

# Essential Mathematics marking guide

Common internal assessment 2023 — Phase 4

## Short response (50 marks)

### Assessment objectives

This assessment instrument is used to determine student achievement in the following objectives:

1. select, recall and use facts, rules, definitions and procedures drawn from all Unit 3 Topics
2. comprehend mathematical concepts and techniques drawn from all Unit 3 Topics
3. communicate using mathematical, statistical and everyday language and conventions
4. evaluate the reasonableness of solutions
5. justify procedures and decisions by explaining mathematical reasoning
6. solve problems by applying mathematical concepts and techniques drawn from all Unit 3 Topics.

## Purpose

This marking guide informs schools and students how marks are matched to characteristics in responses to the common internal assessment.

The marking guide provides:

- explicit statements about what is expected of students when they respond to a question
- sample responses that identify characteristics to assist the marker to make judgments
- where relevant, notes that provide further information to assist the marker in making a decision
- a tool for calibrating markers to ensure comparability of results.

## Mark allocation


Where a response does not meet any of the descriptors for a question or a criterion, a mark of '0' will be recorded.

Where no response to a question has been made, a mark of 'N' will be recorded.

*Allow FT mark/s* — refers to 'follow through', where an error in the prior section of working is used later in the response, a mark (or marks) for the rest of the response can still be awarded so long as it still demonstrates the correct conceptual understanding or skill in the rest of the response.

## Marking guide

Q	Sample response	The response:
1a)	$\text{Length} = 10.2 \times 100$  $\text{Length} = 1020 \text{ cm}$	<ul style="list-style-type: none"> <li>correctly estimates length of side F [1 mark]</li> <li>determines actual length of side F [1 mark]</li> </ul>
1b)	$A = 620\,000 \text{ cm}^2 \div 100^2$ $A = 62 \text{ m}^2$	<ul style="list-style-type: none"> <li>correctly converts area to most appropriate unit of measure [1 mark]</li> </ul>
2a)	Triangular-based prism	<ul style="list-style-type: none"> <li>correctly identifies solid [1 mark]</li> </ul>
2b)	6 vertices	<ul style="list-style-type: none"> <li>correctly states number of vertices [1 mark]</li> </ul>
2c)	Rectangle	<ul style="list-style-type: none"> <li>correctly identifies shape [1 mark]</li> </ul>
2d)	$A = L \times W$ $= 45 \times 25$ $= 1125 \text{ cm}^2$	<ul style="list-style-type: none"> <li>correctly selects an appropriate rule [1 mark]</li> <li>calculates area [1 mark]</li> </ul>
3a)	$P = 2(L + W)$ $= 2 \times (10 + 6.5)$ $= 33 \text{ m}$	<ul style="list-style-type: none"> <li>correctly selects an appropriate rule [1 mark]</li> <li>calculates perimeter [1 mark]</li> </ul>
3b)	$A = \pi r^2$ $A = 3 \times 1^2$  $= 3 \text{ m}^2$	<ul style="list-style-type: none"> <li>correctly uses an appropriate strategy [1 mark]</li> <li>estimates area [1 mark]</li> </ul>

Q	Sample response	The response:
4a)	$\text{Mean} = \frac{\sum x}{n}$ $\bar{x} = \frac{478}{10}$ $\bar{x} = 47.8 \text{ cm}$	<ul style="list-style-type: none"> <li>correctly uses an appropriate strategy [1 mark]</li> <li>calculates mean [1 mark]</li> </ul>
4b)	$40, 44, 46, 46, 48 \mid 48, 48, 50, 52, 56$ Median = 48 cm	<ul style="list-style-type: none"> <li>correctly uses an appropriate strategy [1 mark]</li> <li>calculates median [1 mark]</li> </ul>
4c)	Data is tightly packed around the middle between 46 and 48-cm wheel sizes.	<ul style="list-style-type: none"> <li>correctly identifies data is clustered [1 mark]</li> </ul>
5a)	2	<ul style="list-style-type: none"> <li>correctly states number of drains [1 mark]</li> </ul>
5b)	The scale states that every 10 mm on the plan represents 50 cm in real life for the bathroom.	<ul style="list-style-type: none"> <li>correctly interprets the scale [1 mark]</li> </ul>
5c)	$\text{Area} = L \times W$ $= 1.75 \times 1.50$ $= 2.625 \text{ m}^2$	<ul style="list-style-type: none"> <li>correctly applies the scale [1 mark]</li> <li>calculates area [1 mark]</li> </ul>
5d)	 <p>The image shows a digital scale interface. It has a power button on the left, a display showing '14', and a unit selector set to 'mg'. Below the display, it says 'Mass'. There are also two circular buttons on the right side.</p>	<ul style="list-style-type: none"> <li>correctly determines the mass [1 mark]</li> </ul>

