National
Qualifications
2018

2018 Applications of Mathematics

National 5 - Paper 1

Finalised Marking Instructions

General marking principles for National Applications of 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.

This is no longer a solution of a quadratic equation, so the mark is not awarded.

$$x^2+5x+7=9x+4$$
$$x-4x+3=0$$
$$x=1$$

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.

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

(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:

	$\bullet^5$	$\bullet^6$
$\bullet^5$	$x=2$	$x=-4$
$\bullet^6$	$y=5$	$y=-7$

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 $y=-7$

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.

Detailed marking instructions for each question

Question			Generic scheme	Illustrative scheme	Max mark
1.			•[1] Process: calculate 3% of 400 •[2] Process: calculate max and min •[3] Process: calculate fraction that will be rejected	•[1] 12 •[2] 412 and 388 •[3] $\frac{4}{13}$ cakes will be rejected	**3**

Notes:

1. Correct answer with no working award 3/3
2. Incorrect answer with no working award 0/3
3. •[1] can be implied by subsequent working
4. Where answer is incorrect, •[3] can be awarded if there is evidence of where the fraction has come from

Commonly Observed Responses:

1. 403 and 397 leading to an answer of $\frac{11}{13}$ — award 2/3 × ✓ ✓

Question			Generic scheme	Illustrative scheme	Max mark
2.			•[1] Process: calculate cost of city break •[2] Strategy/process: know how to find number of weeks •[3] Process/communication: find number of weeks	•[1] $270+90\times4+450+30=1110$ •[2] Evidence of dividing cost by 50 or other appropriate strategy •[3] 23	**3**

Notes:

1. •[2] is only available for a relevant calculation involving 50

2. •[3] not available for error in calculation eg $1110\div50=22\cdot1$ leading to 23

Commonly Observed Responses:

1. $270+90+450+30=840\rightarrow\mathbf{16\cdot8}$ leading to 17 — award 2/3 × ✓ ✓

<table>
<tr><th colspan="3">Question</th><th>Generic scheme</th><th>Illustrative scheme</th><th>Max mark</th></tr>
<tr><td>3.</td><td>(a)</td><td></td><td>•1 Communication: 4 points correct

•2 Communication: all 8 points correct</td><td>•1 Evidence

•2 Evidence</td><td>2</td></tr>
<tr><td colspan="6">Notes:
<table>
<tr><td>H</td><td>99</td><td>104</td><td>104</td><td>107</td><td>120</td><td>124</td><td>127</td><td>130</td></tr>
<tr><td>W</td><td>17</td><td>18</td><td>19</td><td>19</td><td>24</td><td>22</td><td>25</td><td>24</td></tr>
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<tr><td colspan="6">Commonly Observed Responses:</td></tr>
<tr><td></td><td>(b)</td><td></td><td>•3 Communication: consistent line of best fit</td><td>•3 Evidence</td><td>1</td></tr>
<tr><td colspan="6">Notes:</td></tr>
<tr><td colspan="6">Commonly Observed Responses:</td></tr>
<tr><td></td><td>(c)</td><td></td><td>•4 Communication: answer consistent with line of best fit</td><td>•4 Evidence</td><td>1</td></tr>
<tr><td colspan="6">Notes:

1. When the height falls between 2 whole numbers accept either number or any value in between</td></tr>
<tr><td colspan="6">Commonly Observed Responses:</td></tr>
<tr><td>4.</td><td></td><td></td><td>•1 Process: calculate new temperature

•2 Communication: mark temperature on Celsius scale</td><td>•1 -28

•2 Evidence</td><td>2</td></tr>
<tr><td colspan="6">Notes:

1. Correct temperature marked with no working — award 2/2
2. Where a candidate writes 28 then marks -28 on the gauge — award 2/2</td></tr>
<tr><td colspan="6">Commonly Observed Responses:

1. 6°C on correct scale — award 1/2 × ✓
2. 28°C on correct scale — award 1/2 × ✓
3. 34°C on correct scale — award 0/2 ×</td></tr>
</table>

Question			Generic scheme	Illustrative scheme	Max mark
5.			•[1] Strategy: know how to add fractions •[2] Process: add fractions •[3] Process: calculate fraction who had vegetarian option	•[1] evidence of attempt to change both fractions to a valid common denominator •[2] $\frac{3}{7}+\frac{1}{3}=\frac{9}{21}+\frac{7}{21}=\frac{16}{21}$ •[3] $\frac{5}{21}$	3
			Alternative Strategy •[1] Strategy: know how to convert a fraction to a decimal •[2] Process: add decimals •[3] Process: calculate decimal who had vegetarian option	•[1] evidence of numerator divided by denominator •[2] $0{\cdot}333\ldots+0{\cdot}428\ldots=0{\cdot}761\ldots$ •[3] 0·239 or 0·238	3

