National Qualifications 2016

2016 Mathematics Paper 1 (Non-calculator)

National 5

Finalised Marking Instructions

General Marking Principles for National 5 Mathematics

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this Paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

For each question the marking instructions are generally in two sections, namely Illustrative Scheme and Generic Scheme. The Illustrative Scheme covers methods which are commonly seen throughout the marking. The Generic Scheme indicates the rationale for which each mark is awarded. In general, markers should use the Illustrative Scheme and only use the Generic Scheme where a candidate has used a method not covered in the Illustrative Scheme.

(a) Marks for each candidate response must always be assigned in line with these General Marking Principles and the Detailed Marking Instructions for this assessment.

(b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.

(c) If a specific candidate response does not seem to be covered by either the principles or detailed Marking Instructions, and you are uncertain how to assess it, you must seek guidance from your Team Leader.

(d) Credit must be assigned in accordance with the specific assessment guidelines.

(e) One mark is available for each •. There are no half marks.

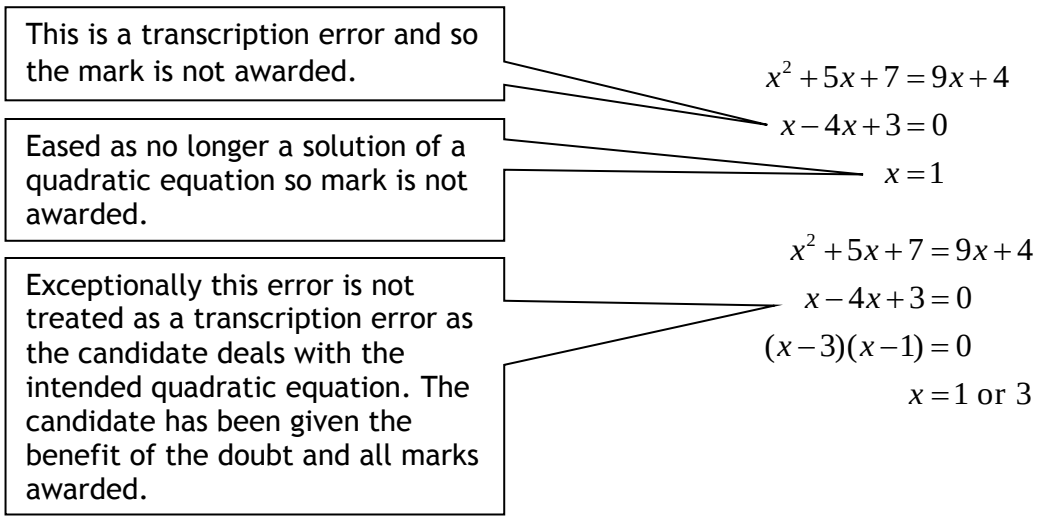
(f) Working subsequent to an error must be **followed through**, with possible credit for the subsequent working, provided that the level of difficulty involved is approximately similar. Where, subsequent to an error, the working for a follow through mark has been eased, the follow through mark cannot be awarded.

(g) As indicated on the front of the question paper, full credit should only be given where the solution contains appropriate working. Unless specifically mentioned in the marking instructions, a correct answer with no working receives no credit.

(h) Candidates may use any mathematically correct method to answer questions except in cases where a particular method is specified or excluded.

(i) As a consequence of an error perceived to be trivial, casual or insignificant, eg $6\times6=12$ candidates lose the opportunity of gaining a mark. However, note the second example in comment **(j)**.

(j) Where a transcription error (paper to script or within script) occurs, the candidate should normally lose the opportunity to be awarded the next process mark, eg



(k) **Horizontal/vertical marking**
Where a question results in two pairs of solutions, this technique should be applied, but only if indicated in the detailed marking instructions for the question.

Example:

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

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

Markers should choose whichever method benefits the candidate, but **not** a combination of both.

(l) In final answers, unless specifically mentioned in the detailed marking instructions, numerical values should be simplified as far as possible, eg:

$\frac{15}{12}$ must be simplified to $\frac{5}{4}$ or $1\frac{1}{4}$ $\frac{43}{1}$ must be simplified to 43

$\frac{15}{0\cdot3}$ must be simplified to 50 $\frac{4/5}{3}$ must be simplified to $\frac{4}{15}$

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

*The square root of perfect squares up to and including 100 must be known.

(m) 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.

(n) Unless specifically mentioned in the marking instructions, the following should not be penalised:

- Working subsequent to a correct answer
- Correct working in the wrong part of a question
- Legitimate variations in numerical answers/algebraic expressions, eg angles in degrees rounded to nearest degree
- Omission of units
- Bad form (bad form only becomes bad form if subsequent working is correct), eg $(x^3+2x^2+3x+2)(2x+1)$ written as $(x^3+2x^2+3x+2)\times 2x+1$

  $2x^4+4x^3+6x^2+4x+x^3+2x^2+3x+2$ written as $2x^4+5x^3+8x^2+7x+2$ gains full credit

- Repeated error within a question, but not between questions or papers

(o) In any 'Show that…' question, where the candidate has to arrive at a required result, the last mark of that part is not available as a follow-through from a previous error unless specified in the detailed marking instructions.

(p) All working should be carefully checked, even where a fundamental misunderstanding is apparent early in the candidate's response. Marks may still be available later in the question so reference must be made continually to the marking instructions. The appearance of the correct answer does not necessarily indicate that the candidate has gained all the available marks.

(q) Scored-out working which has not been replaced should be marked where still legible. However, if the scored out working has been replaced, only the work which has not been scored out should be marked.

(r) Where a candidate has made multiple attempts using the same strategy and not identified their final answer, mark all attempts and award the lowest mark. Where a candidate has tried different valid strategies, apply the above ruling to attempts within each strategy and then award the highest resultant 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.

Detailed Marking Instructions for each question

Question	Generic Scheme	Illustrative Scheme	Max Mark
1.	**Ans:** $\begin{pmatrix}-3\\-4\end{pmatrix}$ $\bullet^1$ calculate $\frac{1}{2}\mathbf{p}$ $\bullet^2$ solution	 $\bullet^1$ $\begin{pmatrix}2\\-3\end{pmatrix}$ $\bullet^2$ $\begin{pmatrix}-3\\-4\end{pmatrix}$	**2**

Notes:

1. Correct answer without working award 2/2
2. Treat $\begin{pmatrix}\frac{-3}{-4}\end{pmatrix}$ as bad form award 2/2
3. Where there are no brackets ie $\begin{matrix}-3\\-4\end{matrix}$ award 1/2
4. For $\frac{-3}{-4}$ award 1/2
5. Where there is invalid subsequent working $\bullet^2$ is not available
   eg award 1/2 ✓× for the following:

   $\begin{pmatrix}-3\\-4\end{pmatrix}\rightarrow$ (a) $(-3,-4)$

   (b) $-3+(-4)=-7$

   (c) $\sqrt{(-3)^2+(-4)^2}=5$

Commonly Observed Responses:

