



National  
Qualifications  
2023

---

## **2023 Applications of Mathematics**

### **National 5 - Paper 2**

### **Finalised Marking Instructions**

© Scottish Qualifications Authority 2023

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

The information in this document may be reproduced in support of SQA qualifications only on a non-commercial basis. If it is reproduced, SQA must be clearly acknowledged as the source. If it is to be reproduced for any other purpose, written permission must be obtained from [permissions@sqa.org.uk](mailto:permissions@sqa.org.uk).



## General marking principles for 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.*

- 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.
- 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.
- One mark is available for each •. There are no half marks.
- 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.
- 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.
- Candidates may use any mathematically correct method to answer questions, except in cases where a particular method is specified or excluded.
- If an error is trivial, casual or insignificant, for example  $6 \times 6 = 12$ , candidates lose the opportunity to gain a mark, except for instances such as the second example in point (h) below.
- 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:

$$\begin{array}{cc} \bullet^5 & \bullet^6 \\ \bullet^5 & x = 2 \quad x = -4 \\ \bullet^6 & y = 5 \quad y = -7 \end{array}$$

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

$\frac{15}{0.3}$  must be simplified to 50     $\frac{4\frac{4}{5}}{3}$  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.			<ul style="list-style-type: none"> <li>•<sup>1</sup> Strategy: know how to calculate percentage decrease</li> <li>•<sup>2</sup> Strategy: identify power or equivalent</li> <li>•<sup>3</sup> Strategy/process: know to multiply and calculate value</li> <li>•<sup>4</sup> Process/communication: round to 3 significant figures</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> evidence of 0.972 or equivalent</li> <li>•<sup>2</sup> ...<sup>3</sup> or equivalent</li> <li>•<sup>3</sup> 13 527 001.61...</li> <li>•<sup>4</sup> 13 500 000</li> </ul>	4

### Notes:

1. Correct answer without working award 0/4
2. •<sup>3</sup> can only be awarded for a calculation involving a multiplication and a power of 3 or equivalent.
3. Candidates using repeated subtraction must work to a minimum of 4 significant figures, rounded or truncated, to gain •<sup>3</sup>.
4. Where all calculations are shown, •<sup>3</sup> can be implied by •<sup>4</sup>.

### Commonly Observed Responses:

- |  |                |
|--|----------------|
| 1. 13527 001.61 → 13500 000 with no working shown  | award 4/4 ✓✓✓✓ |
| 2. $14\,730\,000 \times 0.972^3 = 13\,500\,000$  | award 4/4 ✓✓✓✓ |
| 3. 13 527 001(.61...) with no working shown  | award 3/4 ✓✓✓✗ |
| 4. $14\,730\,000 \div 0.972^3 = 16\,039\,984.79 \rightarrow 16\,000\,000$                        | award 3/4 ✓✓✗✓ |
| 5. $14\,730\,000 \times 1.028^3 = 16\,002\,288.31 \rightarrow 16\,000\,000$                      | award 3/4 ✗✓✓✓ |
| 6. $14\,730\,000 \times 2.8^3 = 323\,352\,960 \rightarrow 323\,000\,000$                         | award 3/4 ✗✓✓✓ |
| 7. $14\,730\,000 - (0.028^3 \times 14\,730\,000) = 14\,729\,676.65 \rightarrow 14\,700\,000$     | award 3/4 ✗✓✓✓ |
| 8. $14\,730\,000 \div 1.028^3 = 13\,558\,867.07 \rightarrow 13\,600\,000$                        | award 2/4 ✗✓✗✓ |
| 9. $14\,730\,000 - (0.028 \times 14\,730\,000) \times 3 = 13\,492\,680 \rightarrow 13\,500\,000$ | award 2/4 ✓✗✗✓ |

Question			Generic scheme	Illustrative scheme	Max mark
2.			<ul style="list-style-type: none"> <li>•<sup>1</sup> Strategy: substitute into formula for arc length of two quarter circles with diameter of 1400</li> <li>•<sup>2</sup> Process: calculate missing straight length</li> <li>•<sup>3</sup> Process: calculate perimeter of the window</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\frac{1}{4} \times \pi \times 1400 \times 2</math> or <math>\frac{1}{2} \times \pi \times 1400</math></li> <li>•<sup>2</sup> 900</li> <li>•<sup>3</sup> 7399.114....</li> </ul>	3

**Notes:**

1. Correct answer without working award 2/3
2. Accept rounding or truncating to at least 2 significant figures for final answer.
3. For candidates who use  $\pi r^2$  only •<sup>2</sup> is available, see COR 6.
4. •<sup>1</sup> can only be awarded if valid working is shown.
5. •<sup>2</sup> can be implied by •<sup>3</sup>.
6. •<sup>3</sup> can only be awarded for  $2300 + 1000 + 1000$  added to the candidates answer to •<sup>1</sup> and •<sup>2</sup>.
7. Accept use of  $\pi$  to at least 2 decimal places, eg COR 1.

