



National
Qualifications
2017

X747/75/02

**Mathematics
Paper 2**

Amended Marking Instructions

FRIDAY, 5 MAY

Strictly Confidential

These instructions are **strictly confidential** and, in common with the scripts you will view and mark, they must never form the subject of remark of any kind, except to Scottish Qualifications Authority staff.

Version 3
25/05/17



Version 3

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.	$x - 4x + 3 = 0$ $x = 1$
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.	$x^2 + 5x + 7 = 9x + 4$ $x - 4x + 3 = 0$ $(x - 3)(x - 1) = 0$ $x = 1 \text{ or } 3$

(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:

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

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:

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

*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.

Key E-Marking Information

Response Overview: Before you start marking you must check every page of the candidate's response. This is to identify :

- If the candidate has written in any unexpected areas of their answer booklet
- If the script is legible and that it does not require to be re-scanned
- If there is an additional answer booklet/answer sheet, you need to check that it belongs to the same candidate
- If the candidate has continued an answer to a question at the back or in a different location in the booklet
- The presence of any non-script related objects.


No Response (NR): Where a candidate has not attempted to answer a question use No Response (NR).

Candidates are advised in the 'Your Exams' booklet to cross out any rough work when they have made a final copy. However, crossed-out work must be marked if the candidate has not made a second attempt to answer the question. Where a second attempt has been made, the crossed-out answers should be ignored.

Zero marks should only be applied when a candidate has attempted the question/item and their response does not attract any marks.

Additional Objects: Where a candidate has used an additional answer sheet this is known as an additional object. When you open a response that contains an additional object, a popup message will advise you of this. You are required to add a minimum of one annotation on every additional page to confirm that you have viewed it. You can use any of the normal marking annotations such as tick/cross

or the **SEEN** annotation to confirm that you have viewed the page. You will not be able to submit a script with an additional object, until every additional page contains an annotation.

Link tool: The Link tool  allows you to link pages/additional objects to a particular question item on a response.

In "Full Response View":

- Check which question the candidate's answer relates to
- Click on the question in the marks display panel
- On the left hand side, select the Link Page check box beneath the thumbnail for the page.
- Once all questions have been linked, click 'Structured Response View' to start marking. When you select a linked question item in the mark input panel, the linked page(s) are displayed.

Other

Any subject specific instructions to markers, for example optionality/combinations of options and how to deal with these, should be added by the Standardisation team.

Ref	
Ref	
Ref	

Exception	Description	Marker Action
Image Rescan request	You should raise this exception when you are unable to mark the candidate's response because the image you are viewing is of poor quality and you believe a rescan would improve the quality of the image, therefore allowing you to mark the response. Some examples of this include scan lines, folded pages or image skew.	If image is to be rescanned RM will remove the script from your work list. RM will inform you of this. No further action is required from you. If RM do not think that a rescan will improve the image then you should raise the script as an Undecipherable exception.
Offensive Content	You should raise this exception when the candidate's response contains offensive, obscene or frivolous material. Examples of this include vulgarity, racism, discrimination or swearing.	Raise this exception and enter a short report in the comments box. You should then mark the script and submit in the normal manner
Incorrect Question Paper	You should raise this exception when the image you are viewing does not correspond to the paper you are marking.	Raise script as an exception. Do not mark the image until SQA have contacted you and provided advice.
Undecipherable	You should raise this exception when you are unable to mark the candidate's response because the response cannot be read and you do not believe that a re-scan will improve the situation because the problem is with the writing and not the image. Some examples of this include poor handwriting and overwriting the original response.	Raise script as an exception to alert SQA staff. SQA will contact you to advise further action and when to close the exception.
Answer Outside of Guidance	You should raise this exception when you are unable to mark because the Marking Instructions do not cover this candidate's response.	Act on advice from Team Leader.
Concatenated Script Exception	You should raise this exception when the additional object(s) ie pages or scripts displayed do not belong to the candidate you are marking. You need not use this exception if the additional objects are transcriptions or additional pages submitted for the candidate.	Raise script as an exception. You can mark the correct script then review the marks once the erroneous script has been removed. SQA will contact you and advise of any actions and when to close the exception.









