National
Qualifications
2026

2026 Mathematics

National 5 Paper 2

Question Paper Finalised Marking Instructions

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

Qualifications Scotland
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General marking principles for National 5 Mathematics

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

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

generic scheme — this indicates why each mark is awarded
illustrative scheme — this covers methods which are commonly seen throughout the marking

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

(a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.

(b) If you are uncertain how to assess a specific candidate response because it is not covered by the general marking principles or the detailed marking instructions, you must seek guidance from your team leader.

(c) One mark is available for each ○. There are no half marks.

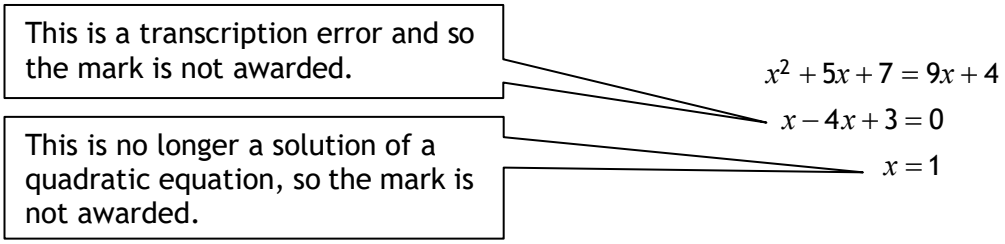
(d) If a candidate's response contains an error, all working subsequent to this error must still be marked. Only award marks if the level of difficulty in their working is similar to the level of difficulty in the illustrative scheme.

(e) Only award full marks where the solution contains appropriate working. A correct answer with no working receives no mark, unless specifically mentioned in the marking instructions.

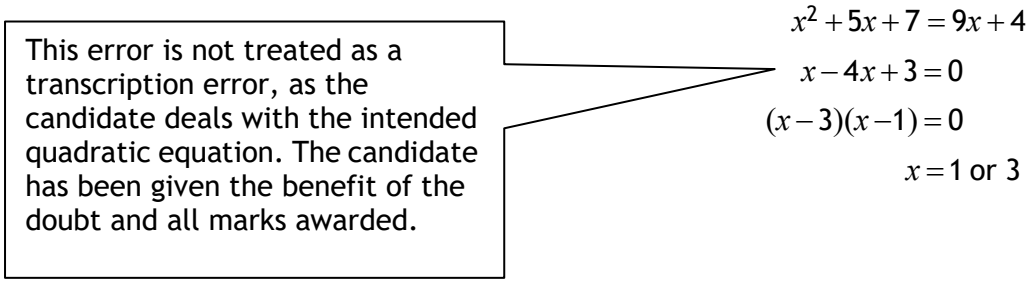
(f) Candidates may use any mathematically correct method to answer questions, except in cases where a particular method is specified or excluded.

(g) If an error is trivial, casual or insignificant, for example 6 x 6 = 12, candidates lose the opportunity to gain a mark, except for instances such as the second example in point (h) below.

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



The following example is an exception to the above



(i) Horizontal/vertical marking

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

Example:

	○5	○6
○5	$x = 2$	$x = -4$
○6	$y = 5$	$y = -7$

Horizontal: ○5 $x = 2$ and $x = -4$ Vertical: ○5 $x = 2$ and $y = 5$

○6 $y = 5$ and $y = -7$ ○6 $x = -4$ and $y = -7$

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

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

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

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

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

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

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

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

(k) Commonly Observed Responses (COR) are shown in the marking instructions to help mark common and/or non-routine solutions. CORs may also be used as a guide when marking similar non-routine candidate responses.

(l) Do not penalise candidates for any of the following, unless specifically mentioned in the detailed marking instructions:

- working subsequent to a correct answer
- correct working in the wrong part of a question
- legitimate variations in numerical answers/algebraic expressions, for example angles in degrees rounded to nearest degree
- omission of units
- bad form (bad form only becomes bad form if subsequent working is correct), for example

  $(x^3 + 2x^2 + 3x + 2)(2x + 1)$ written as

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

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

  gains full credit

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

(m) In any 'Show that…' question, where candidates have to arrive at a required result, the last mark is not awarded as a follow-through from a previous error, unless specified in the detailed marking instructions.

(n) You must check all working carefully, even where a fundamental misunderstanding is apparent early in a candidate's response. You may still be able to award marks later in the question so you must refer continually to the marking instructions. The appearance of the correct answer does not necessarily indicate that you can award all the available marks to a candidate.

(o) You should mark legible scored-out working that has not been replaced. However, if the scored-out working has been replaced, you must only mark the replacement working.

