N5

National
Qualifications
2022

2022 Mathematics

Paper 2

National 5

Finalised Marking Instructions

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General marking principles for National 5 Mathematics

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

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

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

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

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

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

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

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

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

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

(g) If an error is trivial, casual or insignificant, for example 6 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

This is a transcription error and so the mark is not awarded.	$x^2 + 5x + 7 = 9x + 4$ $x - 4x + 3 = 0$
This is no longer a solution of a quadratic equation, so the mark is not awarded.	$x = 1$

The following example is an exception to the above

This error is not treated as a transcription error, as the candidate deals with the intended quadratic equation. The candidate has been given the benefit of the doubt and all marks awarded.	$x^2 + 5x + 7 = 9x + 4$ $x - 4x + 3 = 0$ $(x-3)(x-1) = 0$ $x = 1$ or 3

(i) **Horizontal/vertical marking**
If a question results in two pairs of solutions, apply the following technique, but only if indicated in the detailed marking instructions for the question.

Example:

	○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

$\frac{15}{0\cdot3}$ 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.

(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			$\bullet^1$ start to expand	$\bullet^1$ evidence of any 3 correct terms eg $6x^3+15x^2-3x$	**3**
			$\bullet^2$ complete expansion	$\bullet^2$ $6x^3+15x^2-3x-4x^2-10x+2$	
			$\bullet^3$ collect like terms which must include a term in x^3 and a term with a negative coefficient	$\bullet^3$ $6x^3+11x^2-13x+2$	

Notes:

1. Correct answer without working award 3/3

2. For subsequent incorrect working $\bullet^3$ is not available

3. Evidence for $\bullet^1$ and $\bullet^2$ may appear in a grid

Commonly Observed Responses:

Question			Generic scheme	Illustrative scheme	Max mark
2			•1 know how to increase by 3% •2 know how to calculate expected profit after 4 years •3 evaluate to nearest thousand pounds	•1 $\times 1.03$ •2 $215\,000 \times 1.03^4$ •3 (£) 242 000	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
   eg for $215\,000 \times 1.3^4 = 614\,000$ — award 2/3 ✗✓1✓1

3. Where an incorrect power (≥ 2) is used, the working must be followed through to give the possibility of awarding 2/3
   eg $215\,000 \times 1.03^3 = 235\,000$ — award 2/3 ✓✗✓1

4. Where division is used:
   (a) along with 1.03 •1 is not available
   eg $215\,000 \div 1.03^4 = 191\,000$ — award 2/3 ✗✓1✓1
   (b) along with an incorrect percentage, •1 and •2 are not available
   eg $215\,000 \div 0.97^4 = 243\,000$ — award 1/3 ✗✗✓1

5. Accept (£) 242 000.00 for the award of •3

6. Where intermediate calculations are shown, premature rounding must be to at least 4 significant figures

Commonly Observed Responses:

1. $215\,000 \times 1.03^4 = 241\,984(.39\ldots)$ — award 2/3 ✓✓✓2

2. $215\,000 \times 0.97^4 = 190\,000$ — award 2/3 ✗✓1✓1

3. $215\,000 \times 1.03 = 221\,000$ — award 1/3 ✓✗✓2

4. $215\,000 \times 1.03 \times 4 = 886\,000$ — award 1/3 ✓✗✓2

5. $215\,000 \times 0.03 = 6450 \rightarrow 215\,000 + 4 \times 6450 = 241\,000$ — award 1/3 ✓✗✓2

6. $215\,000 \times 0.03 \times 4 = 26\,000$ — award 0/3 ✗✗✓2

Question			Generic scheme	Illustrative scheme	Max mark
3.			•[1] correct substitution into volume of sphere formula •[2] correct substitution into volume of cuboid formula **and** add to volume of sphere •[3] consistent calculation (see note 5) **and state correct units** in final answer	•[1] $\frac{4}{3}\times\pi\times0.2^3$ •[2] volume of sphere + $0.48\times0.48\times2$ •[3] $0.49(4\ldots)$ m^3	3

Notes:

