2014 Mathematics Paper 2

National 5

Finalised Marking Instructions

SQA

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.

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

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

(e) 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 is easier, candidates lose the opportunity to gain credit.

(f) Where transcription errors occur, candidates would normally lose the opportunity to gain a processing mark.

(g) 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.

(h) Where a candidate has made multiple attempts, mark all attempts and award the lowest mark.

(i) Unless specifically mentioned in the specific assessment guidelines, do not penalise:
- Working subsequent to a correct answer
- Correct working in the wrong part of a question
- Legitimate variations in solutions
- Bad form
- Repeated error within a question

Detailed Marking Instructions for each question

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
1.			**Ans: 590** •^{1} know how to decrease by 15% •^{2} know how to calculate roll •^{3} carry out calculations correctly within a valid strategy and round to the nearest ten	3	•^{1} $\times 0\cdot 85$ •^{2} $964 \times 0\cdot 85^3$ •^{3} 590

Notes:

1. For an answer of 590 without working   award 3/3   ✓✓✓

2. For an answer of 592 or 592·0165 without working   award 2/3   ✓✓✗

3. Where an incorrect percentage has been used, the working must be followed through to give the possibility of awarding 2/3   ✗✓✓

4. For an answer of 2460 $(964 \times 0\cdot 85 \times 3)$ with working,   award 1/3   ✓✗✗

5. For an answer of 530 $(964 - 964 \times 0\cdot 15 \times 3)$ with working,   award 1/3   ✓✗✗

6. For an answer of 430 $(964 \times 0\cdot 15 \times 3)$ award 0/3   ✗✗✗

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
2.			**Ans: B (8, 4, 10), C (4, 0, 10)** •^{1} state coordinates of B •^{2} state coordinates of C	2	•^{1} (8, 4, 10) •^{2} (4, 0, 10)

Notes:
1. For eg B(8, 4, 9) leading to C(4, 0, 9)   award 1/2 ✗✓
2. The maximum mark available is 1/2 where
    (a) brackets are omitted
    (b) answers are given in component form

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
3.	(a)		**Ans: $5a + 3c = 158 \cdot 25$** •¹ construct equation	1	 •¹ $5a + 3c = 158 \cdot 25$
Notes: **1.** Accept variables other than a and c.					
	(b)		**Ans: $3a + 2c = 98$** •¹ construct equation	1	 •¹ $3a + 2c = 98$
Notes:					

	(c)		**Ans: Adult ticket costs £22·50**
			        Child ticket costs £15·25
			
			•¹ evidence of scaling
			
			•² follow a valid strategy
			    through to produce values
			    for a and c
			
			•³ calculate correct values for
			    a and c
			
			•⁴ communicate answers in
			    money
				4	
					
					•¹ eg $\begin{array}{l} 10a + 6c = 316 \cdot 50 \\ 9a + 6c = 294 \end{array}$
					
					•² values for a and c
					
					•³ $a = 22 \cdot 5$ and $c = 15 \cdot 25$
					
					•⁴ Adult £22·50
					    Child £15·25

Notes:
1. The fourth mark may only be awarded when **all** of the following are given in the final
    answer: the words "adult" and "child", the £ signs and **both** amounts written with two
    decimal figures.					

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
4.	(a)	(i)	Ans: $\bar{x} = 56 \cdot 5$ •¹ calculate mean	1	•¹ $\bar{x} = 56 \cdot 5$

Notes:
1.   Do not accept 56·5 rounded to 57.

		(ii)	Ans: $s = 2 \cdot 4$ •¹ calculate $\left(x - \bar{x}\right)^2$ •² substitute into formula •³ calculate standard deviation	3	•¹ 0·25, 0·25, 2·25, 2·25, 12·25, 12·25 •² $\sqrt{\dfrac{29 \cdot 5}{5}}$ •³ 2·4(2….)

Notes:
1.   For use of alternative formula, award marks as follows:

•¹ calculate $\sum x$ and $\sum x^2$	•¹ 339, 19183
•² substitute into formula	•² $\sqrt{\dfrac{19183 - \dfrac{339^2}{6}}{5}}$
•³ calculate standard deviation	•³ 2·4(2….)