**Commonly Observed Responses:**

- |   |               |
|---|---------------|
| 1. $3.14 \times 1400 \div 2 + 5200 = 7398$        | award 3/3 ✓✓✓ |
| 2. $\pi \times 1400 \div 2 + 4300 = 6499.1...$    | award 1/3 ✓xx |
| 3. $(\pi \times 700) \div 2 + 5200 = 6299.5...$   | award 2/3 x✓✓ |
| 4. $\pi \times 1400 + 5200 = 9598.2...$           | award 2/3 x✓✓ |
| 5. $(\pi \times 1400 \div 4) + 5200 = 6299.5...$  | award 2/3 x✓✓ |
| 6. $\pi \times 700^2 \div 2 + 5200 = 774890.2...$ | award 1/3 x✓x |

Question			Generic scheme	Illustrative scheme	Max mark
3.			<ul style="list-style-type: none"> <li>•<sup>1</sup> Strategy/communication: correct substitution into Pythagoras' theorem</li> <li>•<sup>2</sup> Process: calculate AC or AC<sup>2</sup></li> <li>•<sup>3</sup> Strategy/communication: correct substitution into Pythagoras' theorem</li> <li>•<sup>4</sup> Process: calculate BC</li> <li>•<sup>5</sup> Process: calculate the number of rolls required.</li> <li>•<sup>6</sup> Process: calculate total cost</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>7^2 + 5^2</math></li> <li>•<sup>2</sup> 8.60... or 74</li> <li>•<sup>3</sup> <math>21^2 - 8.60...^2</math> or <math>21^2 - 74</math></li> <li>•<sup>4</sup> 19.15....</li> <li>•<sup>5</sup> <math>40.15... \div 3</math> leading to 14 rolls</li> <li>•<sup>6</sup> 308</li> </ul>	6

**Notes:**

1. Correct answer without working award 0/6
2. Do not penalise candidates who truncate or round to the nearest whole number throughout.
3. For candidates who do not use a calculation involving Pythagoras •<sup>5</sup> and •<sup>6</sup> are still available.
4. •<sup>5</sup> is not available if the total length of the fence is a multiple of 3.
5. •<sup>5</sup> and •<sup>6</sup> are not available where no attempt is made to divide a length by 3.
6. •<sup>6</sup> is still available where a candidate does not round in •<sup>5</sup>.
7. Where final answer is not a whole number •<sup>6</sup> is only available where final answer is rounded or truncated to 2 decimal places.

**Commonly Observed Responses:**

- |   |                  |
|---|------------------|
| 1. $7^2 + 5^2 \rightarrow 74 \rightarrow 21^2 - 74 \rightarrow 19.15... \rightarrow 40.15 \div 3 \rightarrow 13.38... \times 22 = 294.43$ | award 5/6 ✓✓✓✓x✓ |
| 2. $7^2 - 5^2 \rightarrow 24 \rightarrow 21^2 - 24 \rightarrow 20.42... \rightarrow 41.42 \div 3 \rightarrow 14 \times 22 = 308$          | award 5/6 x✓✓✓✓✓ |
| 3. $7^2 + 5^2 \rightarrow 74 \rightarrow 21^2 + 74 \rightarrow 22.69... \rightarrow 43.69 \div 3 \rightarrow 15 \times 22 = 330$          | award 5/6 ✓✓x✓✓✓ |
| 4. $7^2 + 5^2 \rightarrow 74 \rightarrow 21^2 - 74 \rightarrow 19.15... \rightarrow 40.15 \div 3 \rightarrow 13 \times 22 = 286$          | award 5/6 ✓✓✓✓x✓ |
| 5. $7^2 - 5^2 \rightarrow 24 \rightarrow 21^2 + 24 \rightarrow 21.56... \rightarrow 42.56 \div 3 \rightarrow 15 \times 22 = 330$          | award 4/6 x✓x✓✓✓ |
| 6. $21 \div 3$ stated explicitly $\rightarrow 7 \times 22 = 154$  | award 1/6 xxxxx✓ |