Exception	Description	Marker Action
Non-Script Object	<p>You should raise this exception when the additional object displayed does not relate to the script you are marking</p> <p>OR</p> <p>If you think that there is a piece of the candidate's submission missing eg because the script you are marking contains only responses to diagrams or tables and you suspect there should be a further script or word processed response or the response on the last page ends abruptly.</p>	<p>Raise script as an exception. Write a short report to advise the issue and continue to mark. SQA will contact you and advise of any actions and when to close the exception.</p>
Candidate Welfare Concern	<p>You should raise this exception when you have concerns about the candidate's well-being or welfare when marking any examination script or if coursework and there is no tick on the flyleaf to identify these issues are being or have been addressed by the centre.</p>	<p>Telephone the Child Welfare Contact on 0345 213 6587 as early as possible on the same or next working day for further instruction. Click on the Candidate Welfare Concern button and complete marking the script and submit the mark as normal.</p>
Malpractice	<p>You should raise this exception when you suspect wrong doing by the candidate. Examples of this include plagiarism or collusion.</p>	<p>Raise this exception and enter a short report in the comments box. You should then mark the script and submit in the normal manner</p>

Other

Any subject specific instructions to markers, for example optionality/combinations of options and how to deal with these, should be added by the Standardisation team.

Ref	
Ref	
Ref	

Annotations

Annotation	Annotation Name	Instructions on use of annotation
	Tick	
	Cross	
	Highlight	
	SEEN	This annotation should be used by the marker on a blank page to show that they have viewed this page and confirm it contains no candidate response.
	Omission	
	Tick 1	
	Tick 2	
	Horizontal wavy line	

Detailed Marking Instructions for each question

Question		Generic Scheme	Illustrative Scheme	Max Mark								
1.		<p>Ans: 23</p> <ul style="list-style-type: none"> •¹ start process •² solution 	<ul style="list-style-type: none"> •¹ $18^2 + (-14)^2 + 3^2$ •² 23 	2								
<p>Notes:</p> <p>1. Correct answer without working award 2/2</p>												
<p>Commonly Observed Responses:</p> <p>No working necessary:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">1. $\sqrt{529}$</td> <td style="width: 50%;">award 1/2 ✓x</td> </tr> <tr> <td>2. $11 \cdot 7 \dots \left(\text{e.g. } \sqrt{324 - 196 + 9} = \sqrt{137} \right)$</td> <td>award 1/2 x✓</td> </tr> <tr> <td>3. $\sqrt{137}$</td> <td>award 0/2</td> </tr> <tr> <td>4. $2 \cdot 6 \dots \left(\text{e.g. } \sqrt{18 - 14 + 3} = \sqrt{7} \right)$</td> <td>award 0/2</td> </tr> </table>					1. $\sqrt{529}$	award 1/2 ✓x	2. $11 \cdot 7 \dots \left(\text{e.g. } \sqrt{324 - 196 + 9} = \sqrt{137} \right)$	award 1/2 x✓	3. $\sqrt{137}$	award 0/2	4. $2 \cdot 6 \dots \left(\text{e.g. } \sqrt{18 - 14 + 3} = \sqrt{7} \right)$	award 0/2
1. $\sqrt{529}$	award 1/2 ✓x											
2. $11 \cdot 7 \dots \left(\text{e.g. } \sqrt{324 - 196 + 9} = \sqrt{137} \right)$	award 1/2 x✓											
3. $\sqrt{137}$	award 0/2											
4. $2 \cdot 6 \dots \left(\text{e.g. } \sqrt{18 - 14 + 3} = \sqrt{7} \right)$	award 0/2											

Question		Generic Scheme	Illustrative Scheme	Max Mark
2.		<p>Ans: £1369</p> <ul style="list-style-type: none"> •¹ know how to increase by 4.5% •² know how to calculate value after three years •³ evaluate to nearest £ 	<ul style="list-style-type: none"> •¹ $\times 1.045$ •² 1200×1.045^3 •³ 1369 	3

Notes:

1. Correct answer without working award 3/3
2. Where an incorrect percentage is used, the working must be followed through to give the possibility of awarding 2/3,
e.g. for $1200 \times 1.45^3 = 3658$, with working award 2/3 $\times\check{\check{\check{}}}$
3. Where division is used,
 - (a) along with 1.045 , \bullet^1 is not available
e.g. $1200 \div 1.045^3 = 1052$ award 2/3 $\times\check{\check{\check{}}}$
 - (b) along with an incorrect percentage, \bullet^1 and \bullet^2 are not available
e.g. $1200 \div 0.955^3 = 1378$ award 1/3 $\times\times\check{\check{}}$

Commonly Observed Responses:**1. No working necessary:**

- (a) 1369.00 award 3/3
- (b) 1370 or 1369.40 or 1369.4 award 2/3 $\check{\check{\check{}}}\times$