Q	Sample response	The response:
6a)	Number of barrels = $10 \times 3$  = 30 barrels	<ul style="list-style-type: none"> <li>correctly shows use of an appropriate strategy [1 mark]</li> <li>estimates maximum number of barrels [1 mark]</li> </ul>
6b)	$30 \times 600 = 18\,000$ L	<ul style="list-style-type: none"> <li>estimates maximum capacity [1 mark]</li> </ul>
6c)	$0.4 \times 18\,000 = 7\,200$ L	<ul style="list-style-type: none"> <li>determines amount of chemicals [1 mark]</li> </ul>
7a)	$h = \sqrt{c^2 - a^2}$ $h = \sqrt{7^2 - 4^2}$ $h \approx 5.74456$ cm	<ul style="list-style-type: none"> <li>correctly selects an appropriate rule [1 mark]</li> <li>calculates height [1 mark]</li> </ul>
7b)	$V = \frac{1}{3}Ah$ $V = \frac{1}{3}(8 \times 8) \times 5.74456$ $\approx 122.55$ cm <sup>3</sup>	<ul style="list-style-type: none"> <li>selects an appropriate rule [1 mark]</li> <li>calculates volume [1 mark]</li> </ul>
7c)	Capacity = 122.55 mL Capacity $\approx$ 0.12255 L	<ul style="list-style-type: none"> <li>converts capacity to litres [1 mark]</li> </ul>
7d)	Number of paperweights = $10 \div 0.12255$ $\approx 81.6$	<ul style="list-style-type: none"> <li>determines number of paperweights [1 mark]</li> </ul>

Q	Sample response	The response:										
8a)	$V = 0.004125 \times 100^3$ $= 4125 \text{ cm}^3$	<ul style="list-style-type: none"> <li>correctly converts volume to cubic centimetres [1 mark]</li> </ul>										
8b)	$4000 \div 1000 = 4$	<ul style="list-style-type: none"> <li>estimates number of times [1 mark]</li> </ul>										
8c)	$4 \times 8 = 32 \text{ kg}$	<ul style="list-style-type: none"> <li>estimates mass [1 mark]</li> </ul>										
9a)	27 cm	<ul style="list-style-type: none"> <li>correctly identifies mode [1 mark]</li> </ul>										
9b)	<table border="1"> <thead> <tr> <th>Minimum</th> <th>Lower quartile (Q<sub>1</sub>)</th> <th>Median</th> <th>Upper quartile (Q<sub>3</sub>)</th> <th>Maximum</th> </tr> </thead> <tbody> <tr> <td>12</td> <td>15.5</td> <td>22</td> <td>29.5</td> <td>53</td> </tr> </tbody> </table>	Minimum	Lower quartile (Q <sub>1</sub> )	Median	Upper quartile (Q <sub>3</sub> )	Maximum	12	15.5	22	29.5	53	<ul style="list-style-type: none"> <li>correctly identifies median [1 mark]</li> <li>correctly identifies minimum and maximum values [1 mark]</li> </ul>
Minimum	Lower quartile (Q <sub>1</sub> )	Median	Upper quartile (Q <sub>3</sub> )	Maximum								
12	15.5	22	29.5	53								
9c)	<p>Draw your box plot here.</p>	<ul style="list-style-type: none"> <li>draws box section [1 mark]</li> <li>draws whisker sections connecting to box [1 mark]</li> </ul>										

Q	Sample response	The response:
10a)	<p>Surface area of hemispherical section:</p> $S = \frac{1}{2} \times 4\pi r^2$ $= 2\pi r^2$ $= 2\pi(15)^2$ $\approx 1413.72 \text{ cm}^2$ <p>Surface area of base section:</p> $S = 2\pi rh + \pi r^2$ $S = 2\pi(15)(25) + \pi(15)^2$ $\approx 3063.0528 \text{ cm}^2$ <p>Total surface area of metal</p> $TSA = 1413.72 + 3063.0528$ $\approx 4476.77 \text{ cm}^2$	<ul style="list-style-type: none"> <li>• correctly calculates surface area of hemispherical section [1 mark]</li> <li>• correctly selects an appropriate rule [1 mark]</li>   <li>• calculates surface area of cylindrical section [1 mark]</li> <li>• calculates total surface area of metal [1 mark]</li> </ul>
10b)	<p>There will be enough metal to construct the artwork since <math>4476.77 \text{ cm}^2 &lt; 5000 \text{ cm}^2</math>.</p>	<ul style="list-style-type: none"> <li>• provides a justified statement of reasonableness [1 mark]</li> </ul>