Question			Generic scheme	Illustrative scheme	Max mark
4.	(a)		<ul style="list-style-type: none"> <li>•<sup>1</sup> Process: calculate the area of the four semi-circles</li> <li>•<sup>2</sup> Process: calculate area of square and total area</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> 0.769...</li> <li>•<sup>2</sup> 2.209...</li> </ul>	2
<b>Notes:</b> <ol style="list-style-type: none"> <li>1. Correct answer to at least one decimal place without working award 1/2</li> <li>2. •<sup>2</sup> is only available where it is clear that the candidate intended to use <math>\pi r^2</math> at •<sup>1</sup>.</li> <li>3. Accept use of <math>\pi</math> to at least 2 decimal places.</li> </ol>					
<b>Commonly Observed Responses:</b> <ol style="list-style-type: none"> <li>1. <math>\pi \times 0.35^2 + 1.44 = 1.82...</math> award 1/2 ✕✓</li> <li>2. <math>\pi \times 0.35^2 \times 4 + 1.44 = 2.97...</math> award 1/2 ✕✓</li> <li>3. <math>\pi \times 0.7 \times 2 + 1.44 = 5.83...</math> award 0/2 ✕✕</li> </ol>					
	(b)		<ul style="list-style-type: none"> <li>•<sup>3</sup> Strategy: identify costs</li> <li>•<sup>4</sup> Process/communication: calculate total cost</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>3</sup> Evidence of 38, 16, 32 and 20 selected from the table</li> <li>•<sup>4</sup> <math>(3 \times 38 + 3 \times 16 + 32 + 20 =) 214</math></li> </ul>	2
<b>Notes:</b> <ol style="list-style-type: none"> <li>1. Correct answer without working award 2/2</li> <li>2. •<sup>4</sup> is only available for multiplying <b>both</b> glass coating and glass colour thickness by 3 and adding two other values from the table.</li> <li>3. Where final answer is not a whole number •<sup>4</sup> is only available where final answer is rounded or truncated to 2 decimal places.</li> </ol>					
<b>Commonly Observed Responses:</b> <ol style="list-style-type: none"> <li>1. <math>16 + 32 + 20 + 38 = 106</math> award 1/2 ✓✕</li> <li>2. <math>(16 + 32 + 20 + 38) \times 3 = 318</math> award 1/2 ✓✕</li> <li>3. <math>16 \times 3 + 32 + 20 + 38 = 138</math> award 1/2 ✓✕</li> </ol>					



Question			Generic scheme	Illustrative scheme	Max mark
5.	(a)	(i)	• <sup>1</sup> process: calculate mean	• <sup>1</sup> 2	1
		(ii)	• <sup>2</sup> process: calculate $(x - \bar{x})^2$  • <sup>3</sup> strategy/process: calculate $\sum (x - \bar{x})^2$ and substitute into formula  • <sup>4</sup> Process: calculate standard deviation	• <sup>2</sup> 1.44, 0.01, 0.81, 0.36, 1.21, 0.16, 0.01  • <sup>3</sup> $\sqrt{\frac{4}{7-1}}$  • <sup>4</sup> 0.816...	3
			<b>Alternative Strategy</b> • <sup>2</sup> process: calculate $\sum x$ and $\sum x^2$  • <sup>3</sup> strategy: substitute into formula  • <sup>4</sup> Process: calculate standard deviation	• <sup>2</sup> 14, 32  • <sup>3</sup> $\sqrt{\frac{32 - \frac{14^2}{7}}{7-1}}$  • <sup>4</sup> 0.816...	

**Notes:**

- Correct answer without working award 0/3
- Accept rounding or truncating to 1 decimal place for final answer.
- For •<sup>3</sup> do not penalise a square root sign that does not extend to the denominator.
- <sup>4</sup> can only be awarded for a calculation involving at least 2 steps including a division and a square root.
- <sup>4</sup> is not available if the denominator is 1, see COR 5.