1. $\begin{pmatrix}4\\-6\end{pmatrix}+\begin{pmatrix}-5\\-1\end{pmatrix}=\begin{pmatrix}-1\\-7\end{pmatrix}$ award 1/2

2. $\frac{1}{2}\left(\begin{pmatrix}4\\-6\end{pmatrix}+\begin{pmatrix}-5\\-1\end{pmatrix}\right)=\begin{pmatrix}-0{\cdot}5\\-3{\cdot}5\end{pmatrix}$ award 1/2

3. $\begin{pmatrix}4\\-6\end{pmatrix}+\frac{1}{2}\begin{pmatrix}-5\\-1\end{pmatrix}=\begin{pmatrix}1{\cdot}5\\-6{\cdot}5\end{pmatrix}$ award 1/2

Question			Generic Scheme	Illustrative Scheme	Max Mark
2.			**Ans:** $\frac{13}{28}$ **Method 1** $\bullet^1$ start the calculation correctly $\bullet^2$ consistent answer in simplest form **Method 2** $\bullet^1$ start the calculation correctly $\bullet^2$ consistent answer in simplest form	 $\bullet^1$ $\frac{7}{21}+\frac{6}{21}$ $\bullet^2$ $\frac{13}{28}$ $\bullet^1$ $\frac{3}{12}+\frac{6}{28}$ or equivalent $\bullet^2$ $\frac{13}{28}$	**2**

Notes:

1. Correct answer without working award 0/2.
2. Final answer must be in simplest form eg for $\frac{39}{84}$ award 1/2 ✓×
3. $\bullet^2$ is only available where simplifying is required.
4. For subsequent incorrect working, $\bullet^2$ is not available eg for $\frac{13}{28}=2\frac{2}{28}=2\frac{1}{14}$ award 1/2 ✓×

Commonly Observed Responses:

1. For an answer of $\frac{9}{40}$ obtained from

   (a) Method 1: $\frac{3}{4}\left(\frac{1}{3}+\frac{2}{7}\right)=\frac{3}{4}\times\frac{3}{10}=\frac{9}{40}$ award 0/2

   (b) Method 2: $\frac{3}{12}+\frac{6}{28}=\frac{9}{40}$ award 1/2 ✓×

Question			Generic Scheme	Illustrative Scheme	Max Mark
3.			**Ans: 157 cm^2** **Method 1** • ^{1} appropriate fraction • ^{2} correct substitution into area of sector formula • ^{3} calculate area of sector **Method 2** • ^{1} appropriate fraction • ^{2} correct substitution into area of sector formula • ^{3} calculate area of sector	 • ^{1} $\frac{45}{360}$ or equivalent • ^{2} $\frac{45}{360}\times 3\cdot 14\times 20^2$ • ^{3} 157 (cm^2) • ^{1} $\frac{360}{45}$ or equivalent • ^{2} $3\cdot 14\times 20^2 \div \frac{360}{45}$ • ^{3} 157 (cm^2)	**3**

Notes:

1. Correct answer without working award 0/3.

2. Accept "$\div 8$" in working as evidence of $\frac{45}{360}$.

3. Accept "$\times 3\cdot 14$" in working as evidence of substitution into formula.

Commonly Observed Responses:

1. $\frac{45}{360}\times \pi r^2 = 8\times 3\cdot 14\times 20^2 = 10048\,(\text{cm}^2)$ award 2/3 ✓✓×

2. $\frac{360}{45}\times \pi r^2 = 8\times 3\cdot 14\times 20^2 = 10048\,(\text{cm}^2)$ award 2/3 ✓×✓

3. $\frac{45}{360}\times 3\cdot 14\times 20^2 \left(= \frac{45}{360}\times 3\cdot 14\times 40\right) = 15\cdot 7\,(\text{cm}^2)$ award 2/3 ✓✓×

4. $\frac{45}{360}\times 3\cdot 14\times 40 = 15\cdot 7\,(\text{cm}^2)$ award 2/3 ✓×✓

5. $\frac{45}{360}\times \pi\times 20^2$ award 1/3 ✓××

6. $3\cdot 14\times 20^2 = 1256\,(\text{cm}^2)$ award 0/

Question			Generic Scheme	Illustrative Scheme	Max Mark
4.	(a)		**Ans:** $2c+3d=9\cdot6$ $\bullet^1$ construct equation	 $\bullet^1$ $2c+3d=9\cdot6$	**1**
Notes:					
Commonly Observed Responses:					
	(b)		**Ans:** $3c+4d=13\cdot3$ $\bullet^1$ construct equation	 $\bullet^1$ $3c+4d=13\cdot3$	**1**
Notes:					
Commonly Observed Responses:					
	(c)		**Ans: A cloak requires 1·5 m^2 of material** **A dress requires 2·2 m^2 of material** $\bullet^1$ evidence of scaling $\bullet^2$ follow a valid strategy through to produce values for c and d $\bullet^3$ calculate correct values for c and d $\bullet^4$ communicate answers in **square metres**	 $\bullet^1$ eg $6c+9d=28\cdot8$ $6c+8d=26\cdot6$ $\bullet^2$ values for c and d $\bullet^3$ $c=1\cdot5$ and $d=2\cdot2$ $\bullet^4$ cloak 1·5 m^2 dress 2·2 m^2	**4**
Notes: 1. Correct answer without working award 0/4**.** 2. $\bullet^4$ is not available if either c or d is negative. 3. (a) where a candidate calculates values for c and d, $\bullet^4$ can only be awarded for a **conclusion** containing the words 'cloak' and 'dress' along with the **correct units** in **both** cases (b) where a candidate only calculates a value for **either** c **or** d, $\bullet^4$ can only be awarded If the **conclusion** contains the word 'cloak' or 'dress' along with the **correct units**					
Commonly Observed Responses:					

Question			Generic Scheme	Illustrative Scheme	Max Mark
5.	(a)		**Ans:** $W = 20A + 40$		**3**
			$\bullet^1$ gradient	$\bullet^1$ $\frac{240}{12}$ or equivalent	
			$\bullet^2$ substitute gradient and a point into $y = mx + c$ or $y - b = m(x - a)$	$\bullet^2$ $y - 100 = \frac{240}{12}(x - 3)$ or $y - 340 = \frac{240}{12}(x - 15)$ or $100 = \frac{240}{12} \times 3 + c$ or $340 = \frac{240}{12} \times 15 + c$	
			$\bullet^3$ state equation in terms of W and A **and** in simplest form (remove any brackets and collect constants)	$\bullet^3$ $W = 20A + 40$ or equivalent	

Notes:

1. Correct answer without working award 3/3.
2. $\bullet^3$ is not available for invalid subsequent working
   eg $W = 20A + 40 \rightarrow W = 2A + 4$ award 2/3 ✓✓×
3. Where $\frac{240}{12}$ is simplified incorrectly $\bullet^2$ is still available
   eg $m = \frac{240}{12} = \frac{20}{3} \rightarrow y - 100 = \frac{20}{3}(x - 3) \rightarrow W = \frac{20}{3}A + 80$ award 2/3 ✓✓×

Commonly Observed Responses:

1. $y = 20x + 40$ award 2/3 ✓✓×
2. $y = 20x$ award 1/3 ✓××
3. $W = \frac{20}{1}A + 40$ award 2/3 ✓✓×
4. $y - 100 = 20x - 3 \rightarrow W = 20A + 97$ award 2/3 ✓×✓

	(b)		**Ans:** $20 \times 12 + 40 = 280$ kg		**1**
			$\bullet^1$ calculate weight using equation from part (a)	$\bullet^1$ $20 \times 12 + 40 = 280$ **(kg)** stated explicitly	

Notes:

1. Correct answer without working award 0/1
2. Follow through mark from part (a) is only available if 12 is multiplied or divided by a whole number greater than 10 or a non-integer value followed by an addition or subtraction.

