General Mathematics SEE marking guide and response

External assessment 2024

SEE 2 Paper 1: 57 marks

SEE 2 Paper 2: 38 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 Units 3 and 4
2. comprehend mathematical concepts and techniques drawn from Units 3 and 4
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 Units 3 and 4.

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

For all Queensland schools

Purpose

This marking guide:

- provides a tool for calibrating external assessment markers to ensure reliability of results
- indicates the correlation, for each question, between mark allocation and qualities at each level of the mark range
- informs schools and students about how marks are matched to qualities in student responses.

The sample response:

- demonstrates the qualities of a high-level response
- has been annotated using the marking guide.

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 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

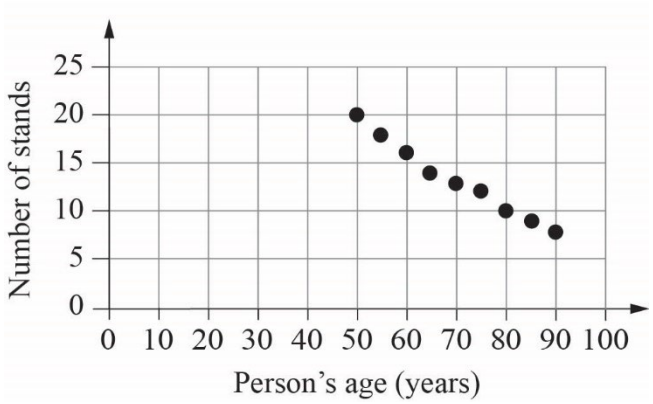
Multiple choice

Question	Response
1	B
2	D
3	B
4	D
5	C
6	A
7	C
8	C
9	D
10	C
11	B
12	A
13	A
14	C
15	A

Paper 1: Short response

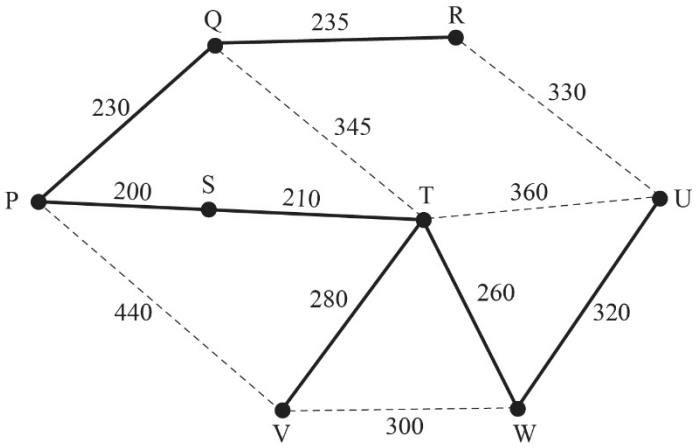
<table>
<tr><th>Q</th><th>Sample response</th><th>The response:</th></tr>
<tr><td>16a)</td><td>$t_2 = t_1 + 8$
$= 25 + 8$
$= 33$
The second row of the theatre has 33 seats.</td><td>• correctly determines the number of seats in the second row [1 mark]</td></tr>
<tr><td>16b)</td><td>$t_3 = t_2 + 8$ $\quad t_4 = t_3 + 8$
$= 33 + 8$ $\quad = 41 + 8$
$= 41$ $\quad = 49$
<table><tr><td>Row</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Number of seats</td><td>25</td><td>33</td><td>41</td><td>49</td></tr></table>Total number of seats in first four rows of the theatre
$= 25 + 33 + 41 + 49$
$= 148$</td><td>• correctly completes the table to display the first four terms [1 mark]
• calculates total number of seats in first four rows [1 mark]</td></tr>
<tr><td>17a)</td><td>A planar graph can be drawn so that no edges cross each other.</td><td>• correctly defines a planar graph [1 mark]</td></tr>
<tr><td>17b)</td><td>5 faces</td><td>• correctly states the number of faces [1 mark]</td></tr>
</table>