**Commonly Observed Responses:**

- $\sqrt{\frac{4}{6}} \rightarrow \sqrt{0.6} \rightarrow 0.816...$  award 3/3 ✓✓✓
- $\sqrt{\frac{4}{6}} \rightarrow \sqrt{0.6} \rightarrow 0.7...$  award 2/3 ✓✓✗
- $\sqrt{\frac{4}{6}} = \sqrt{0.816...}$  award 2/3 ✓✓✗
- $\frac{\sqrt{4}}{6} \rightarrow 0.3...$  award 2/3 ✓✓✗
- $\sqrt{\frac{4}{2-1}} \rightarrow 2$ , in original strategy using mean for n. award 1/3 ✓✗✗
- $\frac{4}{6} \rightarrow 0.66...$  award 1/3 ✓✗✗

Question			Generic scheme	Illustrative scheme	Max mark
5.	(b)		<ul style="list-style-type: none"> <li>•<sup>5</sup> Communication: comment regarding mean</li> <li>•<sup>6</sup> Communication: comment regarding standard deviation</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>5</sup> eg on average, Colin's hot tub chlorine levels are higher</li> <li>•<sup>6</sup> eg Stuart's hot tub chlorine levels are more consistent.</li> </ul>	2

**Notes:**

1. Answer must be consistent with answer to part (a).
2. Numerical comparisons are not required but when used they must be accurate.
3. For the award of •<sup>5</sup>

Accept eg

- On average, Colin's levels are higher.
- On average, Stuart's chlorine is lower.
- Stuart had a lower average chlorine level than Colin.

Do not accept eg

- On average Stuart is lower.
- Colin's levels are higher.
- Stuart's chlorine is lower.
- On average, the **mean** chlorine level was greater for Colin.
- On average, Colin's chlorine level was **better**.
- On average, Colin's hot tub is higher.

4. For the award of •<sup>6</sup>

Accept eg

- The levels in Stuart's hot tub are less varied.
- The levels in Colin's hot tub are less consistent.
- The chlorine in Colin's hot tub is more spread out.
- There is less variation in the chlorine levels in Stuart's hot tub.

Do not accept eg

- "On average" contained in any statement.
- Stuart's standard deviation is more consistent.
- The **range** of chlorine levels in Stuart's hot tub is less varied.
- Colin's hot tub is more varied.

**Commonly Observed Responses:**

1. On average, Stuart's chlorine levels are lower and **the levels** are more consistent  
award 2/2 ✓✓
2. On average, Stuart's chlorine levels are lower and are more consistent  
award 1/2 ✓✗

Question			Generic scheme	Illustrative scheme	Max mark
5.	(c)		<ul style="list-style-type: none"> <li>•<sup>7</sup> Strategy/Process: calculate number of hours for one worker</li> <li>•<sup>8</sup> Process: calculate the decimal time for 5 workers</li> <li>•<sup>9</sup> Process: convert decimal time and calculate finish time</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>7</sup> 48</li> <li>•<sup>8</sup> 9.6</li> <li>•<sup>9</sup> 18:06 or 6:06 pm</li> </ul>	3
			<b>Alternative Strategy</b> <ul style="list-style-type: none"> <li>•<sup>7</sup> Strategy/Process: calculate number of hours for one worker</li> <li>•<sup>8</sup> Process: calculate the decimal time for 5 workers</li> <li>•<sup>9</sup> Process: convert decimal time and calculate finish time</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>7</sup> <math>(12 \div 5 =) 2.4</math></li> <li>•<sup>8</sup> <math>(12 - 2.4 =) 9.6</math></li> <li>•<sup>9</sup> 18:06 or 6:06 pm</li> </ul>	
<b>Notes:</b> <ol style="list-style-type: none"> <li>Correct answer without working award 3/3</li> <li>•<sup>9</sup> is not available where a multiple of 0.5 hours or a whole number of hours is calculated for •<sup>8</sup>.</li> </ol>					
<b>Commonly Observed Responses:</b> <ol style="list-style-type: none"> <li><math>12 \div (5 \div 4) = 9.6 \rightarrow 18:06 \text{ or } 6:06 \text{ pm}</math> award 3/3 ✓✓✓</li> <li>18:06 pm with or without working award 3/3 ✓✓✓</li> <li>18:06 am or 6:06 with or without working award 2/3 ✓✓x</li> <li><math>12 - (12 \div 4) = 9 \rightarrow 17:30</math> award 1/3 x✓x</li> <li><math>12 \div 4 \times 5 = 15</math> award 1/3 x✓x</li> <li><math>12 \div 4 \times 5 = 15 \rightarrow 23:30 \text{ or } 11:30\text{pm}</math> award 1/3 x✓x</li> <li><math>12 \div (4 \div 5) = 15 \rightarrow 23:30 \text{ or } 11:30\text{pm}</math> award 1/3 x✓x</li> </ol>					

Question			Generic scheme	Illustrative scheme	Max mark
6.	(a)		<ul style="list-style-type: none"> <li>•<sup>1</sup> Process: calculate amount of zlotys received</li> <li>•<sup>2</sup> Process: calculate the number of zlotys left</li> <li>•<sup>3</sup> Process: calculate number of euros</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> 3161.6</li> <li>•<sup>2</sup> 1801.6</li> <li>•<sup>3</sup> 419.39 to 419.41</li> </ul>	3

**Notes:**

1. Correct answer without working award 3/3
2. •<sup>1</sup> and •<sup>2</sup> can be rounded or truncated to a whole number or any number of decimal places.
3. •<sup>3</sup> must be rounded or truncated to a whole number of euros or one or two decimal places.
4. If the candidate calculates a negative answer at •<sup>2</sup>, then •<sup>2</sup> and •<sup>3</sup> are not available.
5. Do not penalise the wrong units in the final answer.