(p) If candidates make multiple attempts using the same strategy and do not identify their final answer, mark all attempts and award the lowest mark. If candidates try different valid strategies, apply the above rule to attempts within each strategy and then award the highest mark.

For example:

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

In this case, award 3 marks.

Marking Instructions for each question

Question			Generic scheme	Illustrative scheme	Max mark
1.			$\bullet^1$ know how to decrease by 28% $\bullet^2$ know how to calculate value $\bullet^3$ evaluate $\bullet^4$ answer correct to 3 significant figures	$\bullet^1$ $\times 0.72$ $\bullet^2$ 22600×0.72^3 $\bullet^3$ 8435(.4048) $\bullet^4$ (£) 8440	**4**

Notes:

1. Correct answer without working. award 4/4
2. For the award of $\bullet^4$ do not accept 8440.00.
3. Where an incorrect percentage is used, the working must be followed through to give the possibility of awarding 3/4
   eg for $22600\times 0.28^3 = 496.1\ldots \rightarrow 496$. award 3/4 ×✓1✓1✓1
4. Where an incorrect power (≥2) is used, the working must be followed through to give the possibility of awarding 3/4
   eg $22600\times 0.72^2 = 11715.84 \rightarrow 11700$. award 3/4 ✓×✓1✓1
5. Where division is used:
   (a) along with 0.72, $\bullet^1$ is not available
   eg $22600\div 0.72^3 = 60549(\ldots) \rightarrow 60500$. award 3/4 ×✓1✓1✓1
   (b) along with an incorrect percentage, $\bullet^1$ and $\bullet^2$ are not available
   eg $22600\div 1.28^3 = 10776.5\ldots \rightarrow 10800$. award 2/4 ××✓1✓1
6. Where intermediate calculations are shown, premature rounding must be to at least 4 significant figures.
7. $\bullet^3$ is not available for subsequent incorrect working (see COR 5).

Commonly Observed Responses:

1. $22600\times 0.72 = 16272 \rightarrow 16300$ award 2/4 ✓××✓1
2. $22600\times 0.72\times 3 = 48816 \rightarrow 48800$ award 2/4 ✓××✓1
3. $22600\times 0.28 = 6328 \rightarrow 22600 - 6328\times 3 = 3616 \rightarrow 3620$ award 1/4 ×××✓1
4. $22600\times 0.28\times 3 = 18984 \rightarrow 19000$ award 1/4 ×××✓1
5. (a) $22600\times 0.72^3 = 22600 - 8435(.4048) \rightarrow 14164(.5952) \rightarrow 14200$ award 3/4 ✓✓×✓1
   (b) $22600\times 0.28^3 = 22600 - 496(.1152) \rightarrow 22103(.8848) \rightarrow 22100$ award 2/4 ×✓1×✓1

Question			Generic scheme	Illustrative scheme	Max mark
2.			•[1] correct substitution into cosine rule •[2] evaluate XY[2] •[3] evaluate XY	•[1] $4^2+5^2-2\times4\times5\times\cos106$ •[2] $52.0\ldots$ •[3] $7.2\ldots$ (cm)	**3**

Notes:

1. Correct answer without working. award 0/3
2. Accept 7 (cm) with working. award 3/3
3. Where the sine rule or area of triangle formula is used. award 0/3
4. Disregard errors due to premature rounding provided there is evidence.
   (a) $4^2+5^2-2\times4\times5\times\cos106\rightarrow4^2+5^2-2\times4\times5\times(-0.28)\rightarrow52.2\rightarrow7.22$ (cm). award 3/3
   (b) $4^2+5^2-2\times4\times5\times\cos106\rightarrow4^2+5^2-2\times4\times5\times(-0.3)\rightarrow53\rightarrow7.28$ (cm). award 3/3
5. Inappropriate use of RAD or GRAD may only be penalised once in Q2, Q7, Q8 or Q10.
   (a) 3.67… **or** 3.7 RAD.
   (b) 6.69… **or** 6.7 GRAD.