1. Correct answer without working award 0/3

2. Accept variations in π

3. $\frac{4}{3}\times\pi\times20^3+48\times48\times200=494310\ldots cm^3$ award 3/3

4. (a) $\frac{4}{3}\times\pi\times0.2^3+0.48\times0.48\times2\rightarrow0.49(4\ldots)m^3=49.4cm^3$ award 3/3

   (b) $\frac{4}{3}\times\pi\times0.2^3+0.48\times0.48\times2\rightarrow0.49(4\ldots)=49.4cm^3$ award 2/3 ✓✓×

5. For the award of •[3] the calculation must involve the sum or difference of a calculation involving a fraction, π and a power, and a calculation of a product of at least two numbers

   eg $\frac{4}{3}\times\pi\times0.2^3+0.48\times2=0.99(35\ldots)m^3$ award 2/3 ✓×✓1

Commonly Observed Responses:

1. $\frac{4}{3}\times\pi\times0.4^3+0.48\times0.48\times2=0.728\ldots m^3$ or $0.73m^3$ award 2/3 ×✓1✓1
2. $\frac{4}{3}\times\pi\times0.2^3+0.48\times0.48\times2.4=0.586\ldots m^3$ or $0.59m^3$ award 2/3 ✓×✓1
3. $\frac{4}{3}\times\pi\times0.2^2+0.48\times0.48\times2=0.628\ldots m^3$ or $0.63m^3$ award 2/3 ×✓✓1
4. $\frac{4}{3}\times\pi\times0.4^3+0.48\times0.48\times2.4=0.82\ldots m^3$ award 1/3 ××✓1
5. $0.48\times0.48\times2=0.46(08)$ m^3 award 0/3 ^××

Question			Generic scheme	Illustrative scheme	Max mark
4	(a)		•¹ construct equation	•¹ eg $4m + 3a = 4.25$	**1**

Notes:

1. Accept $4m + 3a = 425$
2. Accept $4m + 3a = 425$p or $4m + 3a = £4.25$ as bad form
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 eg $5m + 2a = 4.70$	**1**

Notes:

1. Accept $5m + 2a = 470$ when consistent with answer to part (a)
2. Accept $5m + 2a = 470$p or $5m + 2a = £4.70$ as bad form
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:

Question			Generic scheme	Illustrative scheme	Max mark
4.	(c)		•³ correct scaling •⁴ value for a or m •⁵ value for m or a •⁶ communicate answer with units	•³ eg $20m + 15a = 21.25$ $20m + 8a = 18.80$ or $8m + 6a = 8.50$ $15m + 6a = 14.10$ •⁴ $a = 0.35$ or $m = 0.8$ •⁵ $m = 0.8$ or $a = 0.35$ •⁶ mango = £0.80 or 80p apple = £0.35 or 35p	**4**

Notes:

1. Correct answer without working — award 0/4

2. For a solution obtained by guess and check — award 0/4

3. (a) an earlier error, accept unrounded values or values rounded to the nearest penny for •⁴ and •⁵
   (b) •⁵ is available for an answer calculated from an unrounded value or value rounded to the nearest penny from •⁴
   (c) •⁶ is only available for values given to the nearest penny

4. •⁶ is not available if either a or m is negative

5. •⁶ is only available where a candidate calculates values for a and m, and a conclusion containing the words 'mango' and 'apple' along with the correct units in both cases

6. For •⁶ do **not** accept mango = £0.8 or mango = £0.80p, apple = £0.35p

Commonly Observed Responses:

Question			Generic scheme	Illustrative scheme	Max mark
5.	(a)		**Method 1**		4
			•¹ calculate mean	•¹ 26	
			•² calculate $(x-\bar{x})^2$	•² 9, 1, 4, 25, 16, 49, 16	
			•³ substitute into formula	•³ $\sqrt{\frac{120}{6}}$	
			•⁴ calculate standard deviation	•⁴ $4.47(2\ldots)$ or 4.5	
			Method 2		
			•¹ calculate mean	•¹ 26	
			•² calculate $\sum x$ and $\sum x^2$	•² 182, 4852	
			•³ substitute into formula	•³ $\sqrt{\frac{4852-\frac{182^2}{7}}{6}}$	
			•⁴ calculate standard deviation	•⁴ $4.47(2\ldots)$ or 4.5	