**Commonly Observed Responses:**

1.  $3161 \rightarrow 364.57 \rightarrow 419.26$  award 3/3 ✓✓✓
2.  $3161.60 \rightarrow (3161.60 - 1360) \div 1.15 = 1566.61$  award 2/3 ✓✓×
3.  $3161.60 \rightarrow ((3161.60 - 340) \div 4.94 =) 571.17 \times 1.15 \rightarrow 656.85$  award 2/3 ✓×✓
4.  $3161.60 \rightarrow (3161.60 - 1360) \times 1.15 = 2071.84$  award 2/3 ✓✓×
5.  $3161.60 \times 1.15 = 3635.84$  award 1/3 ✓××
6.  $640 \div 4.94 = 129.55 \rightarrow \text{any answer}$  award 0/3 ×××

	(b)		<ul style="list-style-type: none"> <li>•<sup>4</sup> Process: calculate cost of deal B or C</li> <li>•<sup>5</sup> Process/communication: calculate cost of other deal and state consistent conclusion</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>4</sup> 20 or 18.7</li> <li>•<sup>5</sup> 18.7 or 20 → deal A</li> </ul>	2
			<p><b>Alternative Strategy</b></p> <ul style="list-style-type: none"> <li>•<sup>4</sup> Process: calculate saving of deal A or C</li> <li>•<sup>5</sup> Process/communication: calculate saving of other deals and state consistent conclusion</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>4</sup> 3.5 or 3.3</li> <li>•<sup>5</sup> 3.3 or 3.5 and 2 → deal A</li> </ul>	

**Notes:**

**Commonly Observed Responses:**

1. Deal A with no working award 0/2 ××

Question			Generic scheme	Illustrative scheme	Max mark
6.	(c)		<ul style="list-style-type: none"> <li>•<sup>6</sup> Process: volume of hemisphere</li> <li>•<sup>7</sup> Process: calculate the volume of the cube</li> <li>•<sup>8</sup> Process: calculate total volume including correct units</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>6</sup> 56.54...</li> <li>•<sup>7</sup> 216</li> <li>•<sup>8</sup> 272.54...cm<sup>3</sup></li> </ul>	3
<b>Notes:</b> <ol style="list-style-type: none"> <li>Correct answer without working award 0/3</li> <li>Candidates must state units for •<sup>8</sup> to be awarded.</li> <li>•<sup>8</sup> is only available for the addition of two calculated values.</li> <li>Accept answers given in millilitres or litres.</li> <li>For •<sup>6</sup> accept any rounding or truncation to at least 3 significant figures.</li> <li>For the final answer accept any rounding or truncation to at least 3 significant figures.</li> <li>Accept use of <math>\pi</math> to at least 2 decimal places.</li> </ol>					
<b>Commonly Observed Responses:</b> <ol style="list-style-type: none"> <li><math>\frac{4}{3} \times \pi \times 6^3 \div 2 + 216 \rightarrow 668.38... \text{cm}^3</math> award 2/3 ✕✓✓</li> <li><math>\frac{4}{3} \times \pi \times 3^3 + 216 \rightarrow 329.09... \text{cm}^3</math> award 2/3 ✕✓✓</li> <li><math>\frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 + 36 \rightarrow 92.54... \text{cm}^3</math> award 2/3 ✓✕✓</li> </ol>					