2.   For correct answer without working   award 0/3

	(b)		Ans: **No, standard deviation is greater** OR **No, times are more spread out** •¹ no, with valid explanation	1	•¹ e.g. No, standard deviation is greater

Notes:
1.   Answer must be consistent with answer to part (a)(ii).
2.   Accept "No, as 3·2 > 2·4"
3.   Only award the mark if it is clear that the reason is based on standard deviation **only**.
4.   Do not accept "No, times are less consistent" without further explanation.

Question	Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
5.	Ans: 3072 cm³ •¹ state linear scale factor •² state volume scale factor •³ calculate volume (calculation must involve a power of the scale factor) **and state correct units**	3	•¹ $\dfrac{24}{15}$ or 1·6 •² $\left(\dfrac{24}{15}\right)^3$ or $1\cdot6^3$ (= 4·096) •³ 3072cm³

Notes:
1. Some common answers
   (a) 3072   award 2/3 ✓✓✗

   (b) 1920cm³ ($\left(\dfrac{24}{15}\right)^2 \times 750$)   award 2/3 ✓✗✓

   (c) 1200cm³ ($\left(\dfrac{24}{15}\right) \times 750$)   award 1/3 ✓✗✗

   (d) 675000000cm³ ($\left(\dfrac{24}{15}\right) \times 750^3$)   award 1/3 ✓✗✗

   (e) 183cm³ ($\left(\dfrac{15}{24}\right)^3 \times 750$)   award 2/3 ✗✓✓

   (f) 933cm³ ($\left(\dfrac{15}{24}\right)^3 \times 750 + 750$)   award 2/3 ✗✓✓

2. The third mark is not available where premature rounding leads to an incorrect answer.
   eg 4·1 × 750 = 3075cm³   award 2/3 ✓✓✗

3. Alternative Method

   •¹ know how to find radius of smaller cylinder   •¹ $\sqrt{\dfrac{750}{15\pi}}$

   •² know how to find radius of larger cylinder   •² $\left(\dfrac{24}{15}\right) \times \sqrt{\dfrac{750}{15\pi}}$

   •³ calculate volume **and state correct units**   •³ 3072cm³

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
6.			**Ans: no, with valid reason.** •[1] valid strategy •[2] evaluation •[3] comparison •[4] valid conclusion	4	•[1] use Converse of Pythagoras' Theorem eg 110^2 and $85^2 + 75^2$ •[2] 12 100 and 12 850 •[3] e.g. $110^2 \neq 75^2 + 85^2$ •[4] No, since not right angled

Notes:
1. For alternative methods, award marks as follows:

    (i) •[1] valid strategy   •[1] use Pythagoras' Theorem
                                                eg $85^2 + 75^2$

        •[2] evaluation   •[2] h = 113·36

        •[3] comparison   •[3] e.g. $113·36 > 110$

        •[4] valid conclusion   •[4] No, since not right angled

    (ii) •[1] valid strategy   •[1] substitute correctly into cosine
                                             rule
                                         eg $\dfrac{85^2 + 75^2 - 110^2}{2 \times 85 \times 75}$

        •[2] evaluation   •[2] 86·6°

        •[3] comparison   •[3] $86·6° < 90°$

        •[4] valid conclusion   •[4] No, since not right angled

2. There must be an explicit comparison for the award of the third mark.
    eg $\sqrt{85^2 + 75^2} = 113·36$.
        No, since not right angled.   award 3/4 ✓✓×✓

3. Conclusion **must** involve reference to "not a right angle".
    eg $110^2 = 85^2 + 75^2 \rightarrow 12100 \neq 12850$.
        No, Hightown is not due north of Lowtown.   award 3/4 ✓✓✓×

4. The final mark is not available where the candidate's only conclusion is an invalid
    statement involving the word bearing.
    eg "No, Hightown is on a bearing of 87° from Lowtown, not 90°"

Question	Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
7.	**Ans: 150 cm^3**	**5**	
	•^{1} substitute correctly into formula for volume of cone		•^{1} $\dfrac{1}{3}\times\pi\times4^2\times15$ $(=251{\cdot}32....)$
	•^{2} substitute correctly into formula for volume of sphere **or** hemisphere		•^{2} $\dfrac{4}{3}\times\pi\times3{\cdot}7^3$ $(=212{\cdot}17....)$ or $\dfrac{1}{2}\times\dfrac{4}{3}\times\pi\times3{\cdot}7^3$ $(=106{\cdot}08....)$
	•^{3} know to subtract volume of **hemisphere** from volume of cone		•^{3} evidence
	•^{4} carry out all calculations correctly (must involve difference or sum of two volume calculations)		•^{4} $145{\cdot}24....$
	•^{5} round **final answer** to 2 significant figures		•^{5} 150 (cm^3)