Notes:

1. For 26 and $4.47(2\ldots)$ or 4.5 without working award 1/4 ✓^^✓2

2. (a) For 26 and $\frac{\sqrt{120}}{6} = 4.47(2\ldots)$ or 4.5 award 4/4

   (b) For 26 and $\frac{\sqrt{120}}{6} = 1.8(2\ldots)$ award 3/4 ✓✓×✓1

4. For the award of •⁴ accept an answer in simplified surd form eg $2\sqrt{5}$

5. If one x value is missing from list, do not award •²; however •³ may be awarded for consistent substitution into standard deviation formula with:
   (a) 5 in the denominator (from number of values on written list)
   (b) 6 in the denominator (from wording of the question)

Commonly Observed Responses:

1. (a) 26 and $\sqrt{\frac{120}{6}} = 4.47(2\ldots) = 4.4$ award 4/4

   (b) 26 and $\sqrt{\frac{120}{6}} = 4.4$ award 3/4 ✓✓✓×

Question			Generic scheme	Illustrative scheme	Max mark
5.	(b)		•[5] compare means •[6] compare standard deviations	•[5] eg on average the hockey team recorded a higher number of sit-ups •[6] eg the hockey team's **numbers of sit-ups** were more consistent	**2**

Notes:

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

2. If standard deviation answer to part (a) is left in surd form, •[6] can only be awarded if there is evidence that the comparison is based on two numbers in decimal format

3. Statements must involve reference to number of sit-ups **and** include netball team and/or hockey team
   (a) Accept eg
   - on average the hockey team did more sit-ups

   (b) Do not accept eg
   - the hockey team's sit-ups went up
   - on average the hockey team's **results/scores/data** were higher
   - the hockey team's **results/scores/data** were more consistent

4. For the award of •[5]
   (a) Accept eg
   - the hockey team's average number of sit-ups was more
   - the average amount of sit-ups was more for the hockey team

   (b) Do not accept eg
   - the hockey team had more sit-ups
   - the **mean** number of sit-ups was higher for the hockey team
   - the average number of sit-ups was **better** for the hockey team

5. For the award of •[6]
   (a) Accept eg
   - the hockey team's numbers of sit-ups were less varied
   - the hockey team's numbers of sit-ups were less spread out

   (b) Do not accept eg
   - the hockey team's sit-ups were less spread out
   - the hockey team was less varied
   - the hockey team's **standard deviation** was more consistent
   - the **range** of the hockey team's numbers of sit-ups was less

Commonly Observed Responses:

Question			Generic scheme	Illustrative scheme	Max mark
6.			•¹ correct substitution into area of triangle formula •² calculate area	•¹ $\frac{1}{2}\times 25\times 32\times \sin 58$ •² $339(.21...)$ (cm^2)	**2**

Notes:

1. Correct answer without working award 2/2

2. For $25\times 32\times \sin 58 = 678(.438...)$ award 1/2 ✗✓1

3. Inappropriate use of RAD or GRAD should only be penalised once in Qu 6, 9 or 14
   (a) $397(.149...)$ [RAD] (no working necessary) award 1/2 ✓✗
   (b) $316(.062...)$ [GRAD] (no working necessary) award 1/2 ✓✗

4. Where cosine rule is used award 0/2

Commonly Observed Responses:

1. $\frac{1}{2}\times 25\times 32\times \sin 58 = \sqrt{339.\ ...} = 18.4...$ award 1/2 ✓✓2

2. $\frac{1}{2}\times 25\times 32\times 58 = 23\,200$ award 0/2

Question			Generic scheme	Illustrative scheme	Max mark
7.			•1 correct substitution into quadratic formula •2 evaluate discriminant •3 calculate **both** unrounded values of x or **one** value of x rounded to 2 significant figures •4 calculate **both** values of x rounded to 2 significant figures	•1 $\dfrac{-2\pm\sqrt{2^2-4\times4\times(-7)}}{2\times4}$ •2 116 (stated or implied by •3) •3 $1.09(6...)$ **and** $-1.59(6...)$ **or** 1.1 **or** −1.6 •4 1.1 **and** −1.6	4