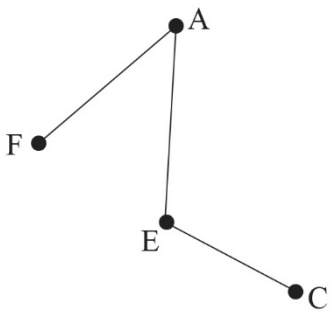
Q	Sample response	The response:
17c)	$v = 6$ $e = 9$ $v + f - e$ $= 6 + 5 - 9$ $= 2$	• correctly identifies the number of vertices and edges for the graph **[1 mark]** • shows Euler's formula works for the graph **[1 mark]**
18	Using compound interest rule $P = 3000$ $i = \frac{0.042}{12} = 0.0035$ $n = 18 \times 12 = 216$ $A = P(1+i)^n$ $= 3000 \times (1 + 0.0035)^{216}$ $A = 6380.79$ $I = A - P$ $= 6380.79 - 3000$ $= 3380.79$ The amount of interest earned is \$3380.79.	• correctly determines the i and n values **[1 mark]** • substitutes into appropriate rule **[1 mark]** • determines value of investment **[1 mark]** • determines amount of interest earned **[1 mark]**

Q	Sample response	The response:
19a)		• correctly identifies the explanatory and response variables **[1 mark]** • accurately plots points **[1 mark]** • formats scatterplot with appropriate scaling and labelling of axes **[1 mark]**
19b)	The form of the relationship is linear.	• states form as linear **[1 mark]**
20a)	Pearson's correlation coefficient is 0.986. So, it is a strong association.	• correctly identifies the value of Pearson's correlation coefficient **[1 mark]** • correctly describes the strength as strong **[1 mark]**
20b)	A confounding variable is another variable that has a similar effect on the response variable.	• correctly defines confounding variable **[1 mark]**
20c)	Air temperature, x, and number of vehicles, y, are both lower at earlier and later times of day when train user vehicles are arriving and leaving the train station; and are both higher in the middle of the day when train users are at work.	• correctly explains why t could be a confounding variable **[1 mark]**
21a)	Quarterly interest rate, $i = \frac{5.2}{100 \times 4}$ $= 0.013$	• correctly determines the quarterly interest rate **[1 mark]**

Q	Sample response	The response:
21b)	$A = \frac{M}{i}$ $A = \frac{975}{0.013}$ $A = 75\,000$ The value of the perpetuity is \$75 000.	• substitutes into appropriate rule **[1 mark]** • calculates value of perpetuity **[1 mark]**
22a)	$\text{Monthly rate} = \frac{8.4}{100 \times 12} = 0.007$ $A_{n+1} = rA_n - R$ $A_{n+1} = 1.007A_n - 250$	• correctly calculates the monthly interest rate **[1 mark]** • determines recurrence relation **[1 mark]**
22b)	$A_0 = 15\,000$ $A_1 = 1.007 \times 15\,000 - 250 = 14\,855$ $A_2 = 1.007 \times 14\,855 - 250 = 14\,708.99$ Loan balance after two months is \$14 708.99	• determines loan balance after two months **[1 mark]**

Q	Sample response	The response:
22c)	**Method 1** Reduction in loan balance = 15 000 – 14 708.99 = $291.01 Total repayments = 2 × 250 = $500 Total amount of interest paid in first two months = total repayments – reduction in loan balance = 2 × 250 – 291.01 = $208.99	• determines reduction in loan balance in first two months **[1 mark]** • determines total repayments in first two months **[1 mark]** • determines total amount of interest paid in the first two months **[1 mark]**
	Method 2 Interest paid in month 1 = 0.007 × 15 000 = 105 Interest paid in month 2 = 0.007 × 14 855 = 103.99 Total amount of interest paid in first two months = 105 + 103.99 = $208.99	• determines interest paid in first month **[1 mark]** • determines interest paid in second month **[1 mark]** • determines total amount of interest paid in the first two months **[1 mark]**

Q	Sample response	The response:
23a)	Minimum spanning tree:  	• correctly draws a spanning tree on the diagram **[1 mark]** • correctly draws the minimum spanning tree on the diagram **[1 mark]**
23b)	Minimum total pipeline length = 235 + 230 + 200 + 210 + 280 + 260 + 320 = 1735 km 1735 < 2000, so 2000 km of pipeline is sufficient.	• determines minimum total pipeline length **[1 mark]** • provides appropriate statement of reasonableness linked to prior working **[1 mark]**

