

Marking Scheme for Sec 4E/5N EMath Prelim P1 (2025)

|    |                                                                                                                                                                                                                                                                                                                                                |        |
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| 1  | $\frac{2x+5}{2} > 1-4x$                                                                                                                                                                                                                                                                                                                        |        |
|    | $2x+5 > 2-8x$                                                                                                                                                                                                                                                                                                                                  | M<br>1 |
|    | $10x > -3$                                                                                                                                                                                                                                                                                                                                     |        |
|    | $x > -\frac{3}{10}$                                                                                                                                                                                                                                                                                                                            | A1     |
|    |                                                                                                                                                                                                                                                                                                                                                |        |
|    |                                                                                                                                                                                                                                                                                                                                                |        |
| 2  | Total amount = $P\left(1+\frac{r}{100}\right)^n$                                                                                                                                                                                                                                                                                               |        |
|    | $620 = 400\left(1+\frac{x}{100}\right)^{2 \times 12}$                                                                                                                                                                                                                                                                                          | M<br>1 |
|    | $x = 1.8428 = 1.84$                                                                                                                                                                                                                                                                                                                            | A1     |
|    |                                                                                                                                                                                                                                                                                                                                                |        |
| 3  | $15 = 3 \times 5$                                                                                                                                                                                                                                                                                                                              |        |
|    | $45 = 3 \times 3 \times 5$                                                                                                                                                                                                                                                                                                                     | M<br>1 |
|    | Thus, the smallest value of $x = 9$                                                                                                                                                                                                                                                                                                            | A1     |
|    |                                                                                                                                                                                                                                                                                                                                                |        |
| 4a | By observation, median mark is 55.                                                                                                                                                                                                                                                                                                             | A1     |
|    |                                                                                                                                                                                                                                                                                                                                                |        |
| 4b | The lower quartile mark is 40 marks, representing the bottom 25% of students.<br>Thus, Rachel is wrong.                                                                                                                                                                                                                                        | A1     |
|    |                                                                                                                                                                                                                                                                                                                                                |        |
| 5a | Answer A : The size of the worker symbol distorts the graph.<br>(Only accept this answer)                                                                                                                                                                                                                                                      | A1     |
|    |                                                                                                                                                                                                                                                                                                                                                |        |
| 5b | Answer A : The area is not proportional to the actual decrease in unemployed workers. The number of unemployed workers in 2020 is half of that in 2010. However, the size of worker symbol is less than half the size of worker symbol for 2010.<br><br>Or Answer B : It exaggerates the differences between the number of unemployed workers. | A1     |
|    |                                                                                                                                                                                                                                                                                                                                                |        |
| 6a | $\sin \hat{MBC} = \frac{40}{41}$                                                                                                                                                                                                                                                                                                               | A1     |
|    |                                                                                                                                                                                                                                                                                                                                                |        |
| 6b | $\cos \hat{BCN} = -\frac{40}{41}$                                                                                                                                                                                                                                                                                                              | A1     |
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| 7   | $Q : P : R = 125 : 100 : 87.5 = 10 : 8 : 7$                                                                                                                                | M<br>1                         |
|     | $P : R = 8 : 7$                                                                                                                                                            | A1                             |
|     |                                                                                                                                                                            |                                |
| 8   | $8^{1-b} = 16^{b-3}$                                                                                                                                                       |                                |
|     | $2^{3(1-b)} = 2^{4(b-3)}$                                                                                                                                                  | M<br>1                         |
|     | By comparing, $3(1-b) = 4(b-3)$<br>$3-3b = 4b-12$<br>$15 = 7b$                                                                                                             | M<br>1                         |
|     | $b = \frac{15}{7}$                                                                                                                                                         | A1                             |
|     |                                                                                                                                                                            |                                |
| 9   | $\frac{a}{(2a-1)^2} - \frac{2a}{1-2a}$ $= \frac{a}{(2a-1)^2} + \frac{2a}{2a-1}$ $= \frac{a+2a(2a-1)}{(2a-1)^2}$ $= \frac{a+4a^2-2a}{(2a-1)^2}$ $= \frac{4a^2-a}{(2a-1)^2}$ | M<br>1<br><br>M<br>1<br><br>A1 |
|     |                                                                                                                                                                            |                                |
| 10a | 1 cm : 200 000 cm                                                                                                                                                          |                                |
|     | 1 cm : 2 km                                                                                                                                                                |                                |
|     | 8 cm : <u>16 km</u>                                                                                                                                                        | A1                             |
|     |                                                                                                                                                                            |                                |
| 10b | 1 cm : 2 km                                                                                                                                                                |                                |
|     | 1 cm <sup>2</sup> : 4 km <sup>2</sup>                                                                                                                                      | M<br>1                         |
|     | <u>150 cm<sup>2</sup></u> : 600 km <sup>2</sup>                                                                                                                            | A1                             |
|     |                                                                                                                                                                            |                                |
| 11a | $20ab - 4b = 4b(5a - 1)$                                                                                                                                                   | A1                             |
|     |                                                                                                                                                                            |                                |
| 11b | $3xy - 2ab - ay + 6xb$                                                                                                                                                     |                                |
|     | $= 3x(2b + y) - a(2b + y)$                                                                                                                                                 | M<br>1                         |
|     | $= (2b + y)(3x - a)$                                                                                                                                                       | A1                             |
|     |                                                                                                                                                                            |                                |
| 12a | $c = \frac{k^2 + h^2}{h}$                                                                                                                                                  |                                |