Notes:

1. Correct answer without working award 0/4
2. •2 is available for $\dfrac{-1\pm\sqrt{29}}{4}$
3. •3 is only available when $b^2-4ac>0$
4. •4 is only available when both roots require rounding
5. •4 is not available if there is invalid subsequent working

Commonly Observed Responses:

1. $116\ (b^2-4ac)$ award 1/4 ^✓^^

2. $\dfrac{-2\pm\sqrt{2^2-4\times4\times(-7)}}{2\times4}\left(\rightarrow\dfrac{-2\pm\sqrt{-108}}{2\times4}\right)\rightarrow\dfrac{-2\pm\sqrt{108}}{2\times4}\rightarrow1.0,-1.5$ award 2/4 ✓××✓1

3. $\dfrac{-2\pm\sqrt{2^2-4\times4\times7}}{2\times4}\rightarrow\dfrac{-2\pm\sqrt{-108}}{2\times4}\rightarrow\left(\dfrac{-2\pm\sqrt{108}}{2\times4}\right)\rightarrow1.0,-1.5$ award 2/4 ×✓1×✓1

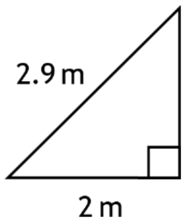
4. $\dfrac{-2\pm\sqrt{2^2-4\times4\times7}}{2\times4}\rightarrow\dfrac{-2\pm\sqrt{108}}{2\times4}\rightarrow1.0,-1.5$ award 2/4 ××✓1✓1

5. (a) $-2\pm\dfrac{\sqrt{2^2-4\times4\times(-7)}}{2\times4}\rightarrow-2\pm\dfrac{\sqrt{116}}{2\times4}\rightarrow1.1,\ -1.6$ award 4/4

   (b) $-2\pm\dfrac{\sqrt{2^2-4\times4\times(-7)}}{2\times4}\rightarrow-2\pm\dfrac{\sqrt{116}}{2\times4}\rightarrow-0.65,\ -3.3$ award 3/4 ×✓✓1✓1

6. $\dfrac{-2\pm\sqrt{2^2-4\times4\times(-7)}}{2\times4}\rightarrow\dfrac{-2\pm\sqrt{116}}{2\times4}\rightarrow-0.65(3...),\ -3.3(4...)\rightarrow-0.65,\ -3.3$

   award 3/4 ✓✓×✓1

Question			Generic scheme	Illustrative scheme	Max mark
8.			$\bullet^1$ marshal facts and recognise right-angled triangle	$\bullet^1$ 	4
			$\bullet^2$ consistent Pythagoras statement	$\bullet^2$ $2.9^2 - 2^2$	
			$\bullet^3$ calculate third side	$\bullet^3$ 2.1	
			$\bullet^4$ calculate height	$\bullet^4$ 5 (m)	

Notes:

1. Correct answer without working — award 0/4
2. In the absence of a diagram, accept $2.9^2 - 2^2$ as evidence for the awards of $\bullet^1$ and $\bullet^2$
3. **BEWARE** where a diagram of a right-angled triangle is shown, working must be consistent with the diagram. $\bullet^2$ is **not** available for an incorrect diagram leading to $2.9^2 - 2^2$
4. $\bullet^2$ is available for a valid trig. method leading to the length of the third side
   (a) award $\bullet^2$ for eg $x = \cos^{-1}\left(\frac{2}{2.9}\right) \rightarrow 2\tan x$ or $2.9\sin x$
   (b) do not award $\bullet^2$ for eg $\cos^{-1}\left(\frac{2}{2.9}\right) = 46.3(9\ldots)$
5. $\bullet^4$ is awarded for adding 2.9 to a value which has been calculated using Pythagoras' theorem or trigonometry
6. $\bullet^1$ and $\bullet^2$ are not available for:
   (a) $4^2 - 2.9^2 \rightarrow 2.75\ldots$; height $= 5.65\ldots$ — award 2/4 ××✓1✓1
   (b) $4^2 + 2.9^2 \rightarrow 4.94\ldots$; height $= 7.84\ldots$ — award 2/4 ××✓1✓1
7. Where a candidate assumes an angle of 45° in the right-angled triangle, only $\bullet^1$ and $\bullet^4$ are available
8. Disregard errors due to premature rounding provided there is evidence

