sup> and 4<sup>th</sup> 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"> <li>•<sup>1</sup> correct denominator</li> <li>•<sup>2</sup> correct numerator(s).</li> <li>•<sup>3</sup> express in simplest form (remove brackets in numerator and collect like terms)</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>(x+5)(x-4)</math></li> <li>•<sup>2</sup> <math>2(x-4)+3(x+5)</math></li> <li>•<sup>3</sup> <math>\frac{5x+7}{(x+5)(x-4)}</math></li> </ul>	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 •<sup>1</sup> and •<sup>2</sup>

3. Do not accept  $x+5(x-4)$  or  $(x+5)x-4$  or  $x+5 \times x-4$  for the award •<sup>1</sup> 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 •<sup>3</sup> is only available for a consistent expansion (unless incorrect expansion already appears at •<sup>1</sup>)  
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, •<sup>3</sup> 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><b>Method 1</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> correct substitution into sine rule</li> <li>•<sup>2</sup> re-arrange formula</li> <li>•<sup>3</sup> calculate BC</li> <li>•<sup>4</sup> consistent substitution into appropriate trig formula</li> <li>•<sup>5</sup> calculate BD</li> </ul> <p><b>Method 2</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> correct substitution into sine rule</li> <li>•<sup>2</sup> re-arrange formula</li> <li>•<sup>3</sup> calculate AB</li> <li>•<sup>4</sup> consistent substitution into appropriate trig formula</li> <li>•<sup>5</sup> calculate BD</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\frac{BC}{\sin 40} = \frac{22}{\sin 110}</math></li> <li>•<sup>2</sup> <math>\frac{22 \sin 40}{\sin 110}</math></li> <li>•<sup>3</sup> 15.0...</li> <li>•<sup>4</sup> <math>\sin 30 = \frac{BD}{15.0...}</math> or <math>\frac{BD}{\sin 30} = \frac{15.0...}{\sin 90}</math></li> <li>•<sup>5</sup> 7.5 (cm)</li> </ul> <ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\frac{AB}{\sin 30} = \frac{22}{\sin 110}</math></li> <li>•<sup>2</sup> <math>\frac{22 \sin 30}{\sin 110}</math></li> <li>•<sup>3</sup> 11.7...</li> <li>•<sup>4</sup> <math>\sin 40 = \frac{BD}{11.7...}</math> or <math>\frac{BD}{\sin 40} = \frac{11.7...}{\sin 90}</math></li> <li>•<sup>5</sup> 7.5 (cm)</li> </ul>	5

Question	Generic scheme	Illustrative scheme	Max mark
<b>13. (continued)</b>			
<b>Notes:</b>			
1. Correct answer without working			
			award 0/5
2. Do not penalise omission of degree signs.			
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 ✓✓xx✓1✓1
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
5. Alternative strategies for ● <sup>4</sup>			
eg (a) ● <sup>4</sup> $\sin 60 = \frac{DC}{15.0...}$ (DC = 12.99...) $\rightarrow \sqrt{(15.0...)^2 - DC^2}$			
(b) ● <sup>4</sup> $\text{Area} = \frac{1}{2} \times 22 \times 15(.048...) \times \sin 30$ (Area = 82.768 ...) $\rightarrow \frac{1}{2} \times 22 \times BD = \text{Area}$			
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 ● <sup>3</sup> is not available due to the negative length of BC			
<b>Commonly Observed Responses:</b>			
1. (a) $\frac{x}{\sin 40} = \frac{22}{\sin 30} \rightarrow x = 28$			
			award 2/5 xx✓1✓1^^
(b) $\frac{x}{\sin 30} = \frac{22}{\sin 40} \rightarrow x = 17$			
			award 2/5 xx✓1✓1^^
2. eg $\frac{AB}{30} = \frac{22}{110} \rightarrow AB = 6 \rightarrow BD = 6 \times \sin 40 = 3.9$ or 4			
			award 2/5 xxxx✓1✓1



Question			Generic scheme	Illustrative scheme	Max mark
14.	(a)		• <sup>1</sup> state vector	• <sup>1</sup> $\mathbf{b} - \mathbf{a}$ or $-\mathbf{a} + \mathbf{b}$	1
<b>Notes:</b> 1. For the award of • <sup>1</sup> accept $\mathbf{b} + -\mathbf{a}$ .					
<b>Commonly Observed Responses:</b>					
	(b)		• <sup>2</sup> valid pathway  • <sup>3</sup> Express $\overline{\mathbf{WM}}$ in terms of $\mathbf{a}$ and $\mathbf{b}$ in simplest form	• <sup>2</sup> $\mathbf{b} - \mathbf{a} - \frac{1}{2}\mathbf{a}$ OR $\overline{\mathbf{WX}} + \frac{1}{2}\overline{\mathbf{XY}}$ or equivalent  • <sup>3</sup> $\mathbf{b} - \frac{3}{2}\mathbf{a}$	2
<b>Notes:</b> 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 • <sup>2</sup>  3. For the award of • <sup>2</sup> 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 • <sup>3</sup> 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 <b>clearly</b> 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) ✓✓					
<b>Commonly Observed Responses:</b>					
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.			<b>Method 1</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> correct fraction</li> <li>•<sup>2</sup> know how to calculate sector area</li> <li>•<sup>3</sup> calculate sector area</li> </ul> <b>Method 2</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> start strategy for finding angle</li> <li>•<sup>2</sup> know how to calculate sector area</li> <li>•<sup>3</sup> calculate sector area</li> </ul>	<b>Method 1</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\frac{15}{\pi \times 24}</math> (= 0.198...)</li> <li>•<sup>2</sup> <math>\frac{15}{\pi \times 24} \times \pi \times 12^2</math></li> <li>•<sup>3</sup> <math>90(\text{cm}^2)</math></li> </ul> <b>Method 2</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> <math>15 = \frac{\text{angle}}{360} \times \pi \times 24</math></li> <li>•<sup>2</sup> <math>\frac{15}{\pi \times 24} \times 360 = \text{angle}</math>  <math>\rightarrow (\text{area} =) \frac{\text{angle}}{360} \times \pi \times 12^2</math></li> <li>•<sup>3</sup> <math>90(\text{cm}^2)</math></li> </ul>	3

**Notes:**

- Correct answer without working award 0/3
- <sup>2</sup> 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  $\pi$  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.  $\frac{15}{\pi \times 24} \times 360 = 72 \rightarrow \frac{72}{360} \times \pi \times 12^2 = 90.47... \text{ or } 90.5(\text{cm}^2)$  award 3/3
- Where an angle is assumed or calculated using an invalid strategy (eg cosine rule), •<sup>3</sup> is not available  
eg  $\frac{73}{360} \times \pi \times 12^2 = 91.7...(\text{cm}^2)$  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	×✓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	××✓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"><li>•<sup>1</sup> valid substitution</li><li>•<sup>2</sup> express in the form <math>a + b \sin^2 x^\circ</math></li></ul>	<ul style="list-style-type: none"><li>•<sup>1</sup> eg <math>3(1 - \sin^2 x) - 1</math></li><li>•<sup>2</sup> <math>2 - 3 \sin^2 x</math></li></ul>	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 ×✓1
5.	• <sup>1</sup> is not available if there are no variables eg $3(1 - \sin^2) - 1 = 2 - 3 \sin^2$			award 1/2 ×✓1
6.	• <sup>1</sup> is not available if the candidate simply states eg $\cos^2 x = 1 - \sin^2 x$ then proceeds no further.			
7.	• <sup>2</sup> 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]