Commonly Observed Responses:

1. $\sqrt{4^2+5^2}=6.4\ldots$ (cm) award 1/3 ××✓1
2. $16+25-11.0(2\ldots)=29.97\ldots\rightarrow5.47\ldots$ (cm) award 2/3 ✓××1

Question			Generic scheme	Illustrative scheme	Max mark
3.			**Method 1** •^{1} find linear scale factor •^{2} multiply volume by cube of linear scale factor •^{3} find volume (calculation must involve a power of a linear scale factor) **Method 2** •^{1} find linear scale factor •^{2} divide volume by cube of linear scale factor •^{3} find volume (calculation must involve a power of a linear scale factor)	•^{1} $\frac{8}{12}$ $(=0.66\ldots)$ •^{2} $\left(\frac{8}{12}\right)^3\times 540$ •^{3} 160 (ml) •^{1} $\frac{12}{8}$ $(=1.5)$ •^{2} $540\div\left(\frac{12}{8}\right)^3$ •^{3} 160 (ml)	3

Notes:

1. Correct answer without working. award 0/3
2. •^{3} is not available for subsequent invalid working
   eg $540-160=380\,(\text{ml})$. award 2/3 ✓✓×
3. •^{3} is not available if premature rounding leads to an incorrect answer
   eg $\left(\frac{8}{12}\right)^3\times 540=(0.67)^3\times 540=162(.4\ldots)$. award 2/3 ✓✓×

Commonly Observed Responses:

1. $\left(\frac{8}{12}\right)\times 540=360$ award 1/3 ✓××
2. $\left(\frac{12}{8}\right)^3\times 540=1822.5$ award 2/3 ✓×✓1
3. $\left(\frac{8}{12}\right)^2\times 540=240$ award 2/3 ✓×✓1
4. $\left(\frac{8}{12}\right)\times 540^3=104\,976\,000$ award 1/3 ✓××
5. $\left(\frac{12}{8}\right)^2\times 540=1215$ award 2/3 ✓×✓1

Question			Generic scheme	Illustrative scheme	Max mark
4.	(a)		•[1] construct equation	•[1] $5c+6p=45$	**1**

Notes:

1. •[1] is not available where a candidate uses alternative variables.
2. Accept $5c+6p=45$ min or $5c+6p=45$ m.
3. If part (a) is not attempted or the answer is incomplete, accept correct answer to part (a) which appears in parts (b) or (c).

Commonly Observed Responses:

	(b)		•[2] construct equation	•[2] $7c+4p=52$	**1**

Notes:

1. Accept use of consistent alternative variables from part (a).
2. Accept $7c+4p=52$ min or $7c+4p=52$ m.
3. If part (b) is not attempted **or** the answer is incomplete, accept correct answer to part (b) which appears in parts (a) **or** (c).

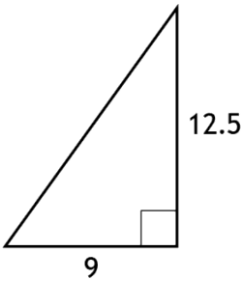
Commonly Observed Responses:

	(c)		•[3] correct scaling	•[3] eg $10c+12p=90$ $21c+12p=156$ **or** $35c+42p=315$ $35c+20p=260$ **or** $20c+24p=180$ $42c+24p=312$	**4**
			•[4] value for c or p	•[4] $c=6$ or $p=2.5$	
			•[5] value for p or c	•[5] $p=2.5$ or $c=6$	
			•[6] calculate final answer	•[6] 80 (minutes)	

Notes:

1. Correct answer without working. award 0/4
2. For a solution obtained by repeated substitution. award 0/4
3. •[6] is not available if either c or p is negative.
4. For the award of •[6] accept 1 hr 20 mins.
5. For the award of •[3] both variables must appear in each equation.

Commonly Observed Responses:

Question	Generic scheme	Illustrative scheme	Max mark
5.	$\bullet^1$ marshal facts and recognise right angled triangle	$\bullet^1$ 	**3**
	$\bullet^2$ consistent Pythagoras statement	$\bullet^2$ 12.5^2+9^2	
	$\bullet^3$ calculate radius	$\bullet^3$ $15.4(02\ldots)$ (cm)	

Notes:

1. Correct answer without working. award 0/3
2. In the absence of a diagram or diagram with no right angle marked, accept 12.5^2+9^2 as evidence for the award of $\bullet^1$ and $\bullet^2$.
3. **BEWARE:** where a diagram is shown, working must be consistent with the diagram; $\bullet^2$ is not available for an incorrect diagram leading to 12.5^2+9^2.
4. Valid trigonometry may used to calculate the length of the radius eg cosine rule.
5. $\bullet^3$ is not available for subsequent invalid working.
6. Accept 15 (cm) with working. award 3/3

Commonly Observed Responses:

1. $12.5^2-9^2 \rightarrow 8.67\ldots$
   (a) working inconsistent with correct diagram — award 2/3 ✓×✓1
   (b) working consistent with candidate's diagram — award 2/3 ×✓1✓1
   (cosine rule may be used to calculate third side)
   (c) no diagram or diagram with no right angle marked — award 1/3 ××✓1
2. $25^2-9^2 \rightarrow 23.32\ldots$ **or** $25^2+9^2 \rightarrow 26.57\ldots$
   (a) working consistent with candidate's diagram — award 2/3 ×✓1✓1
   (cosine rule may be used to calculate third side)
   (b) no diagram or diagram with no right angle marked — award 1/3 ××✓1