Q	Sample response	The response:
24a)	$\begin{array}{c\|cccccc} & A & B & C & D & E & F \\ \hline A & 0 & 0 & 0 & 0 & 1 & 1 \\ B & 0 & 0 & 1 & 0 & 1 & 0 \\ C & 0 & 1 & 0 & 1 & 1 & 0 \\ D & 0 & 0 & 1 & 0 & 1 & 0 \\ E & 1 & 1 & 1 & 1 & 0 & 1 \\ F & 1 & 0 & 0 & 0 & 1 & 0 \end{array}$	• correctly completes entries for one row or one column in a 6 × 6 matrix with same horizontal and vertical labels **[1 mark]** • correctly completes adjacency matrix **[1 mark]**
24b)	Simple, connected	• correctly identifies simple and connected only **[1 mark]**
24c)	Students B, D and E study an identical subject to student C.	• correctly identifies B, D and E only **[1 mark]**
24d)		• correctly draws and labels a connected subgraph that contains student E and has three edges and no cycles **[1 mark]**

<table>
<tr><th>Q</th><th>Sample response</th><th>The response:</th></tr>
<tr><td>25a)</td><td>2022 mean rainfall = (410 + 30 + 205 + 1135)/4 = 445
2023 mean rainfall = (390 + 20 + 150 + 1100)/4 = 415

<table><tr><td></td><td>2022</td><td>2023</td></tr><tr><td>Autumn</td><td>410/445 = 0.9213</td><td>390/415 = 0.9398</td></tr><tr><td>Winter</td><td>30/445 = 0.0674</td><td>20/415 = 0.0482</td></tr><tr><td>Spring</td><td>205/445 = 0.4607</td><td>150/415 = 0.3614</td></tr><tr><td>Summer</td><td>1135/445 = 2.5506</td><td>1100/415 = 2.6506</td></tr></table>

<table><tr><td></td><td>Seasonal index</td></tr><tr><td>Autumn</td><td>(0.9213 + 0.9398)/2 = 0.9306</td></tr><tr><td>Winter</td><td>(0.0674 + 0.0482)/2 = 0.0578</td></tr><tr><td>Spring</td><td>(0.4607 + 0.3614)/2 = 0.4111</td></tr><tr><td>Summer</td><td>(2.5506 + 2.6506)/2 = 2.6006</td></tr></table></td><td>• correctly calculates the 2022 mean rainfall and 2023 mean rainfall [1 mark]

• calculates seasonal ratios for 2022 and 2023 [1 mark]

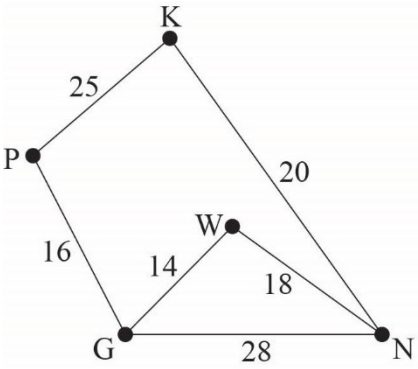
• calculates seasonal index for each season [1 mark]</td></tr>
<tr><td>25b)</td><td><table><tr><td></td><td>Autumn</td><td>Winter</td><td>Spring</td><td>Summer</td></tr><tr><td>Deseasonalised rainfall</td><td>130/0.92 = 141.30</td><td>145/1.02 = 142.16</td><td>155/1.12 = 138.39</td><td>132/0.94 = 140.43</td></tr></table>
Winter has the highest seasonally adjusted rainfall.</td><td>• correctly calculates the deseasonalised rainfall for each season [1 mark]

• identifies season with highest seasonally adjusted rainfall [1 mark]</td></tr>
</table>

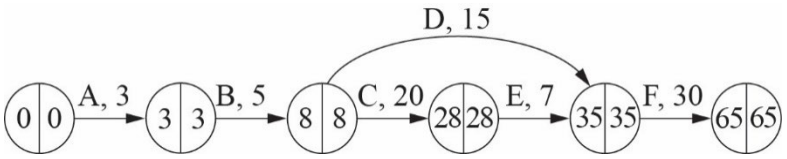
Paper 2: Short response

<table>
<tr><th>Q</th><th>Sample response</th><th>The response:</th></tr>
<tr>
<td>1</td>
<td>
<table>
<tr><th></th><th>Year 11</th><th>Year 12</th><th>Total</th></tr>
<tr><td>Musician</td><td>32 – 8 = 24</td><td>half of 28 = 14</td><td>24 + 14 = 38</td></tr>
<tr><td>Dancer</td><td>one-quarter of 32 = 8</td><td>half of 28 = 14</td><td>8 + 14 = 22</td></tr>
<tr><td>Total</td><td>32</td><td>28</td><td>60</td></tr>
</table>
Percentage of students who are musicians:
$\frac{38}{60} \times 100\% = 63.\dot{3}\%$
</td>
<td>
• correctly calculates the frequencies for total Year 11 students and total Year 12 students [1 mark]
• calculates frequencies for dancers in Year 11 and dancers in Year 12 [1 mark]
• calculates frequencies for musicians in Year 11 and musicians in Year 12 [1 mark]
• calculates frequencies for total musicians and total dancers [1 mark]

