National
Qualifications
2015

2015 Mathematics

National 5 Paper 2

Finalised Marking Instructions

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

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

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

(h) Scored out or erased working which has not been replaced should be marked where still legible. However, if the scored out or erased working has been replaced, only the work which has not been scored out should be judged.

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

(j) 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: £253 628 (·16)** •[1] know how to increase by 2·8% •[2] know how to calculate expected turnover •[3] carry out calculations correctly within a valid strategy	**3**	 •[1] × 1·028 •[2] 240 000 x $1{\cdot}028^2$ •[3] 253 628 (·16)

Notes:

1. For an answer of 253 628 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 an answer of 393 216 (240 000 x $1{\cdot}28^2$), with working award 2/3
3. For an answer of 246 720 (240 000 x 1·028), no working necessary award 1/3
4. For an answer of 493 440 (240 000 x 1·028 x 2), with working award 1/3
5. For an answer of 253 440 (240 000 + 240 000 x 0·028 x 2), with working award 1/3
6. For an answer of 13 440 (240 000 x 0·028 x 2) 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:** $a = 7$ •[1] valid strategy •[2] state value of a	**2**	 •[1] $3a+2=23$ or $3\times 7+2(=23)$ •[2] 7

Notes:

1. Correct answer without working award 2/2
2. Accept $x = 7$ award 2/2
3. For an answer of $3\times 23+2=71$ award 0/2

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
3.			**Ans: 0·78 km** •[1] correct substitution into cosine rule •[2] evaluate AB^2 •[3] calculate AB	**3**	 •[1] $1{\cdot}35^2 + 1{\cdot}2^2 - 2 \times 1{\cdot}35 \times 1{\cdot}2 \times \cos 35^\circ$ •[2] 0·608….. •[3] 0·78

Notes:

1. For 0·8 with valid working award 3/3
2. Disregard errors due to premature rounding provided there is evidence
   e.g. $1{\cdot}35^2 + 1{\cdot}2^2 - 2 \times 1{\cdot}35 \times 1{\cdot}2 \times 0{\cdot}8 = 0{\cdot}6705 \Rightarrow$ final answer = 0·82 award 3/3
3. Correct answer without working award 0/3
4. For 2·49 (uses RAD) or 0·71 (uses GRAD), with working award 3/3

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
4.			•**Ans: 23** •[1] start process •[2] solution	**2**	 •[1] $6^2 + (-13)^2 + 18^2$ •[2] 23

Notes:

1. Correct answer without working award 2/2
2. For $13{\cdot}8$……(e.g. $\sqrt{6^2 - 13^2 + 18^2}$) , no working necessary, award 1/2

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
5.			**Ans:** $\begin{pmatrix} -1 \\ -2 \end{pmatrix}$ • [1] state components of either vector **p** **or** vector **q** • [2] state components of vector **p** **and** vector **q** **and** vector **p** + **q**	**2**	• [1] $\begin{pmatrix} -5 \\ 3 \end{pmatrix}$ or $\begin{pmatrix} 4 \\ -5 \end{pmatrix}$ • [2] $\begin{pmatrix} -1 \\ -2 \end{pmatrix}$

Notes:

1. Alternative method:

• [1] correct nose to tail diagram (must include arrows)
• [2] state components of vector **p** + **q**

2. Correct answer without working award 2/2

3. Special cases (working must be shown)

(a) $\begin{pmatrix} 5 \\ -3 \end{pmatrix} + \begin{pmatrix} -4 \\ 5 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ award 1/2 ×✓

(b) $\begin{pmatrix} 3 \\ -5 \end{pmatrix} + \begin{pmatrix} -5 \\ 4 \end{pmatrix} = \begin{pmatrix} -2 \\ -1 \end{pmatrix}$ award 1/2 ×✓

