



National
Qualifications
2016

2016 Mathematics Paper 2

National 5

Finalised Marking Instructions

© Scottish Qualifications Authority 2016

The information in this publication may be reproduced to support SQA qualifications only on a non-commercial basis. If it is to be used for any other purposes written permission must be obtained from SQA's NQ Assessment team.

Where the publication includes materials from sources other than SQA (secondary copyright), this material should only be reproduced for the purposes of examination or assessment. If it needs to be reproduced for any other purpose it is the centre's responsibility to obtain the necessary copyright clearance. SQA's NQ Assessment team may be able to direct you to the secondary sources.

These Marking Instructions have been prepared by Examination Teams for use by SQA Appointed Markers when marking External Course Assessments. This publication must not be reproduced for commercial or trade purposes.



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 $6 \times 6 = 12$ 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

This is a transcription error and so the mark is not awarded.		$x^2 + 5x + 7 = 9x + 4$
Eased as no longer a solution of a quadratic equation so mark is not awarded.		$x - 4x + 3 = 0$
Exceptionally 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.		$x = 1$
		$x^2 + 5x + 7 = 9x + 4$
		$x - 4x + 3 = 0$
		$(x - 3)(x - 1) = 0$
		$x = 1 \text{ or } 3$

(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:

$$\begin{array}{cc}
 \bullet^5 & \bullet^6 \\
 \bullet^5 x = 2 & x = -4 \\
 \bullet^6 y = 5 & y = -7
 \end{array}$$

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

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:

$$\begin{array}{ll}
 \frac{15}{12} \text{ must be simplified to } \frac{5}{4} \text{ or } 1\frac{1}{4} & \frac{43}{1} \text{ must be simplified to } 43 \\
 \frac{15}{0.3} \text{ must be simplified to } 50 & \frac{4\cancel{5}}{3} \text{ must be simplified to } \frac{4}{15} \\
 \sqrt{64} \text{ must be simplified to } 8^* &
 \end{array}$$

*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 <ul style="list-style-type: none"> •¹ know how to decrease by 8% •² know how to calculate the sugar content after 3 years •³ evaluate 	<ul style="list-style-type: none"> •¹ $\times 0.92$ •² 35×0.92^3 •³ 27·(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 $35 \times 0.08^3 = 0.01792$, with working award 2/3 $\times \checkmark \checkmark$ 4. Where division is used, (a) along with 0.92 , • ¹ is not available eg $35 \div 0.92^3 = 44.94\dots$ award 2/3 $\times \checkmark \checkmark$ (b) along with an incorrect percentage, • ¹ and • ² are not available eg $35 \div 1.08^3 = 27.78\dots$ award 1/3 $\times \times \checkmark$					
Commonly Observed Responses: Working must be shown 1. $35 \times 1.08^3 = 44.0\dots$ award 2/3 $\times \checkmark \checkmark$ 2. $35 \times 0.08 = 2.8 \rightarrow 35 - 3 \times 2.8 = 26.6$ award 1/3 $\checkmark \times \times$ 3. $35 \times 0.92 = 32.2$ award 1/3 $\checkmark \times \times$ 4. $35 \times 0.92 \times 3 = 96.6$ award 1/3 $\checkmark \times \times$ 5. $35 \times 0.08 \times 3 = 8.4$ award 0/3					