Commonly Observed Responses:

Question			Generic Scheme	Illustrative Scheme	Max Mark
6.			**Ans: real and distinct** $\bullet^1$ find discriminant $\bullet^2$ state nature of roots	 $\bullet^1$ 53 $\left[5^2-4\times7\times(-1)\right]$ $\bullet^2$ real and distinct (or equivalent)	**2**

Notes:

1. Correct answer without working award 0/2
2. 25 + 28 $\rightarrow$ real and distinct award 2/2
3. eg 25 + 28 = 52 $\rightarrow$ real and distinct award 1/2 ×✓
4. Accept '**real** roots'
5. Do not accept 'two distinct roots'
6. Do not award $\bullet^2$ where conclusion is ambiguous
   eg 53 $\rightarrow$ roots are real and even award 1/2 ✓×

Commonly Observed Responses:

1. $\dfrac{-5\pm\sqrt{5^2-4\times7\times(-1)}}{2\times7}=\dfrac{-5\pm\sqrt{53}}{2\times7}$ award 1/2 ✓×
2. $-3\rightarrow$ no real roots award 1/2 ×✓
3. $-3\rightarrow$ no roots award 0/2

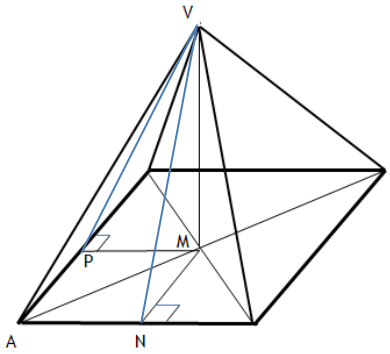
Question			Generic Scheme	Illustrative Scheme	Max Mark
7.	(a)		**Ans: (8, 4, 0)** $\bullet^1$ state coordinates of B	$\bullet^1$ (8, 4, 0)	**1**

Notes:
1. Brackets must be shown.

Commonly Observed Responses:

	(b)		**Ans: 7** $\bullet^1$ know how to find AM^2 $\bullet^2$ know how to find AV $\bullet^3$ find length of AV	 $\bullet^1$ 3^2+2^2 $\bullet^2$ $\sqrt{6^2+(3^2+2^2)}$ $\bullet^3$ 7	**3**

Notes:
1. Correct answer without working award 0/3
2. Alternative methods:



(a)[know how to find AM^2 ....]
- $\bullet^1$ $\frac{1}{4}(6^2+4^2)$
- $\bullet^2$ $\sqrt{6^2+\frac{1}{4}(6^2+4^2)}$
- $\bullet^3$ 7

(b)[know how to find VN^2 ....]
- $\bullet^1$ 6^2+2^2
- $\bullet^2$ $\sqrt{3^2+(6^2+2^2)}$
- $\bullet^3$ 7

(c)[know how to find VP^2....]
- $\bullet^1$ 6^2+3^2
- $\bullet^2$ $\sqrt{2^2+(6^2+3^2)}$
- $\bullet^3$ 7

Commonly Observed Responses:

1. $\bullet^1 \begin{pmatrix}3\\2\\6\end{pmatrix} \rightarrow \bullet^2 \sqrt{3^2+2^2+6^2} \rightarrow \bullet^3 = 7$ award 3/3

2. $\begin{pmatrix}7\\2\\6\end{pmatrix} \rightarrow \sqrt{7^2+2^2+6^2}=\sqrt{89}$ award 1/3 ×✓×

Question	Generic Scheme	Illustrative Scheme	Max Mark
8.	**Ans:** $x=-\frac{5}{8}$ **Method 1** $\bullet^1$ multiply throughout by 6 $\bullet^2$ rearrange $\bullet^3$ solve for x **Method 2** $\bullet^1$ rearrange $\bullet^2$ start to solve for x $\bullet^3$ solve for x	 $\bullet^1$ $4x-5=12x$ $\bullet^2$ $-8x=5$ or $-5=8x$ $\bullet^3$ $x=-\frac{5}{8}$ or $x=-0\cdot625$ $\bullet^1$ $\frac{4}{3}x=-\frac{5}{6}$ $\bullet^2$ $x=-\frac{5}{6}\times\frac{3}{4}$ or $24x=-15$ or equivalent $\bullet^3$ $x=-\frac{5}{8}$ or $x=-0\cdot625$	**3**

Notes:
1. Correct answer without working award 0/3
2. $\bullet^1$ is available for multiplying throughout by any common multiple of 3 and 6
3. $\bullet^1$ is not available for $\frac{4x-5}{6}=2x, \frac{12x-15}{18}=2x$ etc.
4. For the award of $\bullet^3$, the answer must be a non-integer value

Commonly Observed Responses:

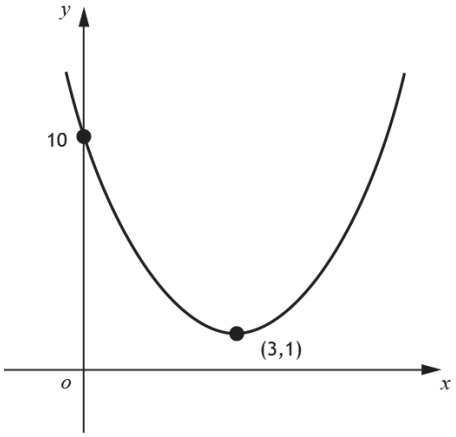
9.	**Ans:** $\frac{2\sqrt{5}}{5}$ $\bullet^1$ correct substitution $\bullet^2$ consistent answer	 $\bullet^1$ $\frac{2}{\sqrt{5}}$ $\bullet^2$ $\frac{2\sqrt{5}}{5}$	

Notes:
1. Correct answer without working award 0/2.