2. Working must be shown:

- (a) $1200 \times 0.955^3 = 1045$ award 2/3 $\times\check{\check{\check{}}}$
- (b) $1200 \times 0.045 = 54 \rightarrow 1200 + 3 \times 54 = 1362$ award 1/3 $\check{\times\times}$
- (c) $1200 \times 1.045 = 1254$ award 1/3 $\check{\times\times}$
- (d) $1200 \times 1.045 \times 3 = 3762$ award 1/3 $\check{\times\times}$
- (e) $1200 \times 0.045 \times 3 = 162$ award 0/3

Question		Generic Scheme	Illustrative Scheme	Max Mark
3.		<p>Ans: 413m</p> <ul style="list-style-type: none"> •¹ correct substitution into cosine rule •² evaluate QR^2 •³ calculate QR 	<ul style="list-style-type: none"> •¹ $180^2 + 250^2 - 2 \times 180 \times 250 \times \cos 147$ •² $170380 \cdot 3$ •³ $412 \cdot 77 \dots (m)$ 	3
<p>Notes:</p> <p>1. Correct answer without working award 0/3</p> <p>2. Accept 412 metres with working award 3/3</p> <p>3. Where sine rule is used award 0/3</p> <p>4. Disregard errors due to premature rounding provided there is evidence</p> <p>(a) $180^2 + 250^2 - 2 \times 180 \times 250 \times (-0 \cdot 84) = 170500 \rightarrow 412 \cdot 9 \dots$ award 3/3</p> <p>(b) $180^2 + 250^2 - 2 \times 180 \times 250 \times (-0 \cdot 8) = 166900 \rightarrow 408 \cdot 5 \dots$ award 3/3</p> <p>5. (a) 407 or 408 (RAD) award 2/3 ✓x✓ (b) 394 (GRAD) award 2/3 ✓x✓</p> <p>Inappropriate use of RAD or GRAD should only be penalised once in either Q3, 10 or 15.</p> <p>Commonly Observed Responses:</p> <p>Working must be shown:</p> <p>1. $\sqrt{180^2 + 250^2} = 308 \cdot 05 \dots$ award 1/3 xx✓</p> <p>2. (a) $180^2 + 250^2 - 2 \times 180 \times 250 \times \cos 147 = 170380 \cdot 0 \dots \rightarrow 410$ award 3/3</p> <p>(b) $180^2 + 250^2 - 2 \times 180 \times 250 \times \cos 147 \rightarrow 410$ award 2/3 ✓x✓</p> <p>3. $32400 + 62500 - 75480 \cdot 35 \dots = 19419 \cdot 64 \dots \rightarrow 139 \cdot 35 \dots$ award 2/3 ✓x✓</p>				

Question	Generic Scheme	Illustrative Scheme	Max Mark
4.	<p>Ans: $x = -3.1, x = 0.6$</p> <ul style="list-style-type: none"> •¹ substitute correctly into quadratic formula •² evaluate discriminant •³ calculate both values of x correct to one decimal place 	<ul style="list-style-type: none"> •¹ $\frac{-5 \pm \sqrt{5^2 - 4 \times 2 \times (-4)}}{2 \times 2}$ •² 57 (stated or implied by •³) •³ -3.1, 0.6 	3

Notes:

1. Correct answer without working award 0/3
2. The final mark is only available if $b^2 - 4ac > 0$; see CORs 2 - 5
3. The final mark is only available when answer requires rounding

Commonly Observed Responses:

1. 57 ($b^2 - 4ac$) award 1/3 x✓x

2. $\frac{-5 \pm \sqrt{5^2 - 4 \times 2 \times (-4)}}{2 \times 2} \rightarrow \frac{-5 \pm \sqrt{-7}}{2 \times 2} \rightarrow -1.9, -0.6$ award 1/3 ✓xx
 (Beware: candidate may get $\sqrt{-7}$ then change it to $\sqrt{7}$)

3. $\frac{-5 \pm \sqrt{5^2 - 4 \times 2 \times (-4)}}{2 \times 2} \rightarrow \frac{-5 \pm \sqrt{7}}{2 \times 2} \rightarrow -1.9, -0.6$ award 2/3 ✓x✓

4. $\frac{-5 \pm \sqrt{5^2 - 4 \times 2 \times 4}}{2 \times 2} \rightarrow \frac{-5 \pm \sqrt{-7}}{2 \times 2} \rightarrow -1.9, -0.6$ award 1/3 x✓x
 (Beware: candidate may get $\sqrt{-7}$ then change it to $\sqrt{7}$)