Question			Generic Scheme	Illustrative Scheme	Max Mark
2.			Ans: 8×10^{-9} grams <ul style="list-style-type: none"> •¹ correct method •² answer 	<ul style="list-style-type: none"> •¹ $12 \div (1.5 \times 10^9)$ •² 8×10^{-9} 	2
Notes: 1. Correct answer without working award 2/2 2. • ² is still available if there is additional multiplication or division by 1000 (but by no other numbers). eg award 1/2 ×✓ for (a) $12 \div (1.5 \times 10^9) \div 1000 = 8 \times 10^{-12}$ (b) $(1.5 \times 10^9) \div 12 \times 1000 = 1.25 \times 10^{11}$					
Commonly Observed Responses: No working necessary 1. $(1.5 \times 10^9) \div 12 = 1.25 \times 10^8$ award 1/2 ×✓ 2. $(1.5 \times 10^9) \div 12 = 1.2 \times 10^8$ or 1.3×10^8 award 1/2 ×✓ 3. $(1.5 \times 10^9) \times 12 = 1.8 \times 10^{10}$ 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: $ABC = 74^\circ$ • 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 $180 - 2 \times \text{angle CAB}$					
Commonly Observed Responses:					

Question			Generic Scheme	Illustrative Scheme	Max Mark
6.	(a)		<p>Ans: mean = 13 minutes, st dev = 5.7 minutes</p> <ul style="list-style-type: none"> •¹ calculate mean •² calculate $(x - \bar{x})^2$ •³ substitute into formula •⁴ calculate standard deviation 	<ul style="list-style-type: none"> •¹ 13 (minutes) •² 0, 9, 9, 81, 64, 1 •³ $\sqrt{\frac{164}{5}}$ •⁴ 5.7... (minutes) 	4
<p>Notes:</p> <p>1. For an answer of 13 and 5.7 without working award 1/4 ✓×××.</p> <p>2. For use of alternative formula award •², •³ and •⁴ as follows:</p> <ul style="list-style-type: none"> •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)		<p>Ans: valid statements</p> <ul style="list-style-type: none"> •¹ compare means •² compare standard deviations 	<ul style="list-style-type: none"> •¹ On average Sophie's waiting time was longer. •² Sophie's waiting times were more consistent. 	2

Question	Generic Scheme	Illustrative Scheme	Max Mark
<p>Notes:</p> <ol style="list-style-type: none"> Answers must be consistent with answers to part (a). Statements regarding the mean must show an understanding that mean is an average. <ol style="list-style-type: none"> eg Accept <ul style="list-style-type: none"> Sophie's average waiting time is more In general her time is more Sophie's waiting time is more overall eg Do not accept <ul style="list-style-type: none"> Sophie's mean waiting time is more Sophie's waiting time is longer (this implies that all her waiting times are longer) Statements regarding the standard deviation must show an understanding that standard deviation is a measure of spread. <ol style="list-style-type: none"> eg Accept <ul style="list-style-type: none"> The spread of Sophie's times is less Sophie's times are more consistent Her waiting is less varied eg Do not accept <ul style="list-style-type: none"> 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 Statements must refer to Sophie/Jack or she/he eg do not accept "on average the waiting time was longer". Accept statements using 'waiting time', 'call time', 'time' or 'waiting'. 			
<p>Commonly Observed Responses:</p>			

Question			Generic Scheme	Illustrative Scheme	Max Mark
7.			<p>Ans: 5300 cubic centimetres</p> <ul style="list-style-type: none"> •¹ know to find difference in two volumes •² substitute correctly into formula for volume of large cone •³ substitute correctly into formula for volume of small cone •⁴ carry out all calculations correctly (must involve difference or sum of two volume calculations and include a fraction) •⁵ round final answer to 2 significant figures and state correct units 	<ul style="list-style-type: none"> •¹ evidence of difference in two volumes •² $\frac{1}{3} \times \pi \times 16^2 \times 24$ (= 6433.98...) •³ $\frac{1}{3} \times \pi \times 9^2 \times 13.5$ (= 1145.11...) •⁴ 5288.87... •⁵ 5300 cm³ 	5

Notes:

1. Correct answer without working award 0/5.

2. Accept variations in π .

eg $\frac{1}{3} \times 3.14 \times 16^2 \times 24 - \frac{1}{3} \times 3.14 \times 9^2 \times 13.5 = 6430.72 - 1144.53 = 5286.19 = 5300 \text{ cm}^3$