Question			Generic scheme	Illustrative scheme	Max mark
7.	(a)		<ul style="list-style-type: none"> <li>•<sup>1</sup> Process: calculate overtime pay</li> <li>•<sup>2</sup> Process: calculate weekly gross pay</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> 42</li> <li>•<sup>2</sup> (392 + 42=)434</li> </ul>	2
			<b>Alternative Strategy</b> <ul style="list-style-type: none"> <li>•<sup>1</sup> Process: calculate number of hours to be paid</li> <li>•<sup>2</sup> Process: calculate weekly gross pay</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> 38.75</li> <li>•<sup>2</sup> 434</li> </ul>	
<b>Notes:</b> <ol style="list-style-type: none"> <li>Correct answer without working award 2/2</li> <li>Where final answer is not a whole number •<sup>2</sup> is only available where final answer is rounded or truncated to 2 decimal places.</li> <li>In the original strategy •<sup>2</sup> is only available for adding overtime pay to 392.</li> </ol>					
<b>Commonly Observed Responses:</b> <ol style="list-style-type: none"> <li><math>(2.5 \times 11.2 \times 2 =) 56 \rightarrow 448</math> award 1/2 ✕✓</li> <li><math>(37.5 \times 11.2 \times 1.5 =) 630 \rightarrow 1022</math> award 1/2 ✕✓</li> <li><math>(37.5 \times 11.2 \times 1.5 =) 630</math> award 0/2 ✕✕</li> <li><math>37.5 \times 11.2 = 420</math> award 0/2 ✕✕</li> <li><math>392 + 2.5 = 394.50</math> award 0/2 ✕✕</li> </ol>					
	(b)		<ul style="list-style-type: none"> <li>•<sup>3</sup> Process: determine the median</li> <li>•<sup>4</sup> Process: find the upper quartile and lower quartile</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>3</sup> Median = 45</li> <li>•<sup>4</sup> <math>Q_1 = 41</math> and <math>Q_3 = 48</math></li> </ul>	2
<b>Notes:</b> <p>Ordered list: 37, 37, 39, 41, 42, 44, 44, 46, 47, 47, 48, 49, 51, 54.</p> <ol style="list-style-type: none"> <li>The answers for (b) can be inferred from the boxplot if not stated.</li> <li>If the numbers are unordered, only •<sup>4</sup> is available, see COR 1.</li> <li>If <b>one</b> number is missed from or added to an <b>unordered</b> list, •<sup>3</sup> and •<sup>4</sup> are not available.</li> <li>If <b>one</b> number is missed from or added to an <b>ordered</b> list, <ul style="list-style-type: none"> <li>➤ •<sup>3</sup> is not available</li> <li>➤ •<sup>4</sup> is only available when all three quartiles are consistent with the candidate's list.</li> </ul> </li> <li>If <b>more than one</b> number is missed from or added to an <b>ordered</b> list, •<sup>3</sup> and •<sup>4</sup> are not available.</li> </ol>					
<b>Commonly Observed Responses:</b> <ol style="list-style-type: none"> <li>Median = 50.5 and quartiles of 41 and 49 award 1/2 ✕✓</li> </ol>					

Question			Generic scheme	Illustrative scheme	Max mark
7.	(c)		<ul style="list-style-type: none"> <li>•<sup>5</sup> Communication: end points correctly annotated</li> <li>•<sup>6</sup> Communication: <math>Q_1</math>, <math>Q_2</math>, <math>Q_3</math> correctly annotated and box plot drawn</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>5</sup> end points at 37 and 54</li> <li>•<sup>6</sup> box showing <math>Q_1</math>, <math>Q_2</math>, <math>Q_3</math></li> </ul>	2
<b>Notes:</b> <ol style="list-style-type: none"> <li>The answers for (b) can be inferred from the boxplot if not stated.</li> <li>If the candidate constructs a dot plot award 0/2.</li> <li>•<sup>6</sup> is not available for candidates who only annotate the five figure summary using dots or crosses.</li> <li>For follow through from COR 1 in (b), only •<sup>5</sup> is available.</li> </ol>					
<b>Commonly Observed Responses:</b>					
	(d)	(i)	• <sup>7</sup> Process: calculate interquartile range	• <sup>7</sup> 7	1
<b>Notes:</b> <ol style="list-style-type: none"> <li>Correct answer without working award 1/1</li> <li>•<sup>7</sup> must be consistent with quartiles from •<sup>4</sup>.</li> </ol>					
<b>Commonly Observed Responses:</b> <ol style="list-style-type: none"> <li>IQR = 7, SIQR = 3.5 award 1/1 ✓</li> <li>7 → 3.5 award 0/1 ✗</li> </ol>					
		(ii)	• <sup>8</sup> Communication: comment regarding consistency	• <sup>8</sup> eg The number of words typed per minute by Lynn is more consistent	1
<b>Notes:</b> <ol style="list-style-type: none"> <li>Answer must be consistent with answer to part (d)(i).</li> <li>Numerical comparisons are not required but when used they must be accurate.</li> <li>Comments <b>must</b> refer to words and/or typing as well as Lynn and/or Dave.</li> <li>For the award of •<sup>8</sup> accept. <ul style="list-style-type: none"> <li>Accept eg <ul style="list-style-type: none"> <li>Lynn's typing is more consistent.</li> <li>Lynn's words per minute were less varied.</li> <li>Dave's typing speed is more spread out.</li> <li>Dave's typing is more varied.</li> <li>There is less variation in her typing.</li> </ul> </li> <li>Do not accept eg <ul style="list-style-type: none"> <li>"On average" contained in any statement.</li> <li>Lynn's <b>speed</b> is more consistent.</li> <li>The <b>range</b> of Lynn's typing is lower.</li> </ul> </li> </ul> </li> </ol>					
<b>Commonly Observed Responses:</b>					

