

# Essential Mathematics marking guide

Common internal assessment 2022 — Phase 1

## 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.

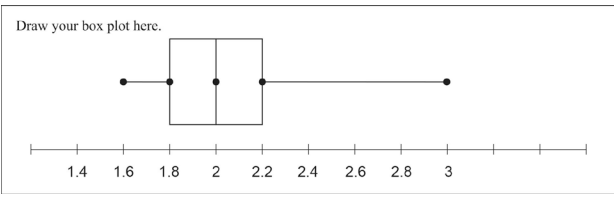
Where no response to a question has been made, a mark of 'N' will be recorded.

*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.

*This mark may be implied by subsequent working* — the full mathematical reasoning and/or working, as outlined in the sample response and associated mark, is not explicitly stated in the student response, but by virtue of subsequent working there is sufficient evidence to award the mark/s.

## Marking guide

Q	Sample response	The response:
1a)	12	<ul style="list-style-type: none"> <li>correctly states the number of vertices <b>[1 mark]</b></li> </ul>
1b)	8	<ul style="list-style-type: none"> <li>correctly states the number of faces <b>[1 mark]</b></li> </ul>
2a)	1, 2, 2, 2, 2, 3, 3, 3, 4, 4, 5, 5	<ul style="list-style-type: none"> <li>correctly lists the values from smallest to largest <b>[1 mark]</b></li> </ul>
2b)	3	<ul style="list-style-type: none"> <li>determines median <b>[1 mark]</b></li> </ul>
2c)	2	<ul style="list-style-type: none"> <li>correctly identifies the mode <b>[1 mark]</b></li> </ul>
2d)	$\text{Mean} = \frac{\sum x}{n}$ $= \frac{33}{11}$ <p>= 3 family members</p>	<ul style="list-style-type: none"> <li>correctly shows use of an appropriate strategy <b>[1 mark]</b></li> <li>calculates mean <b>[1 mark]</b></li> </ul>
3a)	$r = \frac{d}{2} = \frac{2.4}{2} = 1.2 \text{ cm}$	<ul style="list-style-type: none"> <li>correctly determines the radius <b>[1 mark]</b></li> </ul>
3b)	<p>Volume of container, <math>V = \pi r^2 h</math></p> $= \pi \times 1.2^2 \times 8.5$ $= 38.453 \dots$ $\approx 38 \text{ cm}^3$	<ul style="list-style-type: none"> <li>substitutes into appropriate rule <b>[1 mark]</b></li> <li>calculates volume <b>[1 mark]</b></li> <li>rounds to nearest cubic centimetre <b>[1 mark]</b></li> </ul>
3c)	$38 \text{ cm}^3 = 38 \text{ mL}$ <p><math>12 \times 38 = 456 \text{ mL}</math> of creek water</p>	<ul style="list-style-type: none"> <li>recognises that <math>1 \text{ cm}^3 = 1 \text{ mL}</math> <b>[1 mark]</b></li> <li>determines number of millilitres in 12 full containers <b>[1 mark]</b></li> </ul>

Q	Sample response	The response:
4a)	Arc length of enclosure, $l = \frac{\theta}{180} \pi r$ $= \frac{180}{180} \times \pi \times r$ $= 1 \times \pi \times 6$ $\approx 18.85 \text{ m}$	<ul style="list-style-type: none"> <li>• correctly substitutes into appropriate rule [1 mark]</li> <li>• calculates arc length [1 mark]</li> </ul>
4b)	Perimeter of enclosure $= 18.85 + 6 + 6$ $= 30.85 \text{ m}$	<ul style="list-style-type: none"> <li>• identifies use of an appropriate strategy [1 mark]</li> <li>• calculates perimeter of enclosure [1 mark]</li> </ul>
5a)	55	<ul style="list-style-type: none"> <li>• correctly states the median [1 mark]</li> </ul>
5b)	The box plot is symmetrical around 55 cm.	<ul style="list-style-type: none"> <li>• correctly identifies box plot is symmetrical [1 mark]</li> </ul>
5c)	Draw your box plot here. 	<ul style="list-style-type: none"> <li>• correctly plots a value from the five-number summary using an appropriate scale [1 mark]</li> <li>• correctly constructs box plot using an appropriate scale [1 mark]</li> </ul>
5d)	The box plot is positively skewed.	<ul style="list-style-type: none"> <li>• identifies box plot is not symmetrical [1 mark]</li> </ul>

Q	Sample response	The response:
6a)	Measured width = 3 cm Measured length = 6 cm  Actual width = 3 cm × 3 = 9 cm Actual length = 6 cm × 3 = 18 cm	<ul style="list-style-type: none"> <li>• correctly measures the width and the length [1 mark]</li> <li>• applies scale of 1:3 to width [1 mark]</li> <li>• applies scale of 1:3 to length [1 mark]</li> </ul>
6b)	Area of label, $A = bh$ $= 9 \times 18$ $= 162 \text{ cm}^2$	<ul style="list-style-type: none"> <li>• calculates area of label [1 mark]</li> </ul>
6c)	1200 g	<ul style="list-style-type: none"> <li>• correctly converts kilograms to grams [1 mark]</li> </ul>
7a)	Estimated length of piece 1 $= 8 \text{ foot lengths} \times 30 \text{ cm/foot length}$ $= 240 \text{ cm}$	<ul style="list-style-type: none"> <li>• correctly determines the estimated length of piece 1 [1 mark]</li> </ul>
7b)	Estimated length of piece 2 $= 6 \text{ foot lengths} \times 30 \text{ cm/foot length}$ $= 180 \text{ cm}$	<ul style="list-style-type: none"> <li>• correctly determines the estimated length of piece 2 [1 mark]</li> </ul>
7c)	Estimated total length of tubing $= 240 + 180 + 180$ $= 600 \text{ cm}$	<ul style="list-style-type: none"> <li>• determines estimated total length [1 mark]</li> </ul>