3. In awarding •⁵

(a) Intermediate calculations need not be shown

eg $\frac{1}{3} \times \pi \times 16^2 \times 24 - \frac{1}{3} \times \pi \times 9^2 \times 13.5 = 5300 \text{ cm}^3$ award 5/5

(b) Where intermediate calculations are shown, they must involve at least three significant figures

eg $6433.98... - 1145.11... = 6400 - 1100 = 5300 \text{ cm}^3$ award 4/5 ✓✓✓✓×

(c) Where the volume of **only one** cone is calculated •⁵ is available

eg $\frac{1}{3} \times \pi \times 16^2 \times 24 = 6400 \text{ cm}^3$ 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. $\frac{1}{3} \times \pi \times 16^2 \times 24 + \frac{1}{3} \times \pi \times 9^2 \times 13.5 = 7600 \text{ cm}^3$		award 4/5 x✓✓✓✓	
2. $\frac{1}{3} \times \pi \times 32^2 \times 24 - \frac{1}{3} \times \pi \times 18^2 \times 13.5 = 21000 \text{ cm}^3$		award 4/5 ✓x✓✓✓	
3. $\frac{1}{3} \times \pi \times 16^2 \times 24 - \frac{1}{3} \times \pi \times 9^2 \times 10.5 = 5500 \text{ cm}^3$		award 4/5 ✓✓x✓✓	
4. $\frac{1}{3} \times \pi \times 16^2 \times 24 + \frac{1}{3} \times \pi \times 9^2 \times 10.5 = 7300 \text{ cm}^3$		award 3/5 x✓x✓✓	
5. $\frac{1}{3} \times \pi \times 16^2 \times 10.5 - \frac{1}{3} \times \pi \times 9^2 \times 13.5 = 1700 \text{ cm}^3$		award 4/5 ✓x✓✓✓	
6. $\frac{1}{3} \times \pi \times 16^2 \times 10.5 + \frac{1}{3} \times \pi \times 9^2 \times 13.5 = 4000 \text{ cm}^3$		award 3/5 xx✓✓✓	
7. $\pi \times 16^2 \times 24 - \pi \times 9^2 \times 13.5 = 16000 \text{ cm}^3$		award 3/5 ✓x✓x✓	
8. $\frac{4}{3} \times \pi \times 16^3 - \frac{4}{3} \times \pi \times 9^3 = 14000 \text{ cm}^3$		award 3/5 ✓xx✓✓	

Question			Generic Scheme	Illustrative Scheme	Max Mark
8.			Ans: 78° <ul style="list-style-type: none"> •¹ correct substitution into sine rule •² re-arrange formula •³ find x 	<ul style="list-style-type: none"> •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 $x = 78(.18...)$ 	3

Notes:

1. Correct answer without working award 0/3.
2. Do not penalise incorrect rounding in the final answer
eg $\sin x = \frac{150 \sin 66}{140} = 0.978 \rightarrow x = 77.9$ 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. $\pm 0.028...$ (uses rad) award 2 marks (working must be shown)
6. 75, 74.72... (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:

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

$$= 0.98 \rightarrow x = 78.5$$

award 3/3

(b) Premature rounding:

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

$$= \frac{150 \times 0.9}{140}$$

$$= 0.964... \rightarrow x = 74.6$$

award 2/3 ✓✓×

(c) Premature truncation:

$$\sin x = \frac{150 \sin 66}{140} (= 0.978...)$$

$$= 0.97 \rightarrow x = 75.9$$

award 2/3 ✓✓×

Question			Generic Scheme	Illustrative Scheme	Max Mark
10.			<p>Ans: $\frac{1}{n^4}$</p> <p>Method 1</p> <ul style="list-style-type: none"> •¹ simplify $(n^2)^3$ •² simplify $n^6 \times n^{-10}$ •³ express with a positive power <p>Method 2</p> <ul style="list-style-type: none"> •¹ simplify $(n^2)^3$ •² express with a positive power •³ simplify $n^6 \times \frac{1}{n^{10}}$ 	<ul style="list-style-type: none"> •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
<p>Notes:</p> <p>1. Correct answer without working award 3/3</p>					
<p>Commonly Observed Responses:</p>					