Notes:

1. •[2] only available for answer of $\frac{16}{21}$, 0·7610… or equivalent
2. The final answer does not need to be in its simplest form
3. Candidates working in decimals must work to at least 3 decimal places for •[2] to be awarded
4. Candidates working in percentages must work to at least 1 decimal place for •[2] to be awarded

Commonly Observed Responses:

1. 23·9% or 23·8% — award 3/3 ✓ ✓ ✓
2. $\frac{3}{7}+\frac{1}{3}=\frac{4}{10}$ leading to an answer of $\frac{6}{10}$ — award 1/3 × × ✓

Question			Generic scheme	Illustrative scheme	Max mark
6.			•[1] Strategy: know correct order of operations •[2] Process/communication: complete calculation and state conclusion	•[1] evidence •[2] 18·1 and consistent conclusion	2

Notes:

Commonly Observed Responses:

1. $(27{\cdot}2-4{\cdot}6)\times 3+4{\cdot}7=72{\cdot}5$ no he is incorrect — award 1/2 × ✓
2. $27{\cdot}2-(4{\cdot}6\times 3+4{\cdot}7)=8{\cdot}7$ yes he is correct — award 1/2 × ✓
3. $(27{\cdot}2-4{\cdot}6+4{\cdot}7)\times 3=81{\cdot}9$ no he is incorrect — award 1/2 × ✓
4. $(27{\cdot}2-4{\cdot}6)\times(3+4{\cdot}7)=174{\cdot}02$ no he is incorrect — award 1/2 × ✓

Question			Generic scheme	Illustrative scheme	Max mark
7.	(a)		•[1] Process: calculate amount of Bolivian boliviano	•[1] $750 \times 9 = 6750$	1
Notes: 1. Accept £6750					
Commonly Observed Responses:					
	(b)		•[2] Strategy/process: calculate amount of Bolivian boliviano left and convert back to pounds •[3] Process: calculate Argentine peso	•[2] $(6750 - 2700) \div 9 = 450$ •[3] $450 \times 20 = 9000$	2
Notes: 1. When the answer to •[2] is not a whole number of pounds, it must be rounded or truncated to at least 2 decimal places 2. For •[3] accept any correct rounding or truncation to an accuracy of at least the nearest 10 peso					
Commonly Observed Responses:					
8.			•[1] Strategy: know to calculate the sale price in two stages •[2] Process: calculate 75% of the price •[3] Process: calculate final price	•[1] evidence •[2] 525 •[3] 498·75	3
Notes:					
Commonly Observed Responses: 1. 70% of 700 = 490 award 1/3 ✗ ✗ ✓					

<table>
<tr><th colspan="3">Question</th><th>Generic scheme</th><th>Illustrative scheme</th><th>Max mark</th></tr>
<tr><td>9.</td><td></td><td></td><td>•1 Strategy/process: know how to deal with flight time

•2 Strategy: know how to deal with time difference

•3 Process: calculate stop time</td><td>•1 11:10pm or equivalent

•2 eg 11:10 + 8 = 7:10am
or
8:50 − 8 = 00:50am
or equivalent

•3 1 hour 40 minutes</td><td>3</td></tr>
<tr><td colspan="6">Notes:

1. Correct answer with no working — award 3/3</td></tr>
<tr><td colspan="6">Commonly Observed Responses:

1. 17 hours and 40 minutes with relevant working — award 2/3 ✓ × ✓
2. 9 hours and 40 minutes with relevant working — award 2/3 ✓ × ✓</td></tr>
<tr><td>10.</td><td>(a)</td><td></td><td>•1 Process: find 80% of 35</td><td>•1 28</td><td>1</td></tr>
<tr><td colspan="6">Notes:</td></tr>
<tr><td colspan="6">Commonly Observed Responses:</td></tr>
<tr><td></td><td>(b)</td><td></td><td>•2 Strategy/process: calculate overall percentage</td><td>•2 67</td><td>1</td></tr>
<tr><td colspan="6">Notes:</td></tr>
<tr><td colspan="6">Commonly Observed Responses:</td></tr>
</table>