Question			Generic scheme	Illustrative scheme	Max mark
7.	(e)	(i)	<ul style="list-style-type: none"> <li>•<sup>9</sup> Process: calculate amount of national insurance in one band</li> <li>•<sup>10</sup> Process: calculate amount of national insurance in other band</li> <li>•<sup>11</sup> Process: calculate total weekly national insurance contribution</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>9</sup> 96.06 or 2.76</li> <li>•<sup>10</sup> 2.76 or 96.06</li> <li>•<sup>11</sup> 98.82</li> </ul>	3

**Notes:**

1. Correct answer without working award 3/3
2. Accept 98.83 or 98.84 for the final answer.
3. For •<sup>9</sup> and •<sup>10</sup> working must be rounded or truncated to at least 2 decimal places.
4. Where the final answer is not a whole number •<sup>11</sup> is only available when final answer is rounded or truncated to 2 decimal places.
5. Do not penalise working subsequent to candidates calculated National Insurance.

**Commonly Observed Responses:**

- |  |               |
|--|---------------|
| 1. $1052 \times 0.0325 = 34.19$                      | award 1/3 x✓x |
| 2. $1052 \times 0.325 = 341.90$                      | award 0/3 xxx |
| 3. $(1052 - 242) \times 0.1325 = 107.32$ or $107.33$ | award 1/3 x✓x |
| 4. $(1052 - 967) \times 0.1325 = 11.26$ or $11.27$   | award 1/3 x✓x |
| 5. $1052 \times 0.1325 = 139.39$                     | award 1/3 x✓x |
| 6. $967 \times 0.0325 = 31.42$ or $31.43$            | award 1/3 x✓x |
| 7. $(1052 - 242) \times 0.0325 = 26.32$ or $26.33$   | award 1/3 x✓x |

		(ii)	<ul style="list-style-type: none"> <li>•<sup>12</sup> Process: calculate pension contribution</li> <li>•<sup>13</sup> Process: calculate weekly net pay</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>12</sup> 47.34</li> <li>•<sup>13</sup> <math>(1052 - (98.82 + 47.34 + 52.08) =)</math> 853.74 or 853.75 or 853.76</li> </ul>	2
--	--	------	--	---	---

**Notes:**

1. Correct answer without working award 2/2
2. •<sup>12</sup> is only available for 47.34.
3. Where final answer is not a whole number •<sup>13</sup> is only available where final answer is rounded or truncated to 2 decimal places.
4. •<sup>13</sup> is only available for subtraction of three valid amounts from 1052.

**Commonly Observed Responses:**

- |  |              |
|--|--------------|
| 1. From COR 1 in (i) $\rightarrow 1052 - (47.34 + 52.08 + 34.19) = 918.39$               | award 2/2 ✓✓ |
| 2. From COR 3 in (i) $\rightarrow 1052 - (47.34 + 52.08 + 107.32) = 845.26$              | award 2/2 ✓✓ |
| 3. $1052 - (47.34 + 52.08) = 952.58$   | award 1/2 ✓x |
| 4. $(4.5\% \text{ of } 953.18 = 42.89...) \rightarrow 953.18 - (42.89 + 52.08) = 858.21$ | award 1/2 x✓ |