5. $\frac{-5 \pm \sqrt{5^2 - 4 \times 2 \times 4}}{2 \times 2} \rightarrow \frac{-5 \pm \sqrt{7}}{2 \times 2} \rightarrow -1.9, -0.6$ award 1/3 xx✓

Question		Generic Scheme	Illustrative Scheme	Max Mark
5.		<p>Ans: 4200</p> <ul style="list-style-type: none"> •¹ know that 115% = 4830 •² begin valid strategy •³ complete calculation within valid strategy 	<ul style="list-style-type: none"> •¹ 115% = 4830 •² $1\% = \frac{4830}{115}$ or equivalent •³ 4200 	3
<p>Notes:</p> <p>1. For 4200 with or without working award 3/3</p> <p>2. For 4105 or 4106 (85% of 4830) or 5554 or 5555 (115% of 4830)</p> <p>(i) and evidence of •¹ award 1/3 ✓××</p> <p>(ii) otherwise award 0/3</p>				
<p>Commonly Observed Responses:</p> <p>1. $\frac{4830}{1.15} = 4200$ award 3/3</p> <p>2. 85% = 4830 → 5682 award 2/3 ×✓✓</p> <p>3. 15% = 4830 → 32200 award 2/3 ×✓✓</p>				

Question		Generic Scheme	Illustrative Scheme	Max Mark
6.		<p>Ans: 4180mm³</p> <ul style="list-style-type: none"> •¹ know to find difference of two volumes •² substitute correctly into formula for volume of large sphere •³ substitute correctly into formula for volume of small sphere •⁴ carry out all calculations correctly (must involve difference or sum of two volume calculations and include a fraction) •⁵ round final answer to 3 significant figures and correct units 	<ul style="list-style-type: none"> •¹ evidence of difference in two volumes •² $\frac{4}{3} \times \pi \times 12^3 (= 7238.229\dots)$ •³ $\frac{4}{3} \times \pi \times 9^3 (= 3053.628\dots)$ •⁴ 4184.601 •⁵ 4180mm³ 	5

Question	Generic Scheme	Illustrative Scheme	Max Mark
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Notes:

- Correct answer without working award 0/5
- Accept variations in π
e.g. $\frac{4}{3} \times 3.14 \times 12^3 - \frac{4}{3} \times 3.14 \times 9^3 = 4182.48 = 4180 \text{ mm}^3$
- In awarding \bullet^5
 - Intermediate calculations need not be shown
e.g. $\frac{4}{3} \times \pi \times 12^3 - \frac{4}{3} \times \pi \times 9^3 = 4180 \text{ mm}^3$ award 5/5
 - Where intermediate calculations are shown, they must involve at least four significant figures
e.g. $7238.229\dots - 3053.628\dots = 7240 - 3050 = 4190 \text{ mm}^3$ award 4/5 ✓✓✓✓x
- Volume of second sphere may be calculated using volume scale factor
e.g. accept $\left(\frac{3}{4}\right)^3 \times \frac{4}{3} \times \pi \times 12^3$ for the award of \bullet^3

Commonly Observed Responses:

Working must be shown:

- $\frac{4}{3} \times \pi \times 12^3 - \frac{4}{3} \times \pi \times 10 \cdot 5^3 = (7238 \cdot \dots - 4849 \cdot \dots) = 2390 \text{ mm}^3$ award 4/5 ✓✓x✓✓
 - $\frac{4}{3} \times \pi \times 12^3 - \frac{4}{3} \times \pi \times 10 \cdot 5^3 = 7240 - 4850 = 2390 \text{ mm}^3$ award 3/5 ✓✓x✓x
- $\frac{4}{3} \times \pi \times 12^3 - \frac{4}{3} \times \pi \times 3^3 = 7130 \text{ mm}^3$ award 4/5 ✓✓x✓✓
- $\frac{4}{3} \times \pi \times 12^3 = 7240 \text{ mm}^3$ award 2/5 x✓xx✓
- $\frac{4}{3} \times \pi \times 12^3 + \frac{4}{3} \times \pi \times 9^3 = 10300 \text{ mm}^3$ award 4/5 x✓✓✓✓
- $\frac{4}{3} \times \pi \times 24^3 - \frac{4}{3} \times \pi \times 18^3 = 33500 \text{ mm}^3$ award 4/5 ✓x✓✓✓
- $\frac{4}{3} \times \pi \times 24^3 - \frac{4}{3} \times \pi \times 21^3 = 19100 \text{ mm}^3$ award 3/5 ✓xxx✓✓
- $\frac{4}{3} \times \pi \times 1 \cdot 5^3 = 14 \cdot 1 \text{ mm}^3$ award 1/5 xxxx✓
- $\frac{4}{3} \times \pi \times 12^2 - \frac{4}{3} \times \pi \times 9^2 = 264 \text{ mm}^3$ award 4/5 ✓x✓✓✓
- $\frac{4}{3} \times \pi \times 12^3 - \frac{4}{3} \times \pi \times 9^3 = 1332\pi \text{ mm}^3$ award 4/5 ✓✓✓✓x