Q	Sample response	The response:
8a)	Using Pythagoras' theorem $c^2 = a^2 + b^2$ Third length ( $b$ ) $b^2 = c^2 - a^2$ $b^2 = 1000^2 - 760^2$ $b = \sqrt{1000^2 - 760^2}$ $b \approx 650$ m The third length of the track is 650 m.	<ul style="list-style-type: none"> <li>• correctly substitutes into appropriate rule <b>[1 mark]</b></li> <li>• calculates third length of track <b>[1 mark]</b></li> </ul>
8b)	Area inside triangle, $A = \frac{1}{2}bh$ $= \frac{1}{2} \times 760 \times 650$ $= 247\,000 \text{ m}^2$  $= 24.7 \text{ ha}$	<ul style="list-style-type: none"> <li>• substitutes into appropriate rule <b>[1 mark]</b></li> <li>• calculates area <b>[1 mark]</b></li> <li>• converts square metres to hectares <b>[1 mark]</b></li> </ul>
8c)	Number of spectators allowed in viewing area $= 24.7 \times 2000$ $= 49\,400$ people  $45\,000 < 49\,400$ . The predicted number of spectators will be allowed in the viewing area.	<ul style="list-style-type: none"> <li>• determines the maximum number of spectators allowed in viewing area <b>[1 mark]</b></li> <li>• provides a justified decision linked to prior reasoning <b>[1 mark]</b></li> </ul>

Q	Sample response	The response:										
9	<p>Median = middle score = 8  Minimum = 1  Maximum = 23</p> <p>Five-number summary:</p> <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>1</td> <td>3</td> <td>8</td> <td>14</td> <td>23</td> </tr> </tbody> </table>	Minimum	Lower quartile (Q <sub>1</sub> )	Median	Upper quartile (Q <sub>3</sub> )	Maximum	1	3	8	14	23	<ul style="list-style-type: none"> <li>correctly determines the median <b>[1 mark]</b></li> <li>correctly determines the minimum and maximum <b>[1 mark]</b></li> <li>enters appropriate labels and corresponding values into table <b>[1 mark]</b></li> </ul>
Minimum	Lower quartile (Q <sub>1</sub> )	Median	Upper quartile (Q <sub>3</sub> )	Maximum								
1	3	8	14	23								
10a)	<p>Measured width = 4 cm</p> <p>Actual width = 4 m = 400 cm  Scale is 1:100</p>	<ul style="list-style-type: none"> <li>correctly measures a labelled dimension <b>[1 mark]</b></li> <li>determines scale in simplest form <b>[1 mark]</b></li> </ul>										
10b)	Perimeter = 4 + 3 + 3 + 3 + 5 = 18 m	<ul style="list-style-type: none"> <li>correctly calculates the perimeter <b>[1 mark]</b></li> </ul>										
10c)	<p>Find <math>\theta</math> using sin ratio:</p> $\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$ $\sin \theta = \frac{3}{5}$ $\theta = \sin^{-1}\left(\frac{3}{5}\right) = 36.87^\circ$	<ul style="list-style-type: none"> <li>correctly selects and applies an appropriate trigonometric ratio <b>[1 mark]</b></li> <li>calculates angle <b>[1 mark]</b></li> </ul>										

Q	Sample response	The response:
11	<p>Face dimensions.</p> <p>Equilateral triangle:</p> $a = 5 \text{ cm}$ $\text{Actual base length} = 5 \text{ cm} \times 2 = 10 \text{ cm}$ $b = 4.3 \text{ cm}$ $\text{Actual perpendicular height} = 4.3 \text{ cm} \times 2 = 8.6 \text{ cm}$ <p>Isosceles triangle:</p> <p>Given base length = 5 cm (as above)</p> $\text{Actual base length} = 5 \text{ cm} \times 2 = 10 \text{ cm (as above)}$ $c = 6 \text{ cm}$ $\text{Actual perpendicular height} = 6 \text{ cm} \times 2 = 12 \text{ cm}$ <p>Face areas.</p> <p>Equilateral triangle:</p> $\text{Actual area, } A = \frac{1}{2}bh$ $= \frac{1}{2} \times 10 \times 8.6$ $= 43 \text{ cm}^2$ <p>Isosceles triangle:</p> $\text{Actual area, } A = \frac{1}{2}bh$ $= \frac{1}{2} \times 10 \times 12$ $= 60 \text{ cm}^2$ <p>Surface area of one cardboard template</p> $= 43 + 3 \times 60 = 223 \text{ cm}^2$ <p>Cost of one template</p> $= 223 \text{ cm}^2 \times 2 \text{ cents/cm}^2 = 446 \text{ cents} = \$4.46$ <p>Cost of 8 templates = <math>8 \times \\$4.46 = \\$35.68</math></p> $\$35.68 < \$40$ <p>The customer can purchase 8 templates for \$35.68, which is under \$40, so their assumption is valid.</p>	<ul style="list-style-type: none"> <li>• correctly converts the given base length and perpendicular heights using scale <b>[1 mark]</b></li>   <li>• calculates actual area of each face <b>[1 mark]</b></li>   <li>• calculates surface area of one cardboard template <b>[1 mark]</b></li>   <li>• calculates cost of 8 templates <b>[1 mark]</b></li>   <li>• provides a justified statement of reasonableness <b>[1 mark]</b></li> </ul>



## 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>