Commonly Observed Responses:
1. $\bullet^2$ is not available where there is invalid subsequent working

eg $\frac{2\sqrt{5}}{5}=2\sqrt{5}$ award 1/2 ✓×

2. $\frac{2}{\sqrt{x}}\times\frac{\sqrt{x}}{\sqrt{x}}=\frac{2\sqrt{x}}{x}$ award 1/2 ×✓

Question	Generic Scheme	Illustrative Scheme	Max Mark
10.	**Ans:**  		**3**
	•[1] coordinates of turning point correct	•[1] (3,1)	
	•[2] sketch parabola with **minimum** turning point consistent with •[1]	•[2] parabola with **minimum** turning point consistent with •[1]	
	•[3] y-intercept correct	•[3] (0,10) or 10	

Notes:

1. Correct answer without working award 3/3.
2. Where the coordinates of the turning point are not stated elsewhere, then for a sketch of a parabola with minimum turning point $(3,-1)$, $(-3,\pm1)$ or $(\pm1,\pm3)$ award •[2] but not •[1]. Otherwise •[2] is only available where the minimum turning point indicated on the sketch is consistent with that stated elsewhere.
3. The sketch of the parabola need not meet or cut the y-axis for the award of •[2].
4. •[2] is not available if the parabola has a maximum turning point.
5. •[3] is not available if the minimum turning point is on the y-axis.
6. Award •[3] where the y-intercept is calculated to be at $y = 10$ and is plotted on the diagram at (0,10) but annotated as (10,0). Treat this special case as bad form.

Commonly Observed Responses:

Question	Generic Scheme	Illustrative Scheme	Max Mark
11.	**Ans:** $\sin^2 x°$		**2**
	$\bullet^1$ identify correct trigonometric identity to be used	$\bullet^1$ $\frac{\sin x}{\cos x}$ **or** $\frac{\sin^2 x}{\cos^2 x}$	
	$\bullet^2$ use correct trigonometric identity to simplify expression	$\bullet^2$ $\frac{\sin^2 x}{\cos^2 x} \times \cos^2 x = \sin^2 x$	

Notes:

1. $\sin^2 x$ without working award 0/2
2. Degree signs are not required
3. $\bullet^2$ is not available if there is invalid subsequent working

   eg (a) $\frac{\sin^2 x}{\cos^2 x} \times \cos^2 x = \sin^2 x = 1 - \cos x$ award 1/2 ✓×

   (b) $\frac{\sin^2 x}{\cos^2 x} \times \cos^2 x = \sin^2 x = 1 - \cos^2 x$ award 2/2

4. $\bullet^1$ is not available if there are no variables e.g. $\frac{\sin^2}{\cos^2} \times \cos^2 = \sin^2$ award 1/2 ×✓
5. $\bullet^1$ is not available if candidate simply states $\tan x = \frac{\sin x}{\cos x}$ **and** $\sin^2 x + \cos^2 x = 1$ then proceeds no further
6. Alternative acceptable strategies

   (a) $\bullet^1$ $\tan x \cos x = \sin x$

   $\bullet^2$ $\tan^2 x \cos^2 x = \sin^2 x$

   award 2/2

   (b) $\bullet^1$ $\left(\frac{o}{a}\right)^2 \left(\frac{a}{h}\right)^2$

   $\bullet^2$ $\frac{o^2 a^2}{a^2 h^2} = \frac{o^2}{h^2} = \sin^2 x$

   award 2/2

Commonly Observed Responses:

1. $\frac{\cos^2 x}{\sin^2 x} \times \cos^2 x = \frac{\cos^4 x}{\sin^2 x}$ award 0/2
2. $\tan^2 x(1 - \sin^2 x) = \tan^2 x - \tan^2 x \sin^2 x$ award 0/2

Question			Generic Scheme	Illustrative Scheme	Max Mark
12.	(a)		**Ans:** $(2x+1)(x+8)$ • [1] find an expression for the area of the rectangle	[1] $(2x+1)(x+8)$ or equivalent	**1**
Notes: 1. If solution to (a) appears in (b) or (c) award 1/1 2. (a) Accept $(2x+1)\times(x+8)$, $2x+1 \times x+8$ (b) Do **not** accept $2x+1(x+8)$, $x+8(2x+1)$ unless correct expansion appears in (a) (b) or (c)					
Commonly Observed Responses:					
12.	(b)		**Ans: proof** • [1] find **expanded** expression for area of the rectangle • [2] find **expanded** expression for area of the triangle • [3] equate expanded expressions and rearrange into required form	 • [1] $2x^2+16x+x+8$ • [2] $3x^2+15x$ • [3] $2x^2+16x+x+8=3x^2+15x$ $\Rightarrow x^2-2x-8=0$	**3**
Notes: 1. If solution to (b) appears in (a) or (c) then all three marks are available					
Commonly Observed Responses:					

Question			Generic Scheme	Illustrative Scheme	Max Mark
12.	(c)		**Ans: 12 cm and 9 cm** •[1] factorise x^2-2x-8 •[2] solve equation •[3] reject invalid value of x **and** state length and breadth of rectangle	•[1] $(x-4)(x+2)$ •[2] $x=4$ **and** $x=-2$ •[3] 12 (cm) and 9 (cm)	**3**

Notes:

1. Correct answer without working award 0/3.
2. If solution to (c) appears in (a) or (b) then all three marks are available.
3. •[1] is available for $\dfrac{2\pm\sqrt{(-2)^2-4\times1\times(-8)}}{2\times1}$
4. For an answer obtained by guess and check award 0/3

Commonly Observed Responses:

1.(a) $(2x+1)(x+8)=0\rightarrow x=-\dfrac{1}{2}$ and $x=-8$ award 1/3 ×✓×

(b) $x=-\dfrac{1}{2}$ and $x=-8$ without factorised quadratic equation stated award 0/3

[END OF MARKING INSTRUCTIONS]

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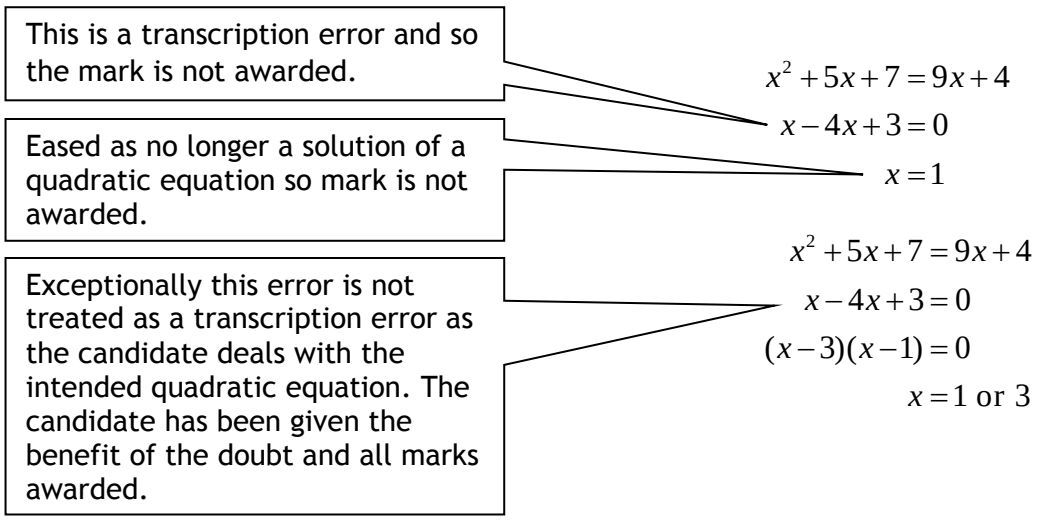

(k) **Horizontal/vertical marking**
Where a question results in two pairs of solutions, this technique should be applied, but only if indicated in the detailed marking instructions for the question.