Question	Generic Scheme	Illustrative Scheme	Max Mark
7.	<p>Ans: No, with valid reason</p> <p>Method 1</p> <ul style="list-style-type: none"> •¹ valid strategy (Converse of Pythagoras' Theorem in correct triangle with correct combination of sides) •² evaluation •³ comparison and state conclusion <p>Method 2</p> <ul style="list-style-type: none"> •¹ valid strategy (Pythagoras' Theorem in correct triangle with correct combination of sides) •² evaluation •³ comparison and state conclusion <p>Method 3</p> <ul style="list-style-type: none"> •¹ valid strategy (correct substitution into cosine rule to find largest angle in correct triangle) •² evaluation •³ find angle and state conclusion <p>Method 4</p> <ul style="list-style-type: none"> •¹ valid strategy (correct substitutions into cosine rule to find angle opposite 6 in triangle A and angle opposite 16 in triangle B) •² evaluation of both cos values •³ find sum of angles and state conclusion 	<ul style="list-style-type: none"> •¹ $8^2 + 19^2$ and 22^2 •² $8^2 + 19^2 = 425$, $22^2 = 484$ •³ $8^2 + 19^2 \neq 22^2$; No <ul style="list-style-type: none"> •¹ $8^2 + 19^2$ •² length of longest side = $20 \cdot 6$ •³ $20 \cdot 6 \neq 22$; No <ul style="list-style-type: none"> •¹ $\cos x^\circ = \frac{8^2 + 19^2 - 22^2}{2 \times 8 \times 19}$ •² $\cos x^\circ = -0 \cdot 194$ •³ ($x =$) $101 \cdot 2$; No <ul style="list-style-type: none"> •¹ $\cos x^\circ = \frac{8^2 + 7^2 - 6^2}{2 \times 8 \times 7}$ and $\cos y^\circ = \frac{7^2 + 19^2 - 16^2}{2 \times 7 \times 19}$ •² $\cos x^\circ = 0 \cdot 6875$ and $\cos y^\circ = 0 \cdot 5789$ •³ (sum =) $101 \cdot 2$; No 	3

Question	Generic Scheme	Illustrative Scheme	Max Mark
<p>Notes:</p> <p>1. In Method 1 \bullet^3 is not available when evaluations at \bullet^2 have not been carried out e.g. $8^2 + 19^2 = 64 + 361$, $22^2 = 484$; $8^2 + 19^2 \neq 22^2$; No award 1/3 ✓×× $8^2 + 19^2 = 64 + 361 = 425$, $22^2 = 484$; $8^2 + 19^2 \neq 22^2$; No award 3/3</p> <p>2. Where the wrong triangle is chosen, \bullet^2 is only available for consistent application of Pythagoras or cosine rule; see CORs 2 and 3</p>			
<p>Commonly Observed Responses:</p> <p>1. $8^2 + 19^2 = 64 + 361 = 425, 22^2 = 484$; $8^2 + 19^2 < 22^2$; No award 3/3</p> <p>2. $7^2 + 16^2 = 305, 19^2 = 361$; $7^2 + 16^2 \neq 19^2$; No award 2/3 ×✓✓</p> <p>3. $7^2 + 19^2 = 410, 16^2 = 256$; $7^2 + 19^2 \neq 16^2$; No award 1/3 ××✓</p> <p>4. $8^2 + 22^2 = 548, 19^2 = 361$; $8^2 + 22^2 \neq 19^2$; No award 2/3 ×✓✓</p> <p>5. (a) $8^2 + 19^2 = 425, 22^2 = 484$; The square of the hypotenuse is not equal to the sum of the squares of the other two sides; No award 3/3 (b) $8^2 + 19^2 = 425, 22^2 = 484$; The hypotenuse is not equal to the sum of the squares of the other two sides; No award 2/3 ✓✓×</p>			