Question			Generic scheme	Illustrative scheme	Max mark
6.	(a)		$\bullet^1$ correct substitution into formula for volume of sphere $\bullet^2$ consistent volume calculation	$\bullet^1$ $\frac{4}{3}\times\pi\times5^3$ $\bullet^2$ $523.59\ldots$ or 524 (cm^3)	2

Notes:

1. Correct answer without working. award 2/2
2. Accept variations in π. eg $\frac{4}{3}\times3.14\times5^3=523.3\ldots$ **or** $523.\dot{3}$. award 2/2
3. $\bullet^2$ is not available for subsequent invalid working.
4. For the award of $\bullet^2$ the calculation must involve a fraction, π and a power
   eg $\pi\times5^3=392.699\ldots$. award 0/2

Commonly Observed Responses:

1. (a) $\frac{4}{3}\times\pi\times5^3=104(.7\ldots)$ award 1/2 ✓×

   (b) $\frac{4}{3}\times\pi\times5^2=104(.7\ldots)$ award 1/2 ×✓1

2. (a) $\frac{4}{3}\times\pi\times10^3=4188(.7\ldots)$ award 1/2 ×✓1

   (b) $\frac{4}{3}\times3.14\times10^3=4186(.6\ldots)$ award 1/2 ×✓1

3. $\frac{4}{3}\times\pi\times5=20(.9\ldots)$ award 0/2

4. $\frac{4}{3}\times\pi\times2.5^3=65(.4\ldots)$ award 1/2 ×✓1

Question			Generic scheme	Illustrative scheme	Max mark
6.	(b)		**Method 1** •[3] start substitution into formula for volume of cone •[4] complete substitution into formula •[5] calculate height **Method 2** •[3] change subject to h •[4] correct substitution into formula •[5] calculate height	•[3] $\frac{1}{3}\times\pi\times6^2\times h$ **or** $\frac{1}{3}\pi r^2h=523.59\ldots$ •[4] $\frac{1}{3}\times\pi\times6^2\times h=523.59\ldots$ •[5] 13.88… **or** 14 (cm) •[3] $(h=)\frac{3V}{\pi r^2}$ **or** $\frac{V}{\frac{1}{3}\pi r^2}$ •[4] $(h=)\frac{3\times523.59\ldots}{\pi\times6^2}$ **or** $\frac{523.59\ldots}{\frac{1}{3}\times\pi\times6^2}$ •[5] 13.88… **or** 14 (cm)	**3**

Notes:

1. For a correct answer without working. award 0/3
2. For an answer obtained by repeated substitution. award 0/3
3. •[5] is only available for:
   - method 1: a calculation involving a fraction, π and a power.
   - method 2: a calculation involving π, a power and division by a product.
4. Alternative method: $\frac{4}{3}\times\pi\times5^3=\frac{1}{3}\times\pi\times6^2\times h\rightarrow h=\frac{\frac{4}{3}\times\pi\times5^3}{\frac{1}{3}\times\pi\times6^2}\left[=\frac{4\times5^3}{6^2}\right]\rightarrow h=\frac{125}{9}$.

Commonly Observed Responses:

1. $(h=)\frac{524}{\frac{1}{3}\times\pi\times6^2}\rightarrow14$ award 3/3
2. $\frac{1}{3}\times\pi\times12^2\times h=523.59\ldots\rightarrow3.47(2\ldots)$ award 2/3 ✓×✓1

Question			Method 1	Illustrative scheme	Max mark
7.			**Method 1** •[1] valid strategy •[2] evaluation •[3] explicit comparison within valid strategy and state conclusion **Method 2** •[1] begin valid strategy •[2] continue valid strategy •[3] explicit comparison within valid strategy and state conclusion **Method 3** •[1] valid strategy •[2] evaluation of $\cos x$ •[3] calculate angle and state conclusion	**Method 1** •[1] 88^2+105^2 and 137^2 •[2] $88^2+105^2=18769$ **and** $137^2=18769$ •[3] $88^2+105^2=137^2$; it is right-angled **Method 2** •[1] $88^2+105^2=18769$ •[2] $\sqrt{18769}=137$ •[3] $\sqrt{88^2+105^2}=137$; it is right-angled **Method 3** •[1] $(\cos x=)\dfrac{88^2+105^2-137^2}{2\times 88\times 105}$ •[2] $(\cos x=)0$ •[3] $(x=)90$; it is right-angled	**3**