Example:

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

Horizontal: $\bullet^5$ $x=2$ and $x=-4$ Vertical: $\bullet^5$ $x=2$ and $y=5$
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Markers should choose whichever method benefits the candidate, but **not** a combination of both.

(l) In final answers, unless specifically mentioned in the detailed marking instructions, numerical values should be simplified as far as possible, eg:

$\frac{15}{12}$ must be simplified to $\frac{5}{4}$ or $1\frac{1}{4}$ $\frac{43}{1}$ must be simplified to 43

$\frac{15}{0\cdot3}$ must be simplified to 50 $\frac{4/5}{3}$ must be simplified to $\frac{4}{15}$

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

*The square root of perfect squares up to and including 100 must be known.

(m) 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.

(n) Unless specifically mentioned in the marking instructions, the following should not be penalised:

- Working subsequent to a correct answer
- Correct working in the wrong part of a question
- Legitimate variations in numerical answers/algebraic expressions, eg angles in degrees rounded to nearest degree
- Omission of units
- Bad form (bad form only becomes bad form if subsequent working is correct), eg $(x^3+2x^2+3x+2)(2x+1)$ written as $(x^3+2x^2+3x+2)\times 2x+1$

  $2x^4+4x^3+6x^2+4x+x^3+2x^2+3x+2$ written as $2x^4+5x^3+8x^2+7x+2$ gains full credit

- Repeated error within a question, but not between questions or papers

(o) In any 'Show that…' question, where the candidate has to arrive at a required result, the last mark of that part is not available as a follow-through from a previous error unless specified in the detailed marking instructions.

(p) All working should be carefully checked, even where a fundamental misunderstanding is apparent early in the candidate's response. Marks may still be available later in the question so reference must be made continually to the marking instructions. The appearance of the correct answer does not necessarily indicate that the candidate has gained all the available marks.

(q) Scored-out working which has not been replaced should be marked where still legible. However, if the scored out working has been replaced, only the work which has not been scored out should be marked.

(r) Where a candidate has made multiple attempts using the same strategy and not identified their final answer, mark all attempts and award the lowest mark. Where a candidate has tried different valid strategies, apply the above ruling to attempts within each strategy and then award the highest resultant 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.

Detailed Marking Instructions for each question

Question			Generic Scheme	Illustrative Scheme	Max Mark
1.			**Ans: 27·(25408) grams** • [1] know how to decrease by 8% • [2] know how to calculate the sugar content after 3 years • [3] evaluate	 • [1] $\times 0\cdot 92$ • [2] $35\times 0\cdot 92^3$ • [3] $27\cdot(25408)$ (grams)	**3**

Notes:

1. Correct answer without working award 3/3
2. Do not penalise incorrect rounding
3. Where an incorrect percentage is used, the working must be followed through to give the possibility of awarding 2/3
   eg For $35\times 0\cdot 08^3 = 0\cdot 01792$, with working award 2/3 ×✓✓
4. Where division is used,
   (a) along with $0\cdot 92$, •[1] is not available
   eg $35\div 0\cdot 92^3 = 44\cdot 94...$ award 2/3 ×✓✓
   (b) along with an incorrect percentage, •[1] and •[2] are not available
   eg $35\div 1\cdot 08^3 = 27\cdot 78...$ award 1/3 ××✓

Commonly Observed Responses:

Working must be shown

1. $35\times 1\cdot 08^3 = 44\cdot 0...$ award 2/3 ×✓✓
2. $35\times 0\cdot 08 = 2\cdot 8 \rightarrow 35 - 3\times 2\cdot 8 = 26\cdot 6$ award 1/3 ✓××
3. $35\times 0\cdot 92 = 32\cdot 2$ award 1/3 ✓××
4. $35\times 0\cdot 92\times 3 = 96\cdot 6$ award 1/3 ✓××
5. $35\times 0\cdot 08\times 3 = 8\cdot 4$ award 0/3

Question			Generic Scheme	Illustrative Scheme	Max Mark
2.			**Ans: 8×10^{-9} grams** $\bullet^1$ correct method $\bullet^2$ answer	 $\bullet^1$ $12\div\left(1\cdot5\times10^{9}\right)$ $\bullet^2$ 8×10^{-9}	**2**

Notes:

1. Correct answer without working award 2/2
2. $\bullet^2$ is still available if there is additional multiplication or division by 1000 (but by no other numbers).
   eg award 1/2 ×✓ for
   (a) $12\div\left(1\cdot5\times10^{9}\right)\div1000=8\times10^{-12}$
   (b) $\left(1\cdot5\times10^{9}\right)\div12\times1000=1\cdot25\times10^{11}$

Commonly Observed Responses:

No working necessary

1. $(1\cdot5\times10^{9})\div12=1\cdot25\times10^{8}$ award 1/2 ×✓
2. $\left(1\cdot5\times10^{9}\right)\div12=1\cdot2\times10^{8}$ or $1\cdot3\times10^{8}$ award 1/2 ×✓
3. $(1\cdot5\times10^{9})\times12=1\cdot8\times10^{10}$ award 1/2 ×✓

Question			Generic Scheme	Illustrative Scheme	Max Mark
3.			**Ans: v − u** •[1] correct answer	 •[1] **v** − **u** or -**u** + **v** or **v** + − **u**	**1**
Notes:					
Commonly Observed Responses:					
4.			**Ans:** $3(x+4)(x-4)$ •[1] begin to factorise •[2] factorise fully	 •[1] $3(x^2-16)$ •[2] $3(x+4)(x-4)$	**2**
Notes: 1. Correct answer without working award 2/2 2. •[1] is also available for $(3x+12)(x-4)$ or $(3x-12)(x+4)$ 3. •[1] is not available for 3 **or** (x^2-16) alone 4. All three factors must be shown **together** to obtain •[2]. 5. Special cases (a) award 1/2 for $3(x-4)^2$ or $(x+4)(x-4)$ or $3(x+8)(x-8)$ (b) award 0/2 for eg $(3x-8)(x+6)$					
Commonly Observed Responses:					
5.			**Ans: ABC = 74°** •[1] calculate the size of angle AOE or CAO •[2] calculate the size of angle CAB •[3] calculate the size of angle ABC	 •[1] 37 •[2] 53 •[3] 74	**3**
Notes: 1. Full marks may be awarded for information marked on the diagram 2. For an answer of 74° with no **relevant** working award 0/3 3. •[3] is available for correct calculation of 180 − 2 × angle CAB					
Commonly Observed Responses:					

Question			Generic Scheme	Illustrative Scheme	Max Mark
6.	(a)		**Ans: mean = 13 minutes, st dev = 5·7 minutes**		**4**
			•[1] calculate mean	•[1] 13 (minutes)	
			•[2] calculate $\left(x-\bar{x}\right)^2$	•[2] 0, 9, 9, 81, 64, 1	
			•[3] substitute into formula	•[3] $\sqrt{\frac{164}{5}}$	
			•[4] calculate standard deviation	•[4] 5·7… (minutes)	
Notes: 1. For an answer of 13 and 5·7 without working award 1/4 ✓××××. 2. For use of alternative formula award •[2], •[3] and •[4] as follows: •[2] calculate $\sum x$ and $\sum x^2$ •[2] 78, 1178 •[3] substitute into formula •[3] $\sqrt{\frac{1178-\frac{78^2}{6}}{5}}$ •[4] calculate standard deviation •[4] 5·7… (minutes)					
Commonly Observed Responses:					
	(b)		**Ans: valid statements**		**2**
			•[1] compare means	•[1] On average Sophie's waiting time was longer.	
			•[2] compare standard deviations	•[2] Sophie's waiting times were more consistent.	