Notes:

1. Accept variations in π.

2. Some common answers (working must be shown):

   (i) $39\ (\dfrac{1}{3}\times\pi\times4^2\times15-\dfrac{4}{3}\times\pi\times3{\cdot}7^3\,)$ award 4/5   ✓✓✗✓✓

   (ii) $120\ (\dfrac{1}{3}\times\pi\times4^2\times15-\dfrac{1}{2}\times\dfrac{4}{3}\times\pi\times4^3\,)$ award 4/5   ✓✗✓✓✓

   (iii) $110\ (\dfrac{1}{3}\times\pi\times3{\cdot}7^2\times15-\dfrac{1}{2}\times\dfrac{4}{3}\times\pi\times3{\cdot}7^3\,)$ award 4/5   ✗✓✓✓✓

   (iv) $160\ (\dfrac{1}{3}\times\pi\times8^2\times15-\dfrac{1}{2}\times\dfrac{4}{3}\times\pi\times7{\cdot}4^3\,)$ award 4/5   ✗✓✓✓✓

   (v) $360\ (\dfrac{1}{3}\times\pi\times4^2\times15+\dfrac{1}{2}\times\dfrac{4}{3}\times\pi\times3{\cdot}7^3\,)$ award 4/5   ✓✓✗✓✓

   (vi) $460\ (\dfrac{1}{3}\times\pi\times4^2\times15+\dfrac{4}{3}\times\pi\times3{\cdot}7^3\,)$ award 4/5   ✓✓✗✓✓

   (vii) $80\ (\dfrac{1}{3}\times\pi\times3{\cdot}7^2\times15-\dfrac{1}{2}\times\dfrac{4}{3}\times\pi\times4^3\,)$ award 3/5   ✗✗✓✓✓

   (viii) $250\ (\dfrac{1}{3}\times\pi\times4^2\times15\,)$ award 2/5   ✓✗✗✗✓

3. The final mark is only available where answers to all intermediate steps involve at least three significant figures.

   eg $251{\cdot}32-106{\cdot}08=250-110=140$ award 4/5   ✓✓✓✓✗

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
8.			Ans: $5n^4$	3	
			•¹ simplify powers in numerator		•¹ $10n^6$
			•² cancel constants		•² $\dfrac{5n^6}{n^2}$
			•³ eliminate n from denominator		•³ $5n^4$

Notes:

1. For $5n^4$ without working   award 3/3

2. For a final answer of $\dfrac{5n^4}{1}$ award 2/3   ✓×✓

3. For an answer of $5n^3$

    (a) (i) $\dfrac{10n^5}{2n^2}=5n^3$ award 2/3   ×✓✓

        (ii) $\dfrac{10n^6}{2n^2}=5n^3$ award 2/3   ✓✓×

    (b) (i) $\dfrac{n^4\times 10}{2n}=\dfrac{n^4\times 10}{2}=5n^3$ award 1/3   ✓×✓

        (ii) $5n^3$ without working   award 1/3

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
9.			Ans: $\dfrac{4x-15}{x(x+5)}$	3	
			•¹ correct common denominator (or correct numerator)		•¹ $x(x+5)$ or $7x-3(x+5)$
			•² consistent numerator (or denominator)		•² $\dfrac{7x-3(x+5)}{x(x+5)}$
			•³ simplify		•³ $\dfrac{4x-15}{x(x+5)}$

Notes:

1. Correct answer without working   award 3/3

2. For $\dfrac{7x}{x(x+5)}-\dfrac{3(x+5)}{x(x+5)}$ award 2/3   ✓✓×

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

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
10.	(a)		**Ans: 84·8°** •¹ substitute correctly into cosine rule •² calculate cos B correctly •³ calculate angle ABC correctly	3	•¹ $\cos B = \dfrac{8^2 + 11^2 - 13^2}{2 \times 8 \times 11}$ •² cos B = 0·09……. •³ 85 or 84·8…….
Notes:					
1. For 1·48 (uses RAD) or 94·2 (uses GRAD), with working award 3/3					
2. The 2nd mark can be awarded for $\cos^{-1}\left(\dfrac{16}{176}\right)$					
	(b)		**Ans: 155·2°** •¹ know how to calculate the angle •² correctly calculate the angle within a valid strategy	2	•¹ 360 − 120 − [answer to (a)] or equivalent •² 155·2
Notes:					