Question	Generic scheme	Illustrative scheme	Max mark
7. (continued)			

Notes:

1. $\bullet^1$ and $\bullet^3$ are not available where a candidate starts by stating that $88^2+105^2=137^2$
   eg $88^2+105^2=137^2$ $\bullet^1$ × $\bullet^3$ ×
   $18769=18769$ $\bullet^2$ ✓
   so it is right-angled. award 1/3 ×✓×
2. $\bullet^3$ is not available where a candidate starts by stating that IF $88^2+105^2=137^2$ unless explicit comparison is demonstrated
   eg IF $88^2+105^2=137^2$ $\bullet^1$ ✓ $\bullet^3$ ×
   $18769=18769$ $\bullet^2$ ✓
   so it is right-angled. award 2/3 ✓✓×
3. For the award of $\bullet^3$:
   (a) accept $88^2+105^2=137^2$ as evidence of explicit comparison unless candidate has started with this statement (see Notes 1 and 2).
   (b) accept 18769 = 18769 as evidence of explicit comparison where the two separate calculations each lead to 18769.
   (c) do NOT accept statement "$c^2=a^2+b^2$ so it is right-angled" unless c, a and b have been labelled on diagram or assigned to sides, and statement is consistent with labelling.
4. Inappropriate use of RAD or GRAD should only be penalised once in Q2, Q7, Q8 or Q10.
   (a) 1.57…, it is not right-angled (RAD).
   (b) 100, it is not right-angled (GRAD).

Commonly Observed Responses:

1. (a) $(\cos x=)\dfrac{88^2+137^2-105^2}{2\times88\times137}\rightarrow(\cos x=)\dfrac{88}{137}\rightarrow 50.033\ldots\rightarrow$ not right angled
   award 2/3 ×✓1✓1

   (b) $(\cos x=)\dfrac{105^2+137^2-88^2}{2\times105\times137}\rightarrow(\cos x=)\dfrac{105}{137}\rightarrow 39.966\ldots\rightarrow$ not right angled
   award 2/3 ×✓1✓1

Question			Generic scheme	Illustrative scheme	Max mark
8.			$\bullet^1$ rearrange equation $\bullet^2$ find first value of x $\bullet^3$ find second value of x	$\bullet^1$ $\tan x° = \frac{1}{5}$ or 0.2 $\bullet^2$ $x = 11.3(09\ldots)$ $\bullet^3$ $x = 191.3(09\ldots)$	**3**

Notes:

1. Correct answers
   (a) without working. award 1/3 ^^✓
   (b) by repeated substitution. award 1/3 ××✓
2. Accept 11 and 191 with valid working.
3. Degree signs are not required.
4. $\bullet^2$ and $\bullet^3$ are only available where angles are obtained using a valid trigonometric calculation.
5. Inappropriate use of RAD or GRAD should only be penalised once in Q2, Q7, Q8 or Q10.
   (a) 0.197…, 180.197… (RAD).
   (b) 12.56…, 192.566… (GRAD).
6. Where more than two final values are stated, $\bullet^3$ is not available
   eg 11, 169 and 191. award 2/3 ✓✓×

Commonly Observed Responses:

1. $\tan x° = -\frac{1}{5} \rightarrow 168.7,\ 348.7$ award 2/3 ×✓1✓1

2. $\tan x° = -\frac{1}{5} \rightarrow 11.3,\ 191.3$ award 0/3

Question			Generic scheme	Illustrative scheme	Max mark
9.			$\bullet^1$ start to divide fractions	$\bullet^1$ $\dfrac{x^2-81}{5}\times\dfrac{2}{x+9}$	**3**
			$\bullet^2$ factorise	$\bullet^2$ $\dfrac{(x-9)(x+9)}{\ldots}\ldots$	
			$\bullet^3$ multiply and simplify	$\bullet^3$ $\dfrac{2(x-9)}{5}$	

Notes:

1. Correct answer without working. award 0/3
2. $\bullet^2$ and $\bullet^3$ are not available if there is no evidence of factorising
   eg $\dfrac{x^{\cancel{2}}-\cancel{81}}{5}\times\dfrac{2}{\cancel{x+9}}\left[=\dfrac{x-9}{5}\times\dfrac{2}{1}\right]=\dfrac{2(x-9)}{5}$ award 1/3 ✓××
3. $\bullet^3$ is not available for subsequent invalid working.
   eg $\dfrac{(x+9)(x-9)}{5}\times\dfrac{2}{x+9}=\dfrac{2(x-9)}{5}=\dfrac{2x-9}{5}$ award 2/3 ✓✓×