Question			Generic Scheme	Illustrative Scheme	Max Mark
11.			<p>Ans: £4.95</p> <p>Method 1</p> <ul style="list-style-type: none"> •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) <p>Method 2</p> <ul style="list-style-type: none"> •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) 	<ul style="list-style-type: none"> •¹ $\frac{60}{100}$ •² $13.75 \times \left(\frac{60}{100}\right)^2$ •³ (£)4.95 <ul style="list-style-type: none"> • $\frac{100}{60}$ •² $13.75 \div \left(\frac{100}{60}\right)^2$ •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. $13.75 \times \frac{60}{100} = 8.25$ award 1/3 ✓××
2. $13.75 \times \left(\frac{60}{100}\right)^3 = 2.97$ award 2/3 ✓×✓
3. $(13.75)^2 \times \frac{60}{100} = 113.44$ award 1/3 ✓××
4. $13.75 \times \left(\frac{100}{60}\right)^2 = 38.19$ award 2/3 ✓×✓
5. $13.75 \div \left(\frac{100}{60}\right)^2 = 13.75 \div 1.67^2 = 4.93$ award 2/3 ✓✓×
- (Premature rounding leads to inaccurate answer)
6. $13.75 \times \left(\frac{100}{60}\right)^2 = 13.75 \times 1.67^2 = 38.35$ award 1/3 ✓××
- (Premature rounding leads to inaccurate answer)

Question			Generic Scheme	Illustrative Scheme	Max Mark
12.			<p>Ans: $k = \frac{L^2 + p}{4t}$</p> <ul style="list-style-type: none"> •¹ square •² add p •³ divide by $4t$ 	<ul style="list-style-type: none"> •¹ $L^2 = 4kt - p$ •² $4kt = L^2 + p$ •³ $k = \frac{L^2 + p}{4t}$ 	3
<p>Notes:</p> <p>1. Correct answer without working award 3/3.</p> <p>2. Final answer should be in simplest form</p> <p>(a) $\frac{1}{4} \left(\frac{L^2 + p}{t} \right)$ award 3/3</p> <p>(b) $\frac{\left(\frac{L^2 + p}{t} \right)}{4}$ award 2/3 ✓✓×</p> <p>3. For subsequent incorrect working, •³ is not available.</p>					
<p>Commonly Observed Responses:</p> <p>1. For the response below award 1/3</p> <ul style="list-style-type: none"> • add p $L + p = \sqrt{4kt}$ × • divide by 4t $\frac{L + p}{4t} = \sqrt{k}$ × • square $k = \left(\frac{L + p}{4t} \right)^2$ ✓ 					

Question			Generic Scheme	Illustrative Scheme	Max Mark
13.			<p>Ans: $\frac{8x-7}{(x-2)(x+1)}$</p> <ul style="list-style-type: none"> •¹ correct denominator •² correct numerator •³ remove brackets and collect like terms in numerator 	<ul style="list-style-type: none"> •¹ $(x-2)(x+1)$ •² $3(x+1)+5(x-2)$ •³ $\frac{8x-7}{(x-2)(x+1)}$ 	3
<p>Notes:</p> <ol style="list-style-type: none"> Correct answer without working award 3/3. Accept $\frac{3(x+1)}{(x-2)(x+1)} + \frac{5(x-2)}{(x-2)(x+1)}$ for the award of •¹ and •². 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. Where a candidate chooses to expand the brackets in the denominator, then •¹ is only available for a correct expansion. <p>eg (a) $\frac{3(x+1)}{(x-2)(x+1)} + \frac{5(x-2)}{(x-2)(x+1)} = \frac{8x-7}{x^2-x-2}$ award 3/3</p> <p>(b) $\frac{3(x+1)}{(x-2)(x+1)} + \frac{5(x-2)}{(x-2)(x+1)} = \frac{8x-7}{x^2-2}$ award 2/3 ✓✓×</p> <p>(c) $\frac{3(x+1)}{x^2-2} + \frac{5(x-2)}{x^2-2} = \frac{8x-7}{x^2-2}$ award 2/3 ×✓✓</p>					
<p>Commonly Observed Responses:</p> <p>1. $\frac{3x+1}{(x-2)(x+1)} + \frac{5x-2}{(x-2)(x+1)} = \frac{8x-1}{(x-2)(x+1)}$ award 1/3 ✓××</p>					