4. For $(-1, -2)$ award 1/2

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
6.	(a)		**Ans: $1{\cdot}1\times10^{12}\,\text{km}^3$** • [1] substitute radius into volume of a sphere formula • [2] evaluate volume • [3] round volume to 2 significant figures	**3**	• [1] $V=\frac{4}{3}\times\pi\times(6400)^3$ • [2] 1·098… x 10^{12} • [3] $1{\cdot}1\times10^{12}$

Notes:

1. Accept variations in π

2. Some answers (without working)
   - (a) $1{\cdot}1\times10^{12}$ award 3/3
   - (b) $1{\cdot}10\times10^{12}$ (2 d.p.) award 2/3 ✓✓×
   - (c) $1{\cdot}0\times10^{12}$ award 0/3

3. Some answers (working must be shown)
   - (a) $\frac{4}{3}\times\pi\times(6400)^2=1{\cdot}71.....\times10^8=1{\cdot}7\times10^8$ award 2/3 ×✓✓
   - (b) $\frac{4}{3}\times\pi\times6400=2{\cdot}68.....\times10^4=2{\cdot}7\times10^4$ award 1/3 ××✓

	(b)		**Ans: 50 times bigger** • [1] know to divide earth volume by moon volume • [2] divide correctly	**2**	• [1] $\frac{1{\cdot}1\times10^{12}}{2{\cdot}2\times10^{10}}$ • [2] 50

Notes:

1. Correct answer without working award 2/2
2. $\frac{1{\cdot}098.....\times10^{12}}{2{\cdot}2\times10^{10}}=49{\cdot}9.....,50\text{ or }49$ award 2/2

Question	Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
7.	**Ans: $10s$** •[1] know how to start division calculation •[2] continue process •[3] express in simplest form	**3**	 •[1] $\frac{5t}{s}\times\frac{2s^2}{t}$ or equivalent •[2] evidence of correctly cancelling either variable or $\frac{10ts^2}{st}$ •[3] $10s$

Notes:

1. Correct answer without working award 3/3
2. For $\frac{10s}{1}$ award 2/3 ✓✓×

Question	Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
8.	**Ans: £350** •[1] know that 85% = £297·50 •[2] begin valid strategy •[3] answer	**3**	 •[1] 85% = 297·50 •[2] 1% = $\frac{297\cdot50}{85}$ (=3·5) •[3] 100% = $\frac{297\cdot50}{85}\times100$ = 350

Notes:

1. For 350 with or without working award 3/3

2. For 252·88 (85% of 297·50) or 342·13 (115% of 297·50)
   (i) and evidence of 85% = 297·50 award 1/3 ✓××
   (ii) otherwise award 0/3

3. For 115% = 297·50 → 258·70 award 2/3 ×✓✓

4. For subsequent incorrect working, the final mark is not available
   e.g. 350 + 297·50 = 647·50 award 2/3 ✓✓×

Question	Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
9.	**Ans: 225 cm^2**	**4**	
	•^{1} linear scale factor		•^{1} $\frac{30}{24}$
	•^{2} know how to find area of triangle PRS		•^{2} $\left(\frac{30}{24}\right)^2 \times 400$
	•^{3} find area of triangle PRS		•^{3} 625
	•^{4} find area of quadrilateral PQTS		•^{4} 225

Notes:

1. (a) $\frac{30}{24} \times 400 = 500$ award 1/4 ✓×××

   (b) $\frac{30}{24} \times 400 - 400 = 100$ award 2/4 ✓××✓

   (c) $\left(\frac{30}{24}\right)^3 \times 400 - 400 = 381 \times 25$ award 3/4 ✓×✓✓

2. Where premature rounding leads to an inaccurate answer the third mark is not available

   e.g. $\frac{30}{24} = 1{\cdot}25 \Rightarrow 1{\cdot}3^2 \times 400 = 676 \rightarrow 276$ award 3/4 ✓✓×✓

3. The fourth mark is not available where area of triangle PRS is less than 400

   e.g. $\left(\frac{24}{30}\right)^2 \times 400 = 256$ award 2/4 ×✓✓×

4. Where candidate assumes that triangles are right-angled the maximum available mark is 3/4 ×✓✓✓ (but see note 2 above)

   •^{2} $QR = \frac{400}{\frac{1}{2} \times 24} = 33\frac{1}{3} \rightarrow PR = \frac{30}{24} \times 33\frac{1}{3} = 41\frac{2}{3}$