Question	Generic Scheme	Illustrative Scheme	Max Mark

Notes:

1. Answers must be consistent with answers to part (a).

2. Statements regarding the mean must show an understanding that mean is an average.
   (a) eg Accept
   - Sophie's average waiting time is more
   - In general her time is more
   - Sophie's waiting time is more overall

   (b) eg Do not accept
   - Sophie's mean waiting time is more
   - Sophie's waiting time is longer (this implies that all her waiting times are longer)

3. Statements regarding the standard deviation must show an understanding that standard deviation is a measure of spread.
   (a) eg Accept
   - The spread of Sophie's times is less
   - Sophie's times are more consistent
   - Her waiting is less varied

   (b) eg Do not accept
   - Sophie's standard deviation is less
   - The range of Sophie's times is less
   - On average her waiting times are less varied
   - The standard deviation is more consistent

4. Statements must refer to Sophie/Jack or she/he
   eg do not accept "on average the waiting time was longer".

5. Accept statements using 'waiting time', 'call time', 'time' or 'waiting'.

Commonly Observed Responses:

Question			Generic Scheme	Illustrative Scheme	Max Mark
7.			**Ans: 5300 cubic centimetres**		**5**
			•[1] know to find difference in two volumes	•[1] evidence of difference in two volumes	
			•[2] substitute correctly into formula for volume of large cone	•[2] $\frac{1}{3}\times\pi\times16^2\times24\ \ (=6433\cdot98\ldots)$	
			•[3] substitute correctly into formula for volume of small cone	•[3] $\frac{1}{3}\times\pi\times9^2\times13\cdot5\ \ (=1145\cdot11\ldots)$	
			•[4] carry out all calculations correctly (must involve difference or sum of two volume calculations and include a fraction)	•[4] $5288\cdot87\ldots$	
			•[5] round **final answer** to 2 significant figures **and state correct units**	•[5] $5300\,\text{cm}^3$	

Notes:

1. Correct answer without working award 0/5.
2. Accept variations in π.
   eg $\frac{1}{3}\times3\cdot14\times16^2\times24-\frac{1}{3}\times3\cdot14\times9^2\times13\cdot5=6430\cdot72-1144\cdot53=5286\cdot19=5300\,\text{cm}^3$
3. In awarding •[5]
   (a) Intermediate calculations need not be shown
   eg $\frac{1}{3}\times\pi\times16^2\times24-\frac{1}{3}\times\pi\times9^2\times13\cdot5=5300\,\text{cm}^3$ award 5/5
   (b) Where intermediate calculations are shown, they must involve at least three significant figures
   eg $6433\cdot98\ldots-1145\cdot11\ldots=6400-1100=5300\,\text{cm}^3$ award 4/5 ✓✓✓✓×
   (c) Where the volume of **only one** cone is calculated •[5] is available
   eg $\frac{1}{3}\times\pi\times16^2\times24=6400\,\text{cm}^3$ award 2/5 ×✓××✓
   (d) Accept 5300 ml or 5·3 litres.

Question	Generic Scheme	Illustrative Scheme	Max Mark
Commonly Observed Responses: **Working must be shown** 1. $\frac{1}{3}\times\pi\times16^2\times24+\frac{1}{3}\times\pi\times9^2\times13\cdot5=7600\,\text{cm}^3$ award 4/5 ×✓✓✓✓ 2. $\frac{1}{3}\times\pi\times32^2\times24-\frac{1}{3}\times\pi\times18^2\times13\cdot5=21000\,\text{cm}^3$ award 4/5 ✓×✓✓✓ 3. $\frac{1}{3}\times\pi\times16^2\times24-\frac{1}{3}\times\pi\times9^2\times10\cdot5=5500\,\text{cm}^3$ award 4/5 ✓✓×✓✓ 4. $\frac{1}{3}\times\pi\times16^2\times24+\frac{1}{3}\times\pi\times9^2\times10\cdot5=7300\,\text{cm}^3$ award 3/5 ×✓×✓✓ 5. $\frac{1}{3}\times\pi\times16^2\times10\cdot5-\frac{1}{3}\times\pi\times9^2\times13\cdot5=1700\,\text{cm}^3$ award 4/5 ✓×✓✓✓ 6. $\frac{1}{3}\times\pi\times16^2\times10\cdot5+\frac{1}{3}\times\pi\times9^2\times13\cdot5=4000\,\text{cm}^3$ award 3/5 ××✓✓✓ 7. $\pi\times16^2\times24-\pi\times9^2\times13\cdot5=16000\,\text{cm}^3$ award 3/5 ✓×✓×✓ 8. $\frac{4}{3}\times\pi\times16^3-\frac{4}{3}\times\pi\times9^3=14000\,\text{cm}^3$ award 3/5 ✓××✓✓		

Question			Generic Scheme	Illustrative Scheme	Max Mark
8.			**Ans: 78°** • [1] correct substitution into sine rule • [2] re-arrange formula • [3] find x	 • [1] $\frac{\sin x}{150}=\frac{\sin 66}{140}$ or $\frac{150}{\sin x}=\frac{140}{\sin 66}$ • [2] $\sin x=\frac{150\sin 66}{140}$ • [3] $x=78(\cdot 18\ldots)$	**3**

Notes:

1. Correct answer without working award 0/3.
2. Do not penalise incorrect rounding in the final answer
   eg $\sin x=\frac{150\sin 66}{140}=0\cdot 978\ \rightarrow x=77\cdot 9$ award 3/3
3. Premature rounding: rounded working must be to at least 2 decimal places.
4. Premature truncation: truncated working must be to at least 3 decimal places.
5. $\pm 0\cdot 028\ldots$ (uses rad) award 2 marks (working must be shown)
6. $75, 74\cdot 72\ldots$ (uses grad) award 3 marks (working must be shown)

Commonly Observed Responses:

1. Examples of premature rounding/truncation (apply notes 2 and 3)

(a) Premature rounding:

$\sin x=\frac{150\sin 66}{140}$

$=0\cdot 98\rightarrow x=78\cdot 5$

award 3/3

(b)Premature rounding:

$\sin x=\frac{150\sin 66}{140}$

$=\frac{150\times 0\cdot 9}{140}$

$=0\cdot 964\ldots\rightarrow x=74\cdot 6$

award 2/3 ✓✓×

(c) Premature truncation:

$\sin x=\frac{150\sin 66}{140}\ (=0\cdot 978\ldots)$

$=0\cdot 97\rightarrow x=75\cdot 9$

award 2/3 ✓✓×

Question			Generic Scheme	Illustrative Scheme	Max Mark
9.			**Ans:** $(x+4)^2-23$ • [1] correct bracket with square • [2] complete process	 • [1] $(x+4)^2$ • [2] $(x+4)^2-23$	**2**

Notes:
1. Correct answer without working award 2/2

Commonly Observed Responses:
No working necessary:

1. Award 2/2 for (a) $(x+4)^2+(-23)$ or $(x+4)^2+-23$
   (b) $(x+4)(x+4)-23$
2. Award 1/2 ×✓ for (a) $(x+4)-23$
   (b) $(x^2+4)-23$
   (c) $(x^2+4)^2-23$
   (d) $(x+4x)^2-23$
   (e) $(x+8)^2-71$
3. Award 0/2 for eg $(x+8)^2-23$

Question			Generic Scheme	Illustrative Scheme	Max Mark
10.			**Ans:** $\frac{1}{n^4}$ **Method 1** • [1] simplify $\left(n^2\right)^3$ • [2] simplify $n^6 \times n^{-10}$ • [3] express with a positive power **Method 2** • [1] simplify $\left(n^2\right)^3$ • [2] express with a positive power • [3] simplify $n^6 \times \frac{1}{n^{10}}$	 • [1] n^6 • [2] n^{-4} • [3] $\frac{1}{n^4}$ • [1] n^6 • [2] $\frac{1}{n^{10}}$ • [3] $\frac{1}{n^4}$	**3**
Notes: 1. Correct answer without working award 3/3					
Commonly Observed Responses:					

Question	Generic Scheme	Illustrative Scheme	Max Mark
11.	**Ans:** £4·95 **Method 1** • [1] linear scale factor • [2] know to multiply cost by the square of the linear scale factor • [3] find cost of smaller picture (calculation must involve a power of the scale factor) **Method 2** • [1] linear scale factor • [2] know to divide cost by the square of the linear scale factor • [3] find cost of smaller picture (calculation must involve a power of the scale factor)	 • [1] $\frac{60}{100}$ • [2] $13\cdot75\times\left(\frac{60}{100}\right)^2$ • [3] (£)4·95 • [1] $\frac{100}{60}$ • [2] $13\cdot75\div\left(\frac{100}{60}\right)^2$ • [3] (£)4·95	

Notes:
1. Correct answer without working award 3/3
2. Disregard incorrect units or omission of units
3. Answer must be rounded to nearest penny if required.

Commonly Observed Responses:

1. $13\cdot75\times\frac{60}{100}=8\cdot25$ award 1/3 ✓××
2. $13\cdot75\times\left(\frac{60}{100}\right)^3=2\cdot97$ award 2/3 ✓×✓
3. $(13\cdot75)^2\times\frac{60}{100}=113\cdot44$ award 1/3 ✓××
4. $13\cdot75\times\left(\frac{100}{60}\right)^2=38\cdot19$ award 2/3 ✓×✓
5. $13\cdot75\div\left(\frac{100}{60}\right)^2=13\cdot75\div1\cdot67^2=4\cdot93$ award 2/3 ✓✓×
   (Premature rounding leads to inaccurate answer)
6. $13\cdot75\times\left(\frac{100}{60}\right)^2=13\cdot75\times1\cdot67^2=38\cdot35$ award 1/3 ✓××
   (Premature rounding leads to inaccurate answer)

Question			Generic Scheme	Illustrative Scheme	Max Mark
12.			**Ans:** $k = \dfrac{L^2 + p}{4t}$ • [1] square • [2] add p • [3] divide by $4t$	 • [1] $L^2 = 4kt - p$ • [2] $4kt = L^2 + p$ • [3] $k = \dfrac{L^2 + p}{4t}$	**3**

Notes:

1. Correct answer without working award 3/3.
2. Final answer should be in simplest form

   (a) $\dfrac{1}{4}\left(\dfrac{L^2 + p}{t}\right)$ award 3/3

   (b) $\dfrac{\left(\dfrac{L^2 + p}{t}\right)}{4}$ award 2/3 ✓✓×
3. For subsequent incorrect working, •[3] is not available.

Commonly Observed Responses:

1. For the response below award 1/3

- add p $\quad L + p = \sqrt{4kt}$ ×
- divide by 4t $\quad \dfrac{L + p}{4t} = \sqrt{k}$ ×
- square $\quad k = \left(\dfrac{L + p}{4t}\right)^2$ ✓

Question	Generic Scheme	Illustrative Scheme	Max Mark
13.	**Ans:** $\dfrac{8x-7}{(x-2)(x+1)}$		**3**
	• [1] correct denominator	• [1] $(x-2)(x+1)$	
	• [2] correct numerator	• [2] $3(x+1)+5(x-2)$	
	• [3] remove brackets and collect like terms in numerator	• [3] $\dfrac{8x-7}{(x-2)(x+1)}$	

Notes:

1. Correct answer without working award 3/3.
2. Accept $\dfrac{3(x+1)}{(x-2)(x+1)}+\dfrac{5(x-2)}{(x-2)(x+1)}$ for the award of •[1] and •[2].
3. Do **not** accept $x-2(x+1)$ or $x+1(x-2)$ for the award of •[1] unless the correct expansion appears in the final answer.
4. Where a candidate chooses to expand the brackets in the denominator, then •[1] is only available for a correct expansion.

   eg (a) $\dfrac{3(x+1)}{(x-2)(x+1)}+\dfrac{5(x-2)}{(x-2)(x+1)}=\dfrac{8x-7}{x^2-x-2}$ award 3/3

   (b) $\dfrac{3(x+1)}{(x-2)(x+1)}+\dfrac{5(x-2)}{(x-2)(x+1)}=\dfrac{8x-7}{x^2-2}$ award 2/3 ✓✓×

   (c) $\dfrac{3(x+1)}{x^2-2}+\dfrac{5(x-2)}{x^2-2}=\dfrac{8x-7}{x^2-2}$ award 2/3 ×✓✓

Commonly Observed Responses:

1. $\dfrac{3x+1}{(x-2)(x+1)}+\dfrac{5x-2}{(x-2)(x+1)}=\dfrac{8x-1}{(x-2)(x+1)}$ award 1/3 ✓××

Question			Generic Scheme	Illustrative Scheme	Max Mark
14.			**Ans: x = 102·5, 282·5** •[1] rearrange equation •[2] find one value of x •[3] find another value of x	•[1] $\tan x = -\frac{9}{2}$ •[2] x = 102·5 •[3] x = 282·5	**3**

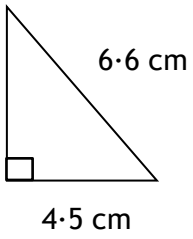
Notes:
1. Correct answer without working award 2/3
2. For x = 178·6, 358·6 (uses RAD), award 3/3 (with working), 2/3 (without working)
3. For x = 93·9, 273·9 (uses GRAD), award 3/3 (with working), 2/3 (without working)
4. Do not penalise omission of degree signs throughout the question