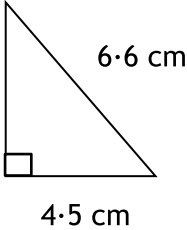
Question			Generic Scheme	Illustrative Scheme	Max Mark
14.			Ans: $x = 102.5, 282.5$ \bullet^1 rearrange equation \bullet^2 find one value of x \bullet^3 find another value of x	$\bullet^1 \tan x = -\frac{9}{2}$ $\bullet^2 x = 102.5$ $\bullet^3 x = 282.5$	3

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 \bullet^2 and \bullet^3 for correct 2nd and 4th quadrant angles
eg $\tan x = -\frac{9}{2} \rightarrow$ (a) $x = 77.5, 102.5$ award 2/3 $\checkmark \times \checkmark$
(b) $x = 77.5, 282.5$ award 2/3 $\checkmark \times \checkmark$
(c) $x = 77.5, 257.5$ award 1/3 $\checkmark \times \times$
2. If $\tan x > 0$ then \bullet^2 is not available (working eased) but award \bullet^3 for correct 3rd quadrant angle
eg $\tan x^\circ = \frac{9}{2} \rightarrow$ (a) $x = 77.5, 257.5$ award 1/3 $\times \times \checkmark$
(b) $x = 77.5, 102.5$ award 0/3
(c) $x = 77.5, 282.5$ award 0/3
(d) $\tan x^\circ = \frac{1}{2} \rightarrow x = 26.6, 206.6$ award 1/3 $\times \times \checkmark$
3. $\tan x^\circ = -\frac{9}{2} \rightarrow x = -77.5$
(a) $x = 257.5 [180 - (-77.5)], 437.5 [360 - (-77.5)]$ award 1/3 $\checkmark \times \times$
(incorrect application of CAST diagram and $437.5 > 360$)
(b) $x = 102.5 [-77.5 + 180], 282.5 [102.5 + 180]$ award 3/3
(correct application of periodicity of $\tan x^\circ$)

Question			Generic Scheme	Illustrative Scheme	Max Mark
15.			<p>Ans: 11.4... (cm)</p> <ul style="list-style-type: none"> •¹ marshal facts and recognise right-angled triangle •² correct Pythagoras statement •³ correct calculation of x •⁴ find height of label 	<div> <div>•¹</div>  </div> <ul style="list-style-type: none"> •² $x^2 = 6 \cdot 6^2 - 4 \cdot 5^2$ •³ 4.8... •⁴ 11.4... (cm) 	4
<p>Notes:</p> <ol style="list-style-type: none"> For correct answer without working award 0/4 •⁴ is for adding 6.6 to a previously calculated value 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. Where a candidate assumes an angle of 45° in the right-angled triangle, only •¹ and •⁴ are available. 					
<p>Commonly Observed Responses:</p> <ol style="list-style-type: none"> For $x^2 = 6 \cdot 6^2 + 4 \cdot 5^2 \rightarrow x = 7.988... \rightarrow \text{height} = 14.588...$ <ol style="list-style-type: none"> with correct diagram award 3/4 ✓x✓✓ without a diagram award 2/4 xx✓✓ 					