Question		Generic Scheme	Illustrative Scheme	Max Mark
8.	(a)	Ans: $d - c$ • ¹ answer	• ¹ $d - c$ or equivalent	1
Notes: 1. Accept $-c + d$ or $d + -c$ 2. Accept $D - C$ as bad form				
Commonly Observed Responses:				
	(b)	Ans: $\frac{3}{2}d - \frac{1}{2}c$ • ¹ valid pathway • ² correct simplified expression	• ¹ $\overrightarrow{TP} + \frac{1}{2}\overrightarrow{PR}$ or $\overrightarrow{TQ} + \overrightarrow{QR} + \frac{1}{2}\overrightarrow{RP}$ • ² $\frac{3}{2}d - \frac{1}{2}c$ or equivalent	2
Notes: 1. Correct answer without working award 2/2 2. Accept $\frac{3}{2}D - \frac{1}{2}C$ 3. $\overrightarrow{TP} + \overrightarrow{PV}$ or $\overrightarrow{TQ} + \overrightarrow{QR} + \overrightarrow{RV}$ alone is not enough for the award of • ¹ 4. For the award of • ¹ (a) accept $d + \frac{1}{2}\overrightarrow{PR}$ but not $d + \overrightarrow{PV}$ (b) accept $2d - c + \frac{1}{2}\overrightarrow{RP}$ but not $2d - c + \overrightarrow{RV}$ (c) accept $\overrightarrow{PV} = \frac{1}{2}(d - c)$ but not $\frac{1}{2}(d - c)$ alone (d) accept $\overrightarrow{RV} = \frac{1}{2}(c - d)$ but not $\frac{1}{2}(c - d)$ alone				
Commonly Observed Responses: 1. $\frac{1}{2}(3d - c)$ award 2/2				

Question		Generic Scheme	Illustrative Scheme	Max Mark
9.	(a)	Ans: $(2x-5)(2x+5)$ • ¹ factorise	• ¹ $(2x-5)(2x+5)$	1
Notes:				
Commonly Observed Responses:				
	(b)	Ans: $\frac{2x+5}{x+2}$ • ¹ start to factorise • ² complete factorising • ³ simplify	• ¹ $(2x-5)(x-2)$ • ² $(2x-5)(x+2)$ • ³ $\frac{2x+5}{x+2}$	3
Notes:				
1. Correct answer without working award 3/3 2. For $(2x-10)(x-1)$ or $(2x-2)(x-5)$ etc award 1/3 ✓xx 3. For subsequent incorrect working, the final mark is not available e.g. $\frac{2x+5}{x+2} = \frac{7}{3}$ award 2/3 ✓✓x 4. • ³ is only available when both the numerator and denominator have at least two factors				
Commonly Observed Responses:				

Question	Generic Scheme	Illustrative Scheme	Max Mark
10.	<p>Ans: 9.9 kilometres</p> <ul style="list-style-type: none"> •¹ calculate size of angles DEF and DFE •² correct substitution into sine rule •³ rearrange formula •⁴ calculate DF 	<ul style="list-style-type: none"> •¹ 40 and 104 •² $\frac{DF}{\sin 40} = \frac{15}{\sin 104}$ •³ $\frac{15 \times \sin 40}{\sin 104}$ •⁴ 9.9(36...) 	4

Notes:

1. Correct answer without working award 0/4
2. Accept a final answer of 10, with working award 4/4
3. •¹ may be awarded for sizes of angles DEF and DFE marked on the diagram
4. Where incorrect sizes are used for angles DEF and DFE
 - (a) with prior evidence of angle sizes (marked on diagram or clearly attached to named angles), marks •², •³ and •⁴ are available
 - (b) without prior evidence of angle sizes, only marks •³ and •⁴ are available
5. **BEWARE** $\frac{DF}{\sin 40} = \frac{15}{\sin 76} \rightarrow 9.9$
 - (a) with prior evidence of DEF = 40 and DFE = 76 award 3/4 x✓✓✓
 - (b) without prior evidence of sizes of angles DEF and DFE award 2/4 xx✓✓
6. Disregard errors due to premature rounding provided there is evidence
7. Inappropriate use of RAD or GRAD should only be penalised once in either Q3, 10 or 15
 - (a) -34.7... (RAD)
 - (b) 8.8... (GRAD)

Commonly Observed Responses:

1. $\frac{DF}{\sin 36} = \frac{15}{\sin 90} \rightarrow 8.8$
 - (a) with prior evidence of sizes of angles DEF and DFE marks award 3/4 x✓✓✓
 - (b) without prior evidence of sizes of angles DEF and DFE award 2/4 xx✓✓
2. $\frac{DF}{\sin 230} = \frac{15}{\sin 126} \rightarrow -14.2$ award 2/4 xx✓✓
3. $\frac{DF}{40} = \frac{15}{104} \rightarrow 5.769.....$ award 1/4 ✓xxx

Question		Generic Scheme	Illustrative Scheme	Max Mark
11.		<p>Ans: $\frac{3}{5}$ or 0.6</p> <p>•¹ isolate term in y or divide throughout by 5</p> <p>•² state gradient explicitly</p>	<p>•¹ $-5y = -3x...$ or $3x... = 5y$ or or $\frac{3x}{5} - \frac{5y}{5} - \frac{10}{5} = 0$</p> <p>•² $\frac{3}{5}$ or 0.6</p>	2
<p>Notes:</p> <p>1. Correct answer without working award 2/2</p> <p>2. Do not accept $x = \frac{3}{5}$ or $y = \frac{3}{5}$ for the award of •²</p> <p>3. Where gradient formula is used with two points which (a) lie on the line $3x - 5y + 10 = 0$, award •¹ for correct substitution into gradient formula award •² for correct calculation of gradient (b) do not lie on the line $3x - 5y + 10 = 0$, award 0/2</p>				
<p>Commonly Observed Responses:</p> <p>1. $\frac{3}{5}x$ or $0.6x$ (with working) award 1/2 ✓✗</p>				

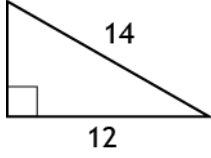
Question	Generic Scheme	Illustrative Scheme	Max Mark
12.	<p>Ans: $x^{-\frac{1}{3}}$</p> <p>•¹ apply $\sqrt[n]{x^m} = x^{\frac{m}{n}}$</p> <p>•² apply $\frac{1}{x^n} = x^{-n}$</p>	<p>•¹ $\frac{1}{x^{\frac{1}{3}}}$ stated or implied by •²</p> <p>•² $x^{-\frac{1}{3}}$</p>	2

Notes:

1. Correct answer without working award 2/2
2. Accept $x^{\frac{1}{3}}$ for •¹
3. Where a number or letter (excluding n) other than x is used
e.g. $a^{-\frac{1}{3}}$ or $8^{-\frac{1}{3}}$ award 1/2
 $n^{-\frac{1}{3}}$ award 0/2

Commonly Observed Responses:

1. $n = -\frac{1}{3}$ award 2/2
2. $-x^{\frac{1}{3}}$ award 1/2 ✓×
3. x^{-3} award 1/2 ×✓

Question	Generic Scheme	Illustrative Scheme	Max Mark
13.	<p>Ans: 42.4 centimetres</p> <ul style="list-style-type: none"> •¹ marshal facts and recognise right-angled triangle •² consistent Pythagoras statement •³ calculation of x •⁴ find height of the logo 	 <ul style="list-style-type: none"> •¹ •² $x^2 = 14^2 - 12^2$ •³ 7.2 •⁴ 42.4 	4

Notes:

1. Correct answer without working award 0/4
2. The final mark is for doubling the result of a **Pythagoras (or trig.)** calculation and then adding 28
3. In the absence of a diagram accept $x^2 = 14^2 - 12^2$ as evidence for the award of •¹ and •²
4. **BEWARE**
Where a diagram is shown, working must be consistent with the diagram.
•² is not available for an incorrect diagram leading to $x^2 = 14^2 - 12^2$
5. Disregard errors due to premature rounding provided there is evidence

Commonly Observed Responses:

1. For $x^2 = 14^2 + 12^2 \rightarrow x = 18.4$ height = 64.8... or 64.9
 - (a) working inconsistent with correct diagram award 3/4 ✓x✓✓
 - (b) working consistent with candidate's diagram award 3/4 x✓✓✓
(cosine rule may be used to calculate x)
 - (c) no diagram award 2/4 xx✓✓
2. For $x^2 = 24^2 - 14^2 \rightarrow x = 19.4...$ height = 66.9... or 67
 - (a) working consistent with candidate's diagram award 3/4 x✓✓✓
 - (b) no diagram or working not consistent with candidate's diagram award 2/4 xx✓✓
3. For $x^2 = 24^2 + 14^2 \rightarrow x = 27.8...$ height = 83.5... or 83.6
 - (a) working consistent with candidate's diagram award 3/4 x✓✓✓
(cosine rule may be used to calculate x)
 - (b) no diagram or working not consistent with candidate's diagram award 2/4 xx✓✓