Q	Sample response	The response:																				
11	<p>Five-number summary of growth heights using potting mix A:</p> <table border="1"> <thead> <tr> <th>Min</th> <th>Q<sub>1</sub></th> <th>Med</th> <th>Q<sub>3</sub></th> <th>Max</th> </tr> </thead> <tbody> <tr> <td>96</td> <td>99</td> <td>102</td> <td>106</td> <td>108</td> </tr> </tbody> </table> <p>Five-number summary of growth heights using potting mix B:</p> <table border="1"> <thead> <tr> <th>Min</th> <th>Q<sub>1</sub></th> <th>Med</th> <th>Q<sub>3</sub></th> <th>Max</th> </tr> </thead> <tbody> <tr> <td>96</td> <td>98</td> <td>99</td> <td>105</td> <td>108</td> </tr> </tbody> </table> <p>Almost 75% of potting mix A's sunflowers were of the same height or greater than potting mix B's median, i.e. 50% of potting mix B's sunflowers were shorter than the majority of potting mix A's sunflowers.</p> <p>Potting mix A's median growth heights are higher than potting mix B's median growth heights (median A = 102 cm &gt; median B = 99 cm). This suggests that potting mix B has less favourable growth heights. Sharnee's belief is reasonable as potting mix A provides consistently taller sunflowers.</p>	Min	Q <sub>1</sub>	Med	Q <sub>3</sub>	Max	96	99	102	106	108	Min	Q <sub>1</sub>	Med	Q <sub>3</sub>	Max	96	98	99	105	108	<ul style="list-style-type: none"> <li>• correctly determines five-number summary for growth heights using potting mix A data [1 mark]</li> <li>• correctly determines five-number summary for growth heights using potting mix B data [1 mark]</li> <li>• interprets quartile growth heights using both potting mixes data [1 mark]</li> <li>• interprets median growth heights using both potting mixes data [1 mark]</li> <li>• provides a justified statement of reasonableness [1 mark]</li> </ul>
Min	Q <sub>1</sub>	Med	Q <sub>3</sub>	Max																		
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## Instrument-specific standards — Common internal assessment

Foundational knowledge and problem solving	Cut-off (marks)	Grades
<b>The student work has the following characteristics</b>		
<ul style="list-style-type: none"> <li>comprehensive selection, recall and use of simple and complex facts, rules, definitions and procedures; comprehension and clear communication of simple and complex mathematical concepts and techniques; evaluation of the reasonableness of solutions and use of mathematical reasoning to justify procedures and decisions; and proficient application of simple and complex mathematical concepts and techniques to solve problems</li> </ul>	> 40	<b>A</b>
<ul style="list-style-type: none"> <li>selection, recall and use of simple and some complex facts, rules, definitions and procedures; comprehension and communication of simple and some complex mathematical concepts and techniques; evaluation of the reasonableness of some solutions using mathematical reasoning; and application of simple and some complex mathematical concepts and techniques to solve problems</li> </ul>	> 30	<b>B</b>
<ul style="list-style-type: none"> <li>selection, recall and use of simple facts, rules, definitions and procedures; comprehension and communication of simple mathematical concepts and techniques; discussion of the reasonableness of solutions using mathematical reasoning; and application of simple mathematical concepts and techniques to solve problems</li> </ul>	> 20	<b>C</b>
<ul style="list-style-type: none"> <li>some selection, recall and use of facts, rules, definitions and procedures; basic comprehension and communication of mathematical concepts and techniques; some discussion of the reasonableness of solutions; and inconsistent application of mathematical concepts and techniques</li> </ul>	> 10	<b>D</b>
<ul style="list-style-type: none"> <li>isolated and inaccurate selection, recall and use of facts, rules, definitions and procedures; disjointed and unclear communication of mathematical concepts and techniques; superficial discussion of the reasonableness of solutions.</li> </ul>	$\geq 0$	<b>E</b>



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