Question			Generic Scheme	Illustrative Scheme	Max Mark
16.			Ans: 6.8 cm <ul style="list-style-type: none"> •¹ identify $\cos A$ or angle A •² substitute into cosine rule ($\cos A$ or angle A must have been found using trigonometry) •³ calculate BC^2 •⁴ calculate BC correct to one decimal place 	<ul style="list-style-type: none"> •¹ $\cos A = \frac{3}{4}$ or $A = 41.4$ •² $BC^2 = 6^2 + 10^2 - 2 \times 6 \times 10 \times \frac{3}{4}$ or $BC^2 = 6^2 + 10^2 - 2 \times 6 \times 10 \times \cos 41.4$ •³ $BC = 46$ •⁴ $BC = 6.8 \text{ (cm)}$ 	4

Notes:

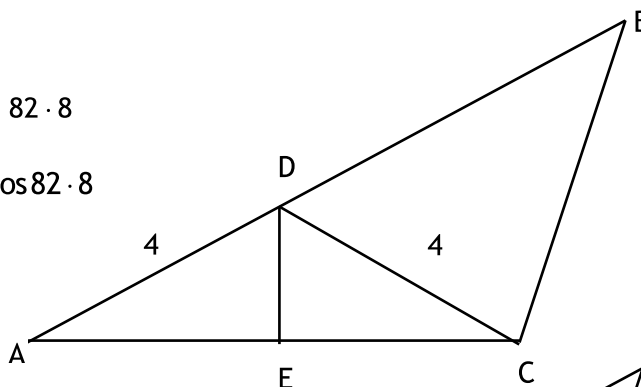
1. Correct answer without working award 0/4
2. Do not accept the substitution of a length or the value of $\sin A$ or $\tan A$ in place of angle A in the cosine rule.
3. •³ and •⁴ are only available for calculations within a valid strategy
4. Alternative valid strategies:

(a) •¹ $\angle ADE = \sin^{-1}\left(\frac{3}{4}\right) = 48.6$
 $\Rightarrow \angle BDC = 180 - 2 \times 48.6 = 82.8$

•² $BC^2 = 6^2 + 4^2 - 2 \times 6 \times 4 \times \cos 82.8$

•³ $BC^2 = 45.984\dots$

•⁴ $BC = 6.8 \text{ (cm)}$

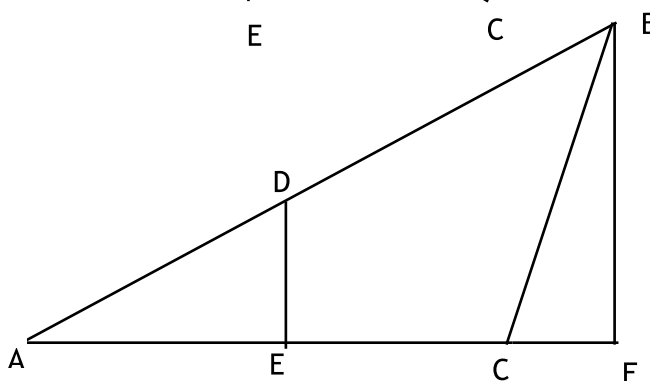


(b) •¹ $AF = \frac{10}{4} \times 3 = 7.5$

•² $BF^2 = 10^2 - 7.5^2 = 43.75$

•³ $BC^2 = 43.75 + 1.5^2 = 46$

•⁴ $BC = 6.8 \text{ (cm)}$



5. If premature rounding leads to an answer other than 6.8 then •⁴ is not available.

Commonly Observed Responses:

1. $DE^2 = 4^2 - 3^2 = 7 \rightarrow DE = 2.6$ award 0/4

2. $BC^2 = 6^2 - 4^2 = 20 \rightarrow BC = 4.5$ award 0/4

[incorrectly assuming that angle BCD = 90° in note 4(a) diagram]

[END OF MARKING INSTRUCTIONS]