Commonly Observed Responses:

1. $2.9^2 + 2^2 \rightarrow 3.52\ldots$; height $= 6.42\ldots$
   (a) working inconsistent with correct diagram — award 3/4 ✓×✓1✓1
   (b) working consistent with candidate's diagram (cosine rule may be used to calculate third side) — award 3/4 ×✓1✓1✓1
   (c) no diagram — award 2/4 ××✓1✓1

Question			Generic scheme	Illustrative scheme	Max mark
9.			•[1] rearrange equation •[2] find first value of x •[3] find second value of x	•[1] $\sin x = \frac{2}{3}$ •[2] 41.8(…) •[3] 138.2 or 138.1(8…)	3

Notes:

1. Correct answers without working — award 1/3 ^^✓
2. Accept 42 and 138 with valid working
3. Degree signs are not required
4. Premature rounding: rounded working must be to at least 2 decimal places

   eg (a) $\sin x = \frac{2}{3} = 0.67 \to x = 42(.06\ldots), 138$ or $137.9(3\ldots)$ — award 3/3

   (b) $\sin x = \frac{2}{3} = 0.7 \to x = 44(.42\ldots), 136$ or $135.5(7\ldots)$ — award 2/3 ✓×✓1

5. Inappropriate use of RAD or GRAD should only be penalised once in Q6, 9 or 14:
   (a) 0.729…, 179.270… (RAD)
   (b) 46.45…, 133.54… (GRAD)

6. Where more than two **final** values are stated, •[3] is not available
   eg 41.8(…),138.1(8…) and 221.8(…) — award 2/3 ✓✓×

Commonly Observed Responses:

1.	$\sin x = -\frac{2}{3} \to 221.8, 318.2$	award 2/3 ×✓1✓1
2.	$\sin x = -\frac{2}{3} \to 41.8, 138.2$	award 0/3
3.	(a) $\sin x = \frac{2}{3} \to 36.8(6\ldots), 143.1\ldots$	award 2/3 ✓×✓1
	(b) $\sin x = 0.6 \to 36.8(6\ldots), 143.1\ldots$	award 2/3 ×✓1✓1

Question			Generic scheme	Illustrative scheme	Max mark
10.			**Method 1**		3
			•¹ expression for arc length	•¹ $\frac{\text{angle}}{360}\times\pi\times30$	
			•² know how to find angle	•² $\frac{69.4\times360}{\pi\times30}$	
			•³ calculate angle	•³ 265(.08…)	
			Method 2		
			•¹ arc length: circumference ratio	•¹ $\frac{69.4}{\pi\times30}$ (= 0.736…)	
			•² know how to find angle	•² $\frac{69.4\times360}{\pi\times30}$	
			•³ calculate angle	•³ 265(.08…)	

Notes:

1. Correct answer without working award 0/3

2. For guess and check •² and •³ are not available
   eg $\frac{265}{360}\times\pi\times30=69.4$ award 1/3 ✓✓2✓2

3. Accept variations in π
   eg $\frac{69.4\times360}{\pi\times30}\left(=\frac{69.4\times360}{3.14\times30}\right)=265(.22\ldots)$

4. Degrees signs not required

5. Premature rounding of $\frac{69.4}{\pi\times30}$ must be to at least 2 decimal places

6. For the award of •³ the calculation must involve a division by a product. The calculation must include 69.4, π, 360 and the candidate's chosen diameter or radius.