Question	Generic Scheme	Illustrative Scheme	Max Mark
14.	<p>Ans: 282°</p> <p>Method 1</p> <ul style="list-style-type: none"> •¹ expression for arc length •² know how to find angle •³ calculate angle <p>Method 2</p> <ul style="list-style-type: none"> •¹ arc length:circumference ratio •² know how to find angle •³ calculate angle 	<ul style="list-style-type: none"> •¹ $\frac{\text{angle}}{360} \times \pi \times 12 \cdot 8$ •² $\frac{31 \cdot 5 \times 360}{\pi \times 12 \cdot 8}$ •³ $282(\cdot)$ <ul style="list-style-type: none"> •¹ $\frac{31 \cdot 5}{\pi \times 12 \cdot 8} (= 0 \cdot 78 \dots)$ •² $\frac{31 \cdot 5 \times 360}{\pi \times 12 \cdot 8}$ •³ $282(\cdot)$ 	3
<p>Notes:</p> <ol style="list-style-type: none"> 1. Correct answer without working award 0/3 2. Accept variations in π 3. Premature rounding of $\frac{31 \cdot 5}{\pi \times 12 \cdot 8}$ must be to at least 2 decimal places 4. For the award of •³, the calculation must involve a division by a product. The calculation must include 31·5, π, 360 and the candidate's chosen diameter or radius 5. For subsequent incorrect working, the final mark is not available e.g. $360 - 282 = 78$ award 2/3 ✓✓✗ 			
<p>Commonly Observed Responses:</p> <ol style="list-style-type: none"> 1. For $\frac{31 \cdot 5 \times 360}{\pi \times 6 \cdot 4} = 564$ award 2/3 ✗✓✓ 2. For $\frac{31 \cdot 5 \times 360}{\pi \times 6 \cdot 4^2} = 88 \cdot 1 \dots$ award 2/3 ✗✓✓ 3. For $\frac{31 \cdot 5}{360} \times \pi \times 12 \cdot 8 = 3 \cdot 518 \dots$ award 0/3 			

Question		Generic Scheme	Illustrative Scheme	Max Mark
15.	(a)	Ans: 51.5 metres • ¹ calculate height	• ¹ 51.5	1
Notes: 1. Inappropriate use of RAD or GRAD should only be penalised once in either Q3, 10 or 15 (a) 18.1... (RAD) (b) 53.5... (GRAD)				
Commonly Observed Responses: 1. 51.5, 308.5 award 0/1				
	(b)	Ans: 17 metres • ¹ calculate minimum height	• ¹ 17	1
Notes: 1. Inappropriate use of RAD or GRAD should only be penalised once in either Q3, 10 or 15 (a) 26.2... (RAD) (b) 18.1... (GRAD)				
Commonly Observed Responses:				
	(c)	Ans: 24.1° and 335.9° • ¹ substitute 61 correctly into equation • ² calculate $\cos x$ • ³ calculate value of x • ⁴ calculate 2 nd value of x	• ¹ $61 = 40 + 23 \cos x$ • ² $\cos x = \frac{21}{23}$ • ³ 24(.07...) • ⁴ 335(.92...)	4

Question	Generic Scheme	Illustrative Scheme	Max Mark
<p>Notes:</p> <p>1. Correct answers (a) without working award 1/4 xxx✓ (b) by repeated substitution award 1/4 xxx✓</p> <p>2. Accept 24 and 336 with valid working</p> <p>3. Disregard errors due to premature rounding provided there is evidence</p> <p>4. Do not penalise omission of degree sign throughout the question</p> <p>5. Inappropriate use of RAD or GRAD should only be penalised once in either Q3, 10 or 15 (a) 0.418..., 359.5... (RAD) (b) 26.7... , 333.3... (GRAD)</p>			
<p>Commonly Observed Responses:</p> <p>1. $61 = 40 + 23 \cos x \rightarrow 61 = 63 \cos x \rightarrow \cos x = \frac{61}{63} \rightarrow x = 14.5, 345.5$ award 3/4 ✓x✓✓</p> <p>2. $\cos x = \frac{-2}{60} \rightarrow x = 91.9, 268.1$ award 2/4 xx✓✓</p>			

[END OF MARKING INSTRUCTIONS]