• calculates percentage of students who are musicians [1 mark]
</td>
</tr>
</table>

Q	Sample response	The response:
2	 Hamiltonian cycle beginning at Waiben: WGPKNW Total travel time = sum of travelled edges = 14 + 16 + 25 + 20 + 18 = 93 min	• correctly constructs a graph showing all 5 labelled vertices and all 6 edges **[1 mark]** • correctly shows weights on all 6 edges **[1 mark]** • identifies a Hamiltonian cycle beginning at Waiben **[1 mark]** • determines total travel time **[1 mark]**

Q	Sample response	The response:
3	slope, $b = -0.227$ vertical axis intercept, $a = 16.7$ $y = a + bx$ $y = 16.7 - 0.227x$	• correctly determines the values for the slope and vertical axis intercept **[1 mark]** • determines least-squares line equation **[1 mark]**
	Let $x = 43$ $y = 16.7 + -0.227(43)$ $y = 6.9$ The predicted ultraviolet index is 7. The notification is reasonable because an ultraviolet index of 7 corresponds to high.	• substitutes latitude into least-squares line equation **[1 mark]** • predicts UV index **[1 mark]** • provides appropriate statement of reasonableness linked to prior working **[1 mark]**

Q	Sample response	The response:
4	 Activity D is a non-critical activity. Float time for D = 35 – 8 – 15 = 12 minutes	• correctly translates information into a network diagram showing all activities and durations **[1 mark]** • completes forward scanning to determine EST for each activity **[1 mark]** • completes backward scanning to determine LST for each activity **[1 mark]** • identifies non-critical activity **[1 mark]** • determines float time for non-critical activity **[1 mark]**

Q	Sample response	The response:
5	**Method 1** Calculate x (distance from A to P): Angular distance $= 28° - 20° = 8°$ $D = 111.2 \times 8° \approx 890$ km Calculate y (distance from A to R): Angular distance $= 147° - 136° = 11°$ $D = 111.2 \times \cos 20° \times 11° \approx 1149$ km P Q R row reduction A 890 600 1149 −600 B 445 485 340 −340 C 980 1170 770 −770 $\begin{bmatrix} 290 & 0 & 549 \\ 105 & 145 & 0 \\ 210 & 400 & 0 \end{bmatrix}$ column reduction −105 0 0 $\begin{bmatrix} \sout{185} & \sout{0} & \sout{549} \\ \sout{0} & \sout{145} & \sout{0} \\ \sout{105} & \sout{400} & \sout{0} \end{bmatrix}$	• correctly calculates distance x in kilometres **[1 mark]** • correctly calculates distance y in kilometres **[1 mark]** • reduces each row **[1 mark]** • reduces each column **[1 mark]**

Q	Sample response	The response:
	Number of lines needed to cover all zeros = number of tasks (3 = 3), so allocate planes. For minimum distance, the plane allocation is airbase A to site Q, airbase B to site P and airbase C to site R. Minimum total distance flown = 600 + 445 + 770 = 1815 km	• identifies optimal allocation for each plane **[1 mark]** • determines minimum total distance flown **[1 mark]**

Q	Sample response	The response:
5	**Method 2** Calculate x (distance from A to P): Angular distance $= 28° - 20° = 8°$ $D = 111.2 \times 8° \approx 890$ km Calculate y (distance from A to R): Angular distance $= 147° - 136° = 11°$ $D = 111.2 \times \cos 20° \times 11° \approx 1149$ km P Q R A 890 600 1149 B 445 485 340 C 980 1170 770 column reduction –445 –485 –340 row reduction $\begin{bmatrix} 445 & 115 & 809 \\ 0 & 0 & 0 \\ 535 & 685 & 430 \end{bmatrix}$ –115 0 –430 $\begin{bmatrix} \cancel{330} & \cancel{0} & \cancel{694} \\ \cancel{0} & \cancel{0} & \cancel{0} \\ \cancel{105} & \cancel{255} & \cancel{0} \end{bmatrix}$	• correctly calculates distance x in kilometres **[1 mark]** • correctly calculates distance y in kilometres **[1 mark]** • reduces each column **[1 mark]** • reduces each row **[1 mark]**