7. For subsequent incorrect working, •³ is not available
   eg $360-265=95$ award 2/3 ✓✓✗

Question		Generic scheme	Illustrative scheme	Max mark
10.	**(continued)**			

Commonly Observed Responses:

1. For $\dfrac{69.4\times360}{\pi\times15}=530$ award 2/3 ×✓1✓1

2. For $\dfrac{69.4\times360}{\pi\times15^2}=35.3(\ldots)$ award 2/3 ×✓1✓1

3. (a) For $\dfrac{69.4}{360}\times\pi\times30=18.1(\ldots)$ award 0/3

   (b) For $\dfrac{\text{angle}}{360}\times\pi\times \boldsymbol{d}\rightarrow\dfrac{69.4}{360}\times\pi\times\mathbf{30}=18.1(\ldots)$ award 1/3 ✓××

Question			Generic scheme	Illustrative scheme	Max mark
11.			•¹ start valid strategy for finding length of face diagonal •² continue valid strategy for finding length of space diagonal •³ calculate length of space diagonal	•¹ 24^2+6^2 or 6^2+8^2 or 24^2+8^2 (stated or implied by •²) •² $24^2+6^2+8^2$ •³ 26 (cm)	3

Notes:

1. Correct answer without working award 0/3

2. Accept •¹ $\begin{pmatrix} 24 \\ 6 \\ 8 \end{pmatrix} \rightarrow$ •² $24^2+6^2+8^2 \rightarrow$ •³ 26

3. Premature rounding: rounded working must be to at least 1 decimal place:
   (a) $\sqrt{24^2+6^2}=24.7\ldots \rightarrow \sqrt{24.7^2+8^2}=25.96\ldots$ award 3/3
   (b) $\sqrt{24^2+6^2}=24.7\ldots \rightarrow \sqrt{25^2+8^2}=26(.2\ldots)$ award 2/3 ✓✓✓2

4. Accept correct use of trigonometry.
   Finding the size of an angle in a right-angled triangle is not sufficient for the award of •¹ or •²

5. For an invalid strategy involving the addition or subtraction of the lengths of two edges followed by a Pythagoras calculation
   eg $24+6=30 \rightarrow \sqrt{30^2+8^2}=31.0\ldots$ award 0/3

Commonly Observed Responses:

1. $\sqrt{24^2+6^2}=24.7\ldots$ award 1/3 ✓^^

2. $\sqrt{24^2+8^2}=25.2(9\ldots)$ award 1/3 ✓^^

3. $\sqrt{6^2+8^2}=10$ award 1/3 ✓^^

Question			Generic scheme	Illustrative scheme	Max mark
12.			•¹ factorise numerator •² factorise denominator •³ express fraction in simplest form	•¹ $2a(b+3)$ •² $(b+3)(b-3)$ •³ $\dfrac{2a}{b-3}$	3

Notes:

1. Correct answer without working award 0/3

2. For the award of •³, only accept simplification consistent with candidate's factorising in •¹ and •²

   eg (a) $\dfrac{2a(b-3)}{(b-3)^2} = \dfrac{2a}{(b-3)}$ award 1/3 ××✓1

   (b) $\dfrac{2a(b+3)}{b^2-9} = \dfrac{2a(b+3)(b-3)}{(b-3)^2} = \dfrac{2a(b+3)}{(b-3)}$ award 1/3 ✓××

3. For subsequent incorrect working, the final mark is not available

Commonly Observed Responses:

Question			Generic scheme	Illustrative scheme	Max mark
13.			•¹ express as separate fractions •² simplify	•¹ $\frac{\sin x}{\cos x} + \frac{2\cos x}{\cos x}$ •² $\tan x + 2$	2

Notes:

1. Correct answer with no working — award 2/2

2. Degrees signs are not required

3. •² is not available if there are any missing variables in the final answer

   eg (a) $\frac{\sin}{\cos} + \frac{2\cos}{\cos} = \tan x + 2$ — award 2/2

   (b) $\frac{\sin}{\cos} + \frac{2\cos}{\cos} = \tan + 2$ — award 1/2 ✓✓2

4. •² is not available if there is invalid subsequent working

5. Alternative acceptable strategy:

   eg •¹ $\left(\frac{\frac{o}{h} + 2\frac{a}{h}}{\frac{a}{h}} = \right) \frac{\frac{o}{h}}{\frac{a}{h}} + \frac{2\frac{a}{h}}{\frac{a}{h}}$