Commonly Observed Responses:

1. If $\tan x^\circ < 0$ then award •[2] and •[3] for correct 2nd and 4th quadrant angles
   eg $\tan x = -\frac{9}{2} \rightarrow$ (a) $x = 77\cdot5, 102\cdot5$ award 2/3 ✓×✓
   (b) $x = 77\cdot5, 282\cdot5$ award 2/3 ✓×✓
   (c) $x = 77\cdot5, 257\cdot5$ award 1/3 ✓××

2. If $\tan x > 0$ then •[2] is not available (working eased) but award •[3] for correct 3rd quadrant angle eg $\tan x^\circ = \frac{9}{2} \rightarrow$ (a) $x = 77\cdot5, 257\cdot5$ award 1/3 ××✓
   (b) $x = 77\cdot5, 102\cdot5$ award 0/3
   (c) $x = 77\cdot5, 282\cdot5$ award 0/3
   (d) $\tan x^\circ = \frac{1}{2} \rightarrow x = 26\cdot6, 206\cdot6$ award 1/3 ××✓

3. $\tan x^\circ = -\frac{9}{2} \rightarrow x = -77\cdot5$
   (a) $x = 257\cdot5\ \left[180 - (-77\cdot5)\right],\ 437\cdot5\ \left[360 - (-77\cdot5)\right]$ award 1/3 ✓××
   (incorrect application of CAST diagram and $437\cdot5 > 360$)
   (b) $x = 102\cdot5\ \left[-77\cdot5 + 180\right],\ 282\cdot5\ \left[102\cdot5 + 180\right]$ award 3/3
   (correct application of periodicity of $\tan x^\circ$)

Question			Generic Scheme	Illustrative Scheme	Max Mark
15.			**Ans: 11·4… (cm)** •[1] marshal facts and recognise right-angled triangle	•[1] 	**4**
			•[2] correct Pythagoras statement	•[2] $x^2 = 6 \cdot 6^2 - 4 \cdot 5^2$	
			•[3] correct calculation of x	•[3] 4·8…	
			•[4] find height of label	•[4] 11·4… (cm)	

Notes:

1. For correct answer without working award 0/4
2. •[4] is for adding 6·6 to a previously calculated value
3. In the absence of a diagram accept $x^2 = 6 \cdot 6^2 - 4 \cdot 5^2$ as evidence for the award of •[1] and •[2].
4. Where a candidate assumes an angle of 45° in the right-angled triangle, only •[1] and •[4] are available.

Commonly Observed Responses:

1. For $x^2 = 6 \cdot 6^2 + 4 \cdot 5^2 \rightarrow x = 7 \cdot 988... \rightarrow$ height $= 14 \cdot 588...$
   (a) with correct diagram award 3/4 ✓×✓✓
   (b) without a diagram award 2/4 ××✓✓

Question			Generic Scheme	Illustrative Scheme	Max Mark
16.			**Ans:** $6\cdot8$ **cm** $\bullet^1$ identify $\cos A$ or angle A $\bullet^2$ substitute into cosine rule (**cos A or angle A must have been found using trigonometry**) $\bullet^3$ calculate BC^2 $\bullet^4$ calculate BC correct to one decimal place	$\bullet^1$ $\cos A = \frac{3}{4}$ or $A = 41\cdot4$ $\bullet^2$ $BC^2 = 6^2 + 10^2 - 2\times6\times10\times\frac{3}{4}$ **or** $BC^2 = 6^2 + 10^2 - 2\times6\times10\times\cos41\cdot4$ $\bullet^3$ $BC = 46$ $\bullet^4$ $BC = 6\cdot8$ (cm)	**4**

Notes:

1. Correct answer without working award 0/4
2. Do not accept the substitution of a length or the value of sin A or tan A in place of angle A in the cosine rule.
3. $\bullet^3$ and $\bullet^4$ are only available for calculations within a valid strategy
4. Alternative valid strategies:

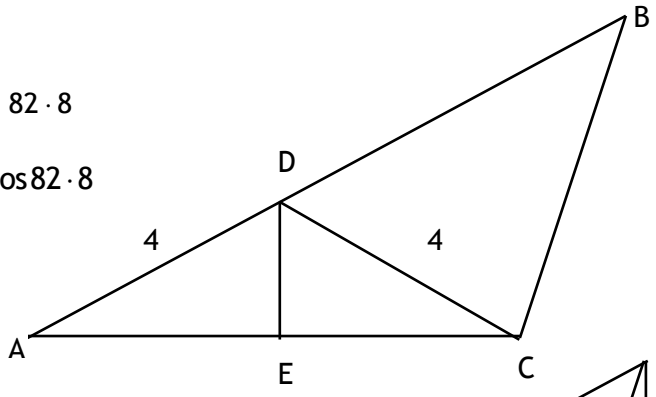
(a) $\bullet^1$ $ADE = \sin^{-1}\left(\frac{3}{4}\right) = 48\cdot6$

$\Rightarrow BDC = 180 - 2\times48\cdot6 = 82\cdot8$

$\bullet^2$ $BC^2 = 6^2 + 4^2 - 2\times6\times4\times\cos82\cdot8$

$\bullet^3$ $BC^2 = 45\cdot984...$

$\bullet^4$ $BC = 6\cdot8$ (cm)

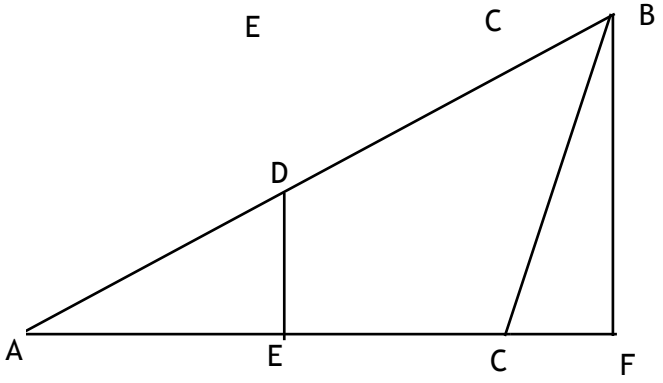


(b) $\bullet^1$ $AF = \frac{10}{4}\times3 = 7\cdot5$

$\bullet^2$ $BF^2 = 10^2 - 7\cdot5^2 = 43\cdot75$

$\bullet^3$ $BC^2 = 43\cdot75 + 1\cdot5^2 = 46$

$\bullet^4$ $BC = 6\cdot8$ (cm)



5. If premature rounding leads to an answer other than 6·8 then $\bullet^4$ is not available.

Commonly Observed Responses:

1. $DE^2 = 4^2 - 3^2 = 7 \rightarrow DE = 2\cdot6$ award 0/4
2. $BC^2 = 6^2 - 4^2 = 20 \rightarrow BC = 4\cdot5$ award 0/4
   [incorrectly assuming that angle BCD = 90° in note 4(a) diagram]

[END OF MARKING INSTRUCTIONS]