Question			Generic scheme	Illustrative scheme	Max mark
11.			•[1] Strategy: know how to find perimeter •[2] Process: calculate semi circles •[3] Strategy/process: calculate total length of ribbon needed	•[1] evidence of $3{\cdot}14 \times 20 + 34 + 34$ •[2] $3{\cdot}14 \times 20 = 62{\cdot}8$ •[3] $62{\cdot}8 + 34 + 34 + 2{\cdot}8 = 133{\cdot}6$	3

Notes:

1. •[2] is only available for a calculation involving 3·14
2. •[3] is only available for adding 2·8 to a previously calculated perimeter
3. Where a candidate considers area of part of the shape instead of perimeter, only •[2] is available

Commonly Observed Responses:

1. For $3{\cdot}14 \times 10 + 34 + 34 + 2{\cdot}8$ leading to a final answer of 102·2 award 2/3 ✗ ✓ ✓
2. For $3{\cdot}14 \times 40 + 34 + 34 + 2{\cdot}8$ leading to a final answer of 196·4 award 2/3 ✗ ✓ ✓
3. For $3{\cdot}14 \times 20 + 34 + 34$ leading to a final answer of 130·8 award 2/3 ✓ ✓ ✗
4. For $3{\cdot}14 \times 10^2 + 34 + 34 + 2{\cdot}8$ leading to a final answer of 384·8 award 1/3 ✗ ✓ ✗
5. For $3{\cdot}14 \times 10^2 + 20 \times 27{\cdot}5 + 2{\cdot}8$ leading to a final answer of 866·8 award 1/3 ✗ ✓ ✗
6. For $3{\cdot}14 \times 10^2 + 20 \times 27{\cdot}5$ leading to a final answer of 864 award 1/3 ✗ ✓ ✗

Question			Generic scheme	Illustrative scheme	Max mark
12.	(a)		•[1] Process: calculate scale distances	•[1] $82 \div 10$ rep by 8·2 cm $46 \div 10$ rep by 4·6 cm	**3**
			•[2] Process/communication: correct bearing measured and correct length drawn	•[2] Bearing of 042° (±1°) measured correctly and 8·2 cm (±0·1 cm) correctly drawn	
			•[3] Process/communication: correct bearing measured and correct length drawn	•[3] Bearing of 194° (±1°) measured correctly and 4·6 cm (±0·1 cm) correctly drawn	
Notes: 1. •[2] alternatively available for 2 correct lengths drawn 2. •[3] alternatively available for 2 correct angles measured 3. •[1] can be implied by drawing 2 lines of the correct length					
Commonly Observed Responses:					
	(b)		•[4] Process: bearing consistent with diagram	•[4] evidence	**2**
			•[5] Process: distance consistent with diagram	•[5] evidence	
Notes: 1. The third leg of the journey need not actually be drawn					
Commonly Observed Responses:					
13.			•[1] Strategy: substitute correctly into Pythagoras' Theorem	•[1] $h^2 = 10^2 - 6^2$	**3**
			•[2] Process: calculate height	•[2] 8	
			•[3] Process: calculate area	•[3] $8 \times 12 \div 2 = 48$	

Notes:

1. Correct answer with no working award 3/3
2. 8 with no working •[1] and •[2] can be awarded
3. •[3] is only available for using a height

Commonly Observed Responses:

1. $\frac{1}{2}\times 12\times 10$ leading to an answer of 60 award 0/3 ✗ ✗ ✗

Question			Generic scheme	Illustrative scheme	Max mark
14.			•[1] Strategy/process: know to find total number of combinations •[2] Process: find the number of combinations less than 5 •[3] Communication: state probability	•[1] evidence of the 35 combinations •[2] 13 •[3] $\frac{13}{35}$	3

Notes:

1. Correct answer with no working award 3/3
2. The combinations need not be listed for award of •[1] and •[2]
3. Where answer is incorrect, •[3] can only be awarded if numerator **and** denominator are consistent with working
4. The final answer does not need to be in its simplest form
5. Do not award •[3] for an answer written as a ratio

Commonly Observed Responses:

1. 13 : 35 award 2/3 ✓ ✓ ✗
2. $\frac{35}{13}$ award 2/3 ✓ ✓ ✗

Question			Generic scheme	Illustrative scheme	Max mark
15.			•[1] Process: consistent units between two values •[2] Communication: state gradient •[3] Process/communication: calculate equivalent fraction(s) and state conclusion	•[1] 25 cm = 0·25 m or 4 m = 400 cm •[2] $\frac{25}{400}$ •[3] Simplify $\frac{25}{400}$ to $\frac{1}{16}$ Yes, $\frac{1}{16}<\frac{1}{14}$	3