Q	Sample response	The response:
	Number of lines needed to cover all zeros = number of tasks (3 = 3), so allocate planes. For minimum distance, the plane allocation is airbase A to site Q, airbase B to site P and airbase C to site R. Minimum total distance flown = 600 + 445 + 770 = 1815 km	• identifies optimal allocation for each plane **[1 mark]** • determines minimum total distance flown **[1 mark]**

Q	Sample response	The response:
5	**Method 3** Calculate x (distance from A to P): Angular distance $= 28° - 20° = 8°$ $D = 111.2 \times 8° \approx 890$ km Calculate y (distance from A to R): Angular distance $= 147° - 136° = 11°$ $D = 111.2 \times \cos 20° \times 11° \approx 1149$ km For minimum distance, the plane allocation is airbase A to site Q, airbase B to site P and airbase C to site R. Minimum total distance flown = 600 + 445 + 770 = 1815 km	• correctly calculates distance x in kilometres **[1 mark]** • correctly calculates distance y in kilometres **[1 mark]** • correctly identifies all six possible allocations **[1 mark]** • determines total distance for all six possible allocations **[1 mark]** • identifies optimal allocation for each plane **[1 mark]** • determines minimum total distance flown **[1 mark]**

Possible Allocation		Total distance (km)
A to P, B to Q, C to R	890 + 485 + 770	2145
A to P, B to R, C to Q	890 + 340 + 1170	2400
A to Q, B to P, C to R	600 + 445 + 770	1815
A to Q, B to R, C to P	600 + 340 + 980	1920
A to R, B to P, C to Q	1149 + 445 + 1170	2764
A to R, B to Q, C to P	1149 + 485 + 980	2614

Q	Sample response	The response:
6	Daily cost for a person in 2021 (n =1). $m_1 = c = \$60$ $a_1 = 2c = \$120$ In 2025, $n = 5$ Daily cost for a person in 2025 for meals: $m_n = m_1 + 3(n-1)$ $m_5 = 60 + 3(5-1)$ $= \$72$ Daily cost for a person in 2025 for accommodation: $a_n = a_1 \times 1.1^{(n-1)}$ $a_5 = 120 \times 1.1^{(5-1)}$ $= \$175.69$	• correctly determines values for m_1 and a_1 **[1 mark]** • correctly determines $n = 5$ **[1 mark]** • uses arithmetic model to determine daily cost for a person in 2025 for meals (m_5) **[1 mark]** • uses geometric model to determine daily cost for a person in 2025 for accommodation (a_5) **[1 mark]**

Q	Sample response	The response:
	Total cost for a person in 2025 for 7 days $= 72 \times 7 + 175.69 \times 7$ $= \$1733.83$ $1500 < 1733.83 < 2000$ $\therefore$ The estimate is reasonable as \$1733.83 is between \$1500 and \$2000.	• calculates total cost for a person in 2025 for 7 days **[1 mark]** • provides appropriate statement of reasonableness linked to prior working **[1 mark]**

Q	Sample response	The response:
7	Total flight distance from Sydney to Los Angeles = 4828 + 7242 = 12 070 km Time difference between Sydney (UTC +10) and Los Angeles (UTC –8) = +10 – (–8) = 18 hours ∴ Sydney is 18 hours ahead of Los Angeles. Local time and day in Sydney when flight arrives in Los Angeles = 6:50 pm Tuesday + 18 h = 12:50 pm Wednesday Total flight duration from Sydney to Los Angeles = 12:50 pm Wednesday – 9:50 pm Tuesday = 15 hours Proportion of total flight distance when 4828 km travelled $= \frac{4828}{12070} \times 100$ = 40% Flight duration when 4828 km travelled = 40% of 15 h	• correctly calculates the total flight distance and the absolute time difference between locations **[1 mark]** • applies relative time difference to Los Angeles arrival time (or Sydney departure time) to determine local time and day in other location **[1 mark]** • calculates total flight duration **[1 mark]** • shows use of appropriate method to determine flight duration **[1 mark]**

Q	Sample response	The response:
	= 6 hours Local time and day in Sydney when 4828 km travelled = 9:50 pm Tuesday + 6 h = 3:50 am Wednesday	• determines flight duration when 4828 km travelled **[1 mark]** • determines local time and day in Sydney when 4828 km travelled **[1 mark]** • shows logical organisation, communicating key steps **[1 mark]**