   •^{3} area of $PRS = \frac{1}{2} \times 41\frac{2}{3} \times 30 = 625$

   •^{4} area of $PQTS = 225$

5. Correct answer without working award 3/4

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
10.			**Ans: 25cm** •[1] correct fraction of circle •[2] construct equation •[3] know how to solve equation •[4] solve equation **and** calculate length of the pendulum	**4**	•[1] $\frac{65}{360}$ •[2] e.g. $\frac{65}{360}\times\pi\times d = 28\cdot4$ •[3] e.g. $d = \frac{28\cdot4}{\frac{65}{360}\times\pi}$ •[4] 25

Notes:

1. Accept variations in π.
2. Accept 0·57 as evidence of $\frac{65}{360}\times\pi$ in awarding 2nd and 3rd marks
3. Disregard errors due to premature rounding provided there is evidence.
   e.g. $d = \frac{28\cdot4}{0\cdot57} = 49\cdot8 \rightarrow 24\cdot9$ award 4/4
4. $\frac{65}{360}\times\pi\times r^2 = 28\cdot4 \rightarrow 7\cdot07\ldots, 7\cdot1$ or 7 award 3/4 ✓×✓✓
5. For the award of the 4th mark, the calculation must include 28·4, a fraction (e.g. $\frac{65}{360}$ or 0·18…) and a division by π
6. Correct answer without working award 0/4

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
11.			**Ans: 1039·2 cm²**	**4**	
			•[1] correct angle		•[1] 60
			•[2] correct substitution into area of triangle formula		•[2] $\frac{1}{2}\times 20\times 20\times \sin 60$
			•[3] know how to find area of hexagon		•[3] $\left(\frac{1}{2}\times 20\times 20\times \sin 60\right)\times 6$
			•[4] correct calculation **and correct units**		•[4] 1039·2 cm²

Notes:

1. Correct units must be given in the **final answer** for the award of the 4th mark.

2. Disregard errors due to premature rounding provided there is evidence.

   e.g. sin60 = 0·87 $\Rightarrow \left(\frac{1}{2}\times 20\times 20\times 0\cdot 87\right)\times 6$ = 1044 cm² award 4/4

3. Some common answers:

   (a) $\left(\frac{1}{2}\times 40\times 40\times \sin 60\right)\times 6 = 4156\cdot 9\text{cm}^2$ award 3/4 ✓×✓✓

   (b) $\frac{1}{2}\times 40\times 40\times \sin 60 = 692\cdot 8\text{cm}^2$ award 1/4 ✓×××

   (c) $\left(\frac{1}{2}\times 20\times 20\right)\times 6 = 1200\text{cm}^2$ award 1/4 ××✓×

4. Use of GRAD or RAD (working must be shown)
   (a) For 970·8cm² [uses GRAD] award 4/4
   (b) For $-365\cdot 8\text{cm}^2$ or $365\cdot 8\text{cm}^2$ [uses RAD] award 3/4

5. Correct answer without working award 4/4

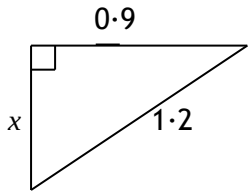
6. Alternative strategy (using $\frac{1}{2}bh$ to find area of triangle).
   Award the marks as follows:

   •[1] correct length of side of hexagon •[1] 20

   •[2] correct substitution into area of triangle formula •[2] $\frac{1}{2}\times 20\times \sqrt{20^2-10^2}$

   •[3] know how to find area of hexagon •[3] $(\frac{1}{2}\times 20\times \sqrt{20^2-10^2})\times 6$