Commonly Observed Responses:

1. $\dfrac{(x+9)(x-9)}{5}\times\dfrac{2}{x+9}\left[=\dfrac{2(x-9)}{5}\right]=\dfrac{2x-18}{5}$ award 3/3
2. $\dfrac{2\left(x^2-81\right)}{5(x+9)}$ **or** $\dfrac{2x^2-162}{5x+45}$ award 1/3 ✓^^
3. $(x+9)(x-9)$ alone award 0/3

Question			Generic scheme	Illustrative scheme	Max mark
10.			**Method 1** •[1] find angle •[2] substitute into area of a triangle formula •[3] substitute into sector formula •[4] know how to calculate area of a segment •[5] calculate area of segment **and state correct units** **Method 2** •[1] find angle •[2] substitute into area of a triangle formula •[3] know how to calculate area of **all** segments •[4] know how to calculate area of a segment •[5] calculate area of segment **and state correct units**	**Method 1** •[1] 72 •[2] $\frac{1}{2}\times 11\times 11\times \sin 72 \ (=57.5\ldots)$ •[3] $\frac{72}{360}\times \pi \times 11^2$ **or** $\frac{1}{5}\times \pi \times 11^2 \ (=76.0\ldots)$ •[4] $\frac{1}{5}\pi r^2 - \frac{1}{2}ab\sin C$ •[5] 18.48… **or** 18.5 cm^2 **Method 2** •[1] 72 •[2] $\frac{1}{2}\times 11\times 11\times \sin 72 \ (=57.5\ldots)$ •[3] $\pi r^2 - 5\times \frac{1}{2}ab\sin C$ •[4] $\frac{\pi\times 11^2 - 5\times\left(\frac{1}{2}\times 11\times 11\times \sin 72\right)}{5}$ •[5] 18.48… or 18.5 cm^2	**5**

Question	Generic scheme	Illustrative scheme	Max mark

10. (continued)

Notes:

1. Correct answer without working. award 0/5
2. Accept variations in π.
3. Disregard errors due to premature rounding provided there is evidence.
4. $\bullet^4$ and $\bullet^5$ are only available for:
   - Method 1: calculating the sum or difference of the **area** of a sector and the **area** of a triangle, where the area of a triangle is calculated using trigonometry.
   - Method 2: calculating the sum or difference of the **area** of a circle and the **area** of a pentagon, where the area of a triangle is calculated using trigonometry.

   See CORs 5 and 6.
5. $\bullet^2$ is available for using $A = \frac{1}{2}bh$ where h is calculated following a valid trigonometric method.
6. Inappropriate use of RAD or GRAD should only be penalised once in Q2, Q7, Q8 or Q10.
   (a) 15.356..., 60.67... (RAD).
   (b) 54.74..., 21.28... (GRAD).
7. For the award of $\bullet^2$ accept an incorrect **acute** angle substituted into the area of a triangle formula eg $\frac{1}{2}\times 11\times 11\times \sin 60$.

Commonly Observed Responses:

1. $\pi\times 11^2 - 5\times\frac{1}{2}\times 11\times 11\times\sin 72 \rightarrow 380.13... - 287.69... \rightarrow 92.43...$ cm^2 award 4/5 ✓✓✓×✓1

2. $\pi\times 11^2 - \frac{1}{2}\times 11\times 11\times\sin 72 \rightarrow 380.13... - 57.53... \rightarrow 322.59...$ cm^2 award 3/5 ✓✓××✓1

3. (a) $\frac{5\times 11\times 11\times\sin 72 - \pi\times 11^2}{5} \rightarrow \frac{575.38... - 380.13...}{5} \rightarrow 39.05...$ cm^2 award 3/5 ✓××✓1✓1

   (b) $\frac{\pi\times 11^2 - 5\times 11\times 11\times\sin 72}{5} \rightarrow \frac{380.13... - 575.38...}{5} \rightarrow \pm 39.05...$ cm^2 award 3/5 ✓×✓✓1×

4. (a) $\frac{1}{5}\times\pi\times 22 - \frac{1}{2}\times 11\times 11\times\sin 72 \rightarrow 13.82... - 57.5... \rightarrow \pm 43.7...$ cm^2 award 2/5 ✓✓×××

   (b) $\frac{\pi\times 22 - 5\times\left(\frac{1}{2}\times 11\times 11\times\sin 72\right)}{5} \rightarrow \frac{69.11... - 287.69...}{5} \rightarrow \pm 43.7...$ cm^2 award 2/5 ✓✓×××