   •² $\left(\frac{o}{a} + 2\frac{a}{a} = \right) \tan x + 2$

Commonly Observed Responses:

1. $\frac{\sin x + 2\cancel{\cos x}}{\cancel{\cos x}} = \sin x + 2$ — award 0/2

2. (a) $\frac{\sin x + 2\cos x}{\cos x} \left(= \frac{\sin x}{\cos x} + 2\cos x \right) = \tan x + 2\cos x$ (trig identity) — award 1/2 ✗✓1

   (b) $\frac{\sin x + 2\cos x}{\cos x} \left(= \frac{\sin x}{\cos x} + 2\cos x \right) = \tan + 2\cos x$ — award 0/2 ✗^

3. $\frac{\sin x}{\cos x} = \tan x$ — award 0/2

Question			Generic scheme	Illustrative scheme	Max mark
14.			**Method 1**		**5**
			•¹ correct substitution into sine rule to calculate AC	•¹ $\frac{\text{AC}}{\sin 12} = \frac{15}{\sin 16}$	
			•² rearrange equation	•² $\frac{15\sin 12}{\sin 16}$	
			•³ calculate AC	•³ $\text{AC} = 11.3(\ldots)$	
			•⁴ valid strategy to calculate BC	•⁴ eg $\cos 28 = \frac{\text{BC}}{11.3\ldots}$ or $\sin 62 = \frac{\text{BC}}{11.3\ldots}$	
			•⁵ calculate BC	•⁵ 9.99 (m)	
			Method 2		
			•¹ correct substitution into sine rule to calculate AD	•¹ $\frac{\text{AD}}{\sin 152} = \frac{15}{\sin 16}$	
			•² rearrange equation	•² $\frac{15\sin 152}{\sin 16}$	
			•³ calculate AD	•³ $\text{AD} = 25.5(\ldots)$	
			•⁴ valid strategy to calculate **BD**	•⁴ eg $\cos 12 = \frac{\textbf{BD}}{25.5\ldots}$ or $\sin 78 = \frac{\textbf{BD}}{25.5\ldots}$	
			•⁵ calculate BC ie BD — 15	•⁵ 9.99 (m)	

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

Notes:

1. Correct answer without working — award 0/5

2. Accept 10 with relevant working

3. Where intermediate calculations are shown, disregard premature rounding provided:
   (a) trigonometric values are rounded to at least 3 decimal places
   (b) lengths are rounded to at least 1 decimal place

4. For the award of $\bullet^5$ accept truncated or correctly rounded **final** answer
   eg method 1 leading to $\cos 28 = \frac{BC}{11.3} \rightarrow 9.97$

5. Where both AC and AD are calculated but one is calculated incorrectly, if there is
   (a) further working, then apply the MIs based on length used to calculate BC
   (b) no further working, disregard the incorrect length — award 3/5 ✓✓✓^^

6. Inappropriate use of GRAD or RAD should only be penalised once in Q6,9 or 14:
   If already penalised, the following marks should be awarded:

	GRAD	RAD
Method 1	$AC = 11.3(\ldots) \rightarrow BC = 10.2(\ldots)$ Award 5/5	$AC = 27.9(5\ldots) \rightarrow BC = \pm 26.9(\ldots)$ Award 4/5 ✓✓✓✓✓2 ($\bullet^5$ is not available due to the negative length)
Method 2	$AD = 41.2(\ldots) \rightarrow BC = 40.5(5\ldots)$ Award 5/5	$AD = \pm 48.6(\ldots) \rightarrow BC = 41.0(\ldots)$ Award 3/5 ✓✓✓2✓✓2 ($\bullet^3$ and $\bullet^5$ are not available due to the negative length)

Commonly Observed Responses:

1. Method 2 leading to $\cos 12 = \frac{\mathbf{BD}}{25.5\ldots} \rightarrow 24.99$ — award 4/5 ✓✓✓✓✗

2. Method 2 leading to $\cos 12 = \frac{\mathbf{BC}}{25.5\ldots} \rightarrow 24.99$ — award 3/5 ✓✓✓✗✗

[END OF MARKING INSTRUCTIONS]