   •[4] correct calculation and correct units •[4] 1039·2 cm²

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
12.			**Ans: 1·99 metres** •[1] marshal facts and recognize right-angle •[2] correct Pythagoras statement •[3] correct calculation of x •[4] find depth of milk	**4**	•[1]  •[2] $x^2 = 1\cdot 2^2 - 0\cdot 9^2 \ \ (= 0\cdot 63)$ •[3] $0\cdot 79$..... •[4] 1×99

Notes:

1. $x = 0\cdot 8$ and depth = 2 are acceptable in awarding the third and fourth marks
2. The final mark is for adding 1·2 to a value which has been calculated
3. In the absence of a diagram accept $x^2 = 1\cdot 2^2 - 0\cdot 9^2$ as evidence for the award of the first 2 marks
4. For $x^2 = 1\cdot 2^2 + 0\cdot 9^2 \rightarrow x = 1\cdot 5 \rightarrow$ depth = $2\cdot 7$
   (a) with correct diagram award 3/4 ✓×✓✓
   (b) without diagram award 2/4 ××✓✓
5. Where a candidate assumes angle MLO = angle OML = 45°, only the 1st and 4th marks are available
6. For an answer of 1·99 without working award 0/4

Question	Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
13.	**Ans: 23·8 kilometres**	**4**	
	•[1] calculate the size of angle PQR		•[1] 52
	•[2] correct substitution into sine rule		•[2] $\frac{q}{\sin 52} = \frac{25}{\sin 56}$
	•[3] know how to solve equation		•[3] $q = \frac{25\sin 52}{\sin 56}$
	•[4] calculate PR correctly		•[4] 23·8

Notes:

1. Disregard errors due to premature rounding provided there is evidence
2. Where incorrect sizes are used for angles, marks 3 and 4 are still available for rearranging and processing a sine rule calculation

   e.g. $\frac{25}{\sin 160} = \frac{q}{\sin 128} \rightarrow q = 57\cdot 6$ award 2/4 ××✓✓

3. For a correct answer without working award 0/4

4. For $\frac{q}{52} = \frac{25}{56} \rightarrow q = 23\cdot 2\ldots\ldots$ award 1/4 ✓×××

5. Use of GRAD or RAD (working must be shown)
   (a) For 23·7 [uses GRAD] award 4/4
   (b) For −47·3 or 47·3 [uses RAD] award 3/4

Question			Expected Answer(s) Give one mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
14.	(a)	(i)	**Ans:** $2x+13$ •[1] correct expression	**1**	 •[1] $2x+13$
		(ii)	**Ans:** $4x^2+44x+117=270$ $\Rightarrow 4x^2+44x-153=0$ •[1] find expression for area of card and expand pair of brackets •[2] construct equation and rearrange into required form	**2**	 •[1] $(2x+13)(2x+9)=4x^2+44x+117$ •[2] $4x^2+44x+117=270$ $\Rightarrow 4x^2+44x-153=0$
Notes: 1. If solution to (a)(ii) appears in (b) then both marks are available					
	(b)		**Ans:** $x=2\cdot 8$ **cm** •[1] correct substitution into quadratic formula •[2] evaluate discriminant •[3] solve for x •[4] select positive value of x, correctly stated to 1 decimal place	**4**	 •[1] $x=\dfrac{-44\pm\sqrt{44^2-4\times 4\times(-153)}}{2\times 4}$ •[2] $x=\dfrac{-44\pm\sqrt{4384}}{2\times 4}$ (stated or implied by •[3]) •[3] $x=2\cdot 77\ldots$ and $-13\cdot 77\ldots.$ •[4] $x=2\cdot 8$
Notes: 1. If solution to (b) appears in a(ii) then all four marks are available. However, if a different value for x is stated in (b) then the fourth mark is not available. (General Marking Principle **(i)** should not be applied in this special case.) 2. Where b^2-4ac is calculated incorrectly, the third and fourth marks are only available if $b^2-4ac>0$. 3. Where a, b and c are all positive the second mark is not available. 4. Correct answer without working award 0/4					

[END OF MARKING INSTRUCTIONS]