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
11.			**Ans:** $a = \dfrac{2(s - ut)}{t^2}$ •¹ subtract ut •² multiply by 2 •³ divide by t^2	3	•¹ $s - ut = \dfrac{1}{2}at^2$ •² $2(s - ut) = at^2$ •³ $a = \dfrac{2(s - ut)}{t^2}$
Notes:					
1. Correct answer without working award 3/3					
2. For subsequent incorrect working, the final mark is not available.					
3. For $a = \dfrac{s - ut}{\frac{1}{2}t^2}$ award 2/3					

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
12.			**Ans: $x° = 63°, 297°$** •^{1} rearrange equation •^{2} find one value of x •^{3} find another value of x	3	•^{1} $\cos x = \dfrac{5}{11}$ •^{2} $x = 63$ •^{3} $x = 297$

Notes:
1. The 2nd angle must be consistent with the first angle.
2. For $x = 1\cdot1, 358\cdot9$ (uses RAD), award 3/3 (with working), award 2/3 (without working)
3. For $x = 70, 290$ (uses GRAD), award 3/3 (with working), award 2/3 (without working)

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
13.			**Ans: $151\cdot3$ m^2** •^{1} know how to find area of segment •^{2} know to express sector as a fraction of a circle •^{3} know how to find area of sector •^{4} know how to calculate area of triangle •^{5} carry out all calculations correctly within a valid strategy	5	•^{1} evidence of e.g. major sector + triangle or circle − minor sector + triangle •^{2} $\dfrac{310}{360}$ or $\dfrac{50}{360}$ •^{3} $\dfrac{310}{360} \times \pi \times 7^2$ (= 132·56) or $\dfrac{50}{360} \times \pi \times 7^2$ (= 21·38) •^{4} $\dfrac{1}{2} \times 7 \times 7 \times \sin 50$ (=18·77) •^{5} 151·3 m^2

Notes for question 13 are on next page.

Question	Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •

Notes:

1. Accept variations in π; disregard premature or incorrect rounding of $\dfrac{310}{360}$ or $\dfrac{50}{360}$.

2. Use of RAD or GRAD (working must be shown)
   (a) For 149·9 [uses GRAD]   award 5/5
   (b) Where the use of RAD leads to an answer of 126·1($-$6·43+132·56)
       or 139·0(6·43+132·56)   award 4/5

3. **Some common answers** (working must be shown):

   $56\cdot6 \left(\dfrac{310}{360} \times \pi \times 14 + \dfrac{1}{2} \times 7 \times 7 \times \sin 50^\circ \right)$ award 4/5   ✓✓✗✓✓

   $40\cdot1 \left(\dfrac{50}{360} \times \pi \times 7^2 + \dfrac{1}{2} \times 7 \times 7 \times \sin 50^\circ \right)$ award 4/5   ✗✓✓✓✓

   $2\cdot6 \left(\dfrac{50}{360} \times \pi \times 7^2 - \dfrac{1}{2} \times 7 \times 7 \times \sin 50^\circ \right)$ award 4/5   ✗✓✓✓✓

   $24\cdot9 \left(\dfrac{50}{360} \times \pi \times 14 + \dfrac{1}{2} \times 7 \times 7 \times \sin 50^\circ \right)$ award 3/5   ✗✓✗✓✓

   $132\cdot6 \left(\dfrac{310}{360} \times \pi \times 7^2 \right)$ award 2/5   ✗✓✓✗✗

   $21\cdot4 \left(\dfrac{50}{360} \times \pi \times 7^2 \right)$ award 2/5   ✗✓✓✗✗

   $18\cdot8 \left(\dfrac{1}{2} \times 7 \times 7 \times \sin 50^\circ \right)$ award 1/5   ✗✗✗✓✗

   $153\cdot9 \left(\pi \times 7^2 \right)$ award 0/5

4. The fifth mark is only available when the area of triangle MON is calculated using trigonometry.

[END OF MARKING INSTRUCTIONS]