Question			Generic scheme	Illustrative scheme	Max mark
8.	(a)		<ul style="list-style-type: none"> <li>•<sup>1</sup> Process: calculate profit</li> <li>•<sup>2</sup> Process: calculate percentage profit</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>1</sup> 95</li> <li>•<sup>2</sup> 29.68...</li> </ul>	2
<b>Notes:</b> <ol style="list-style-type: none"> <li>Correct answer without working award 2/2</li> <li>Accept answers rounded or truncated to at least 2 significant figures.</li> <li>With the exception of the listed CORs, •<sup>2</sup> is only available for a calculation of the form <math>\frac{\text{calculated profit}}{320} \times 100</math>.</li> <li>For •<sup>2</sup> multiplication by 100 can be implied by the answer.</li> </ol>					
<b>Commonly Observed Responses:</b>					
<ol style="list-style-type: none"> <li><math>\left(\frac{415}{320} \times 100\right) - 100 = 29\ldots</math> award 2/2 ✓✓</li> <li><math>\left(\frac{415}{320} \times 100\right) = 129\ldots</math> award 1/2 ✗✓</li> <li><math>\frac{320}{415} \times 100 = 77.1\ldots \rightarrow 100 - 77.1\ldots = 22(\ldots)</math> award 1/2 ✓✗</li> <li><math>\frac{320}{415} \times 100 = 77.1\ldots</math> award 0/2 ✗✗</li> </ol>					
	(b)		<ul style="list-style-type: none"> <li>•<sup>3</sup> Process: calculate the total price</li> <li>•<sup>4</sup> Process: calculate the deposit</li> <li>•<sup>5</sup> Process: calculate monthly instalment</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>3</sup> 912</li> <li>•<sup>4</sup> 228</li> <li>•<sup>5</sup> 58.40</li> </ul>	3
<b>Notes:</b> <ol style="list-style-type: none"> <li>Correct answer without working award 3/3</li> <li>Where final answer is not a whole number, •<sup>5</sup> is only available where final answer is rounded or truncated to 2 decimal places.</li> </ol>					
<b>Commonly Observed Responses:</b>					
<ol style="list-style-type: none"> <li><math>912 - (0.25 \times 800 + 100) = 612 \rightarrow 61.20</math> award 2/3 ✓✗✓</li> <li><math>800 - (0.25 \times 800 + 100) \rightarrow 50</math> award 1/3 ✗✗✓</li> </ol>					

Question			Generic scheme	Illustrative scheme	Max mark
8.	(c)		<ul style="list-style-type: none"> <li>•<sup>6</sup> Process: calculate delivery time in Dubai time</li> <li>•<sup>7</sup> Process: take off 9 hours from Dubai delivery time</li> <li>•<sup>8</sup> Process: calculate date in New York</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>6</sup> 2:45(am) or 02:45 (28 Nov)</li> <li>•<sup>7</sup> 5:45pm or 17:45</li> <li>•<sup>8</sup> 27 November</li> </ul>	3
			<b>Alternative Strategy</b> <ul style="list-style-type: none"> <li>•<sup>6</sup> Process: take off 9 hours from 8:45am</li> <li>•<sup>7</sup> Process: calculate delivery time in New York time</li> <li>•<sup>8</sup> Process: calculate date in New York</li> </ul>	<ul style="list-style-type: none"> <li>•<sup>6</sup> 11:45(pm) or 23:45 (23 Nov)</li> <li>•<sup>7</sup> 5:45pm or 17:45</li> <li>•<sup>8</sup> 27 November</li> </ul>	
<b>Notes:</b> <ol style="list-style-type: none"> <li>For answers of 17:45 on 27 November with no working award 3/3</li> <li>Any incorrect answer, including CORs 2 – 8 , with no working award 0/3</li> <li>Do not penalise 17:45pm for the award of •<sup>7</sup>.</li> <li>For •<sup>8</sup> “November” does not need to be explicitly stated.</li> </ol>					
<b>Commonly Observed Responses:</b> <ol style="list-style-type: none"> <li>27 November without working award 0/3 ***</li> </ol> <p>The marks for the following CORS are based on the alternative strategy</p> <ol style="list-style-type: none"> <li>23:45 + 3 days 45 minutes → 00:30 → 27 November award 2/3 ✓x✓</li> <li>(+4hrs and – 5hrs) 07:45 → 01:45 → 28 November award 2/3 x✓✓</li> <li>(–4hrs and + 5hrs) 09:45 → 03:45 → 28 November award 2/3 x✓✓</li> <li>(+4hrs and + 5hrs) 17:45 → 11:45 → 28 November award 2/3 x✓✓</li> <li>(–4hrs) 04:45 → 22:45 → 27 November award 2/3 x✓✓</li> <li>(+5hrs) 13:45 → 07:45 → 28 November award 2/3 x✓✓</li> <li>(+4hrs) 12:45 → 06:45 → 28 November award 2/3 x✓✓</li> <li>(–5hrs) 03:45 → 21:45 → 27 November award 2/3 x✓✓</li> </ol>					

[END OF MARKING INSTRUCTIONS]