5. $\pi\times 22 - \frac{1}{2}\times 11\times 11\times\sin 72 \rightarrow 69.11... - 57.53... \rightarrow 11.58...$ cm^2 award 2/5 ✓✓×××

6. (a) $\frac{\frac{4}{3}\times\pi\times 11^3 - 5\times\frac{1}{2}\times 11\times 11\times\sin 72}{5} \rightarrow \frac{5575.27... - 287.69...}{5} \rightarrow 1057.5...$ cm^2

   award 2/5 ✓✓×××

   (b) $\frac{\frac{4}{3}\times\pi\times 11^2 - 5\times\frac{1}{2}\times 11\times 11\times\sin 72}{5} \rightarrow \frac{506.84... - 287.69...}{5} \rightarrow 43.8...$ cm^2

   award 2/5 ✓✓×××

Question	Generic scheme	Illustrative scheme	Max mark
11.	•[1] start to simplify denominator	•[1] $\frac{a^{17}}{27\ldots}$ **or** $\frac{a^{17}}{\ldots a^{12}}$	**3**
	•[2] simplify denominator	•[2] $\frac{a^{17}}{27a^{12}}$	
	•[3] complete simplification	•[3] $\frac{a^5}{27}$ **or** $\frac{1}{27}a^5$	

Notes:

1. Correct answer without working. award 0/3
2. •[3] is not available for subsequent incorrect working
   eg $\frac{a^{17}}{27a^{12}} \rightarrow \frac{a^5}{27} \rightarrow \frac{1}{27a^5}$. award 2/3 ✓✓×
3. For the award of •[3] do not accept a decimal approximation
   eg $\frac{a^{17}}{3a^{12}} \rightarrow 0.33a^5$ $\frac{a^{17}}{3a^{12}} \rightarrow 0.33a^5$. award 1/3 ✓××

Commonly Observed Responses:

1. $\frac{a^{17}}{3a^{12}} \rightarrow \frac{a^5}{3}$ **or** $\frac{1}{3}a^5$ award 2/3 ✓×✓1
2. $\frac{a^{17}}{27a^7} \rightarrow \frac{a^{10}}{27}$ **or** $\frac{1}{27}a^{10}$ award 2/3 ✓×✓1
3. $\frac{a^{17}}{3a^7} \rightarrow \frac{a^{10}}{3}$ **or** $\frac{1}{3}a^{10}$ award 1/3 ××✓1
4. $\frac{a^{17}}{3a^{12}} \rightarrow 3a^5$ award 1/3 ✓××

Question			Generic scheme	Illustrative scheme	Max mark
12.			**Method 1** •1 factorises •2 express in simplest form **Method 2** •1 valid substitution •2 express in simplest form	**Method 1** •1 $\cos x\left(\sin^2 x+\cos^2 x\right)$ •2 $\cos x$ **Method 2** •1 $\cos x\left(1-\cos^2 x\right)+\cos^3 x$ •2 $\cos x$	2

Notes:

1. Correct answer without working. award 0/2
2. Do not penalise omission of degrees sign.
3. Accept $\left(\sin x\right)^2$ and $\left(\cos x\right)^2$ but not $\sin x^2$ and $\cos x^2$.
4. •1 is not available if there are no variables eg
   (a) $\cos\left(\cos^2+\sin^2\right)=\cos x$. award 2/2
   (b) $\cos\left(\cos^2+\sin^2\right)=\cos$. award 1/2 ×✓1
   (c) $\cos\left(\cos^2+\sin^2\right)$. award 0/2
5. •1 is not available if the candidate simply states $\cos^2 x+\sin^2 x=1$ then proceeds no further.
6. •2 is not available if there is subsequent invalid working.
7. Alternative acceptable strategy:
   •1 $\left(\frac{a}{h}\right)\left(\left(\frac{o}{h}\right)^2+\left(\frac{a}{h}\right)^2\right)$
   •2 $\left(\frac{a}{h}\right)=\cos x$ award 2/2

Commonly Observed Responses:

1. $\cos x\times 1-\cos^2 x+\cos^3 x\rightarrow\cos x-\cos^3 x+\cos^3 x\rightarrow\cos x$ award 0/2

Question			Generic scheme	Illustrative scheme	Max mark
13.	(a)		$\bullet^1$ correct expression	$\bullet^1$ $2x+6$	**1**
Notes: 1. $\bullet^1$ is available If solution to part (a) appears in parts (b) or (c). 2. Accept $x+x+6$ **or** $6+2x$. 3. Accept $A=(2x+6)(\ldots\ldots)$ **or** $(2x+6)(\ldots\ldots)$.					
Commonly Observed Responses:					
	(b)		$\bullet^2$ find expression for area of extension and expand pair of brackets $\bullet^3$ construct equation and rearrange into required form	$\bullet^2$ $(2x+6)(x+2)=2x^2+4x+6x+12$ $\bullet^3$ $2x^2+10x+12=17$ $\Rightarrow 2x^2+10x-5=0$	**2**
Notes: 1. $\bullet^2$ and $\bullet^3$ are available if solution to part (b) appears in parts (a) or (c). 2. For the award of $\bullet^2$ accept a correct expansion of a pair of brackets, one of which **must** be $(x+2)$.					
Commonly Observed Responses: 1. $2x+6\times x+2=2x^2+10x+12\rightarrow 2x^2+10x+12=17\Rightarrow 2x^2+10x-5=0$ award 1/2 ×✓1 2. $2x^2+10x+12=17\rightarrow 2x^2+10x-5=0$ (with no prior evidence) award 0/2					

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Question			Generic scheme	Illustrative scheme	Max mark
13.	(c)		$\bullet^4$ correct substitution into quadratic formula $\bullet^5$ evaluate discriminant $\bullet^6$ solve for x $\bullet^7$ select correct value of x, stated to 2 decimal places	$\bullet^4$ $\dfrac{-10\pm\sqrt{10^2-4\times2\times(-5)}}{2\times2}$ $\bullet^5$ 140 (stated or implied by $\bullet^6$) $\bullet^6$ 0.458… **and** −5.458… $\bullet^7$ 0.46 (m)	**4**

Notes:

1. Correct answer without working. award 0/4
2. For a solution obtained by repeated substitution. award 0/4
3. $\bullet^4$, $\bullet^5$, $\bullet^6$ and $\bullet^7$ are available If solution to (c) appears in part (a) or (b). However, if a different value for x is stated in part (c) then $\bullet^7$ is not available. (General Marking Principle (l) should not be applied in this special case).
4. $\bullet^4$ and $\bullet^5$ are available for $\dfrac{-5\pm\sqrt{35}}{2}$.
5. Where b^2-4ac is calculated incorrectly, $\bullet^6$ is only available if $b^2-4ac>0$.
6. For: (a) $\dfrac{-10+\sqrt{10^2-4\times2\times(-5)}}{2\times2}\rightarrow0.46$. award 4/4
   (with explicit justification of why second root has not been calculated eg 2nd substitution leads to a negative solution)

   (b) $\dfrac{-10+\sqrt{10^2-4\times2\times(-5)}}{2\times2}\rightarrow0.46$. award 1/4 ×✓××

   c) $\dfrac{-10+\sqrt{10^2-4\times2\times(-5)}}{2\times2}$. award 0/4
7. $\bullet^7$ is not available if:
   - there is subsequent invalid working
   - premature rounding leads to an incorrect answer

Question	Generic scheme	Illustrative scheme	Max mark

13. (c) (continued)

Commonly Observed Responses:

1. $\left(b^2-4ac=\right)140$ award 1/4 ×✓××

2. (a) $\dfrac{-10\pm\sqrt{10^2-4\times2\times(-5)}}{2\times2}\rightarrow\dfrac{-10\pm\sqrt{60}}{2\times2}\rightarrow -0.563\ldots$ **or** $-4.436\ldots$ award 2/4 ✓×✓1×

   (b) $\dfrac{-10\pm\sqrt{10^2-4\times2\times5}}{2\times2}\left(\rightarrow\dfrac{-10\pm\sqrt{60}}{2\times2}\right)\rightarrow -0.563\ldots$ **or** $-4.436\ldots$ award 2/4 ×✓1✓1×

3. (a) $-10\pm\dfrac{\sqrt{10^2-4\times2\times(-5)}}{2\times2}\rightarrow-10\pm\dfrac{\sqrt{140}}{2\times2}\rightarrow 0.458\ldots$ **or** $-5.458\ldots\rightarrow 0.46$ award 4/4

   (b) $-10\pm\dfrac{\sqrt{10^2-4\times2\times(-5)}}{2\times2}\rightarrow-10\pm\dfrac{\sqrt{140}}{2\times2}\rightarrow -7.041\ldots$ **or** $-12.958\ldots$ award 2/4 ×✓✓1×

4. $\dfrac{-10\pm\sqrt{10^2-4\times2\times5}}{2\times2}\rightarrow\dfrac{-10\pm\sqrt{140}}{2\times2}\left(\rightarrow-10\pm\dfrac{\sqrt{140}}{2\times2}\right)\rightarrow -7.041\ldots$ **or** $-12.958\ldots$

   award 0/4

[END OF MARKING INSTRUCTIONS]