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|     |                                                                                                                                                                                  |                                |
|     | $c = \frac{(2.81)^2 + (3.67)^2}{(3.67)} = 5.8215 = 5.8$                                                                                                                          | A1                             |
|     |                                                                                                                                                                                  |                                |
| 12b | $c = \frac{k^2 + h^2}{h}$                                                                                                                                                        |                                |
|     | $hc = k^2 + h^2$                                                                                                                                                                 |                                |
|     | $k^2 = hc - h^2$                                                                                                                                                                 | M<br>1                         |
|     | $k = \pm\sqrt{hc - h^2}$                                                                                                                                                         | A1                             |
|     |                                                                                                                                                                                  |                                |
| 13a | sum of interior angles = $(n - 2)(180^\circ)$                                                                                                                                    |                                |
|     | $285^\circ + \text{fourth angle} = ((4 - 2)(180^\circ))$                                                                                                                         |                                |
|     | Fourth angle = $360^\circ - 285^\circ = 75^\circ$                                                                                                                                | A1                             |
|     |                                                                                                                                                                                  |                                |
| 13b | Given: interior angle of a regular polygon is $165^\circ$                                                                                                                        |                                |
|     | 1 ext angle = $180^\circ - 165^\circ = 15^\circ$                                                                                                                                 | M<br>1                         |
|     | 1 ext angle = $\frac{360^\circ}{n}$                                                                                                                                              |                                |
|     | $n = \frac{360^\circ}{15^\circ} = 24$                                                                                                                                            |                                |
|     | Number of sides is 24.                                                                                                                                                           | A1                             |
|     |                                                                                                                                                                                  |                                |
| 14a | The elements are {5, 6, 7, 8, 9, 11, 12, 13, 14}                                                                                                                                 | A1                             |
|     |                                                                                                                                                                                  |                                |
| 14b | <u><math>A \cap B = \emptyset</math></u> $A \cup C = \{4, 5, 7, 11\}$ <u><math>8 \notin C</math></u> $9 \subset B$                                                               | A2                             |
|     |                                                                                                                                                                                  |                                |
| 15  | $\frac{x^4 - 81}{2x - 6}$ $= \frac{(x^2)^2 - 9^2}{2(x - 3)}$ $= \frac{(x^2 - 9)(x^2 + 9)}{2(x - 3)}$ $= \frac{(x - 3)(x + 3)(x^2 + 9)}{2(x - 3)}$ $= \frac{(x + 3)(x^2 + 9)}{2}$ | M<br>1<br><br>M<br>1<br><br>A1 |
|     |                                                                                                                                                                                  |                                |
| 16a |                                                                                                                                                                                  |                                |

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|     |                                                                                                                                                                                | M<br>1 |
|     |                                                                                                                                                                                | A1     |
| 16b | The maximum point is $(-2.5, -10.25)$ .                                                                                                                                        | A1     |
| 17a | $3x = 18 \quad 3x = 18$                                                                                                                                                        |        |
|     | $x = 6$                                                                                                                                                                        | B1     |
|     | $a = 11 - 6 = 5$                                                                                                                                                               |        |
|     | $b = 11 + 6 = 17$                                                                                                                                                              |        |
|     | $c = 17 + 6 = 23$                                                                                                                                                              | A1     |
| 17b | $6n - 1$                                                                                                                                                                       | A1     |
| 17c | $6n$ is always an even number regardless the value of $n$ . $6n - 1$ will always be an odd number. Therefore, the value of every term must be odd for all values of $n$ .      | B1     |
| 18a | $2.4 \times 10^{-4}$                                                                                                                                                           | A1     |
| 18b | $5.4246 \times 10^4$ megametres $= 5.4246 \times 10^4 \times 10^6 \text{ m} = 5.4246 \times 10^{10} \text{ m}$                                                                 | A1     |
| 18c | $(5.2 \times 10^{50}) - (2.0 \times 10^{49}) = (10^{49})(5.2 \times 10 - 2.0)$                                                                                                 | M<br>1 |
|     | $= (10^{49})(52 - 2.0) = (10^{49})(50) = 5.0 \times 10^{50}$                                                                                                                   | A1     |
| 19a | $\text{Perimeter of shaded region} = \frac{60^\circ}{360^\circ} \times 2\pi(4) + 4 + 4 + \frac{60^\circ}{360^\circ} \times 2\pi(8)$<br>$= 20.566 \text{ cm} = 20.6 \text{ cm}$ | M<br>1 |
| 19b | $\text{Area of shaded region} = \frac{60^\circ}{360^\circ} \times \pi(8)^2 - \frac{60^\circ}{360^\circ} \times \pi(4)^2$                                                       |        |
|     | $\frac{60^\circ}{360^\circ} \times \pi(8)^2 - \frac{60^\circ}{360^\circ} \times \pi(4)^2$                                                                                      | M<br>1 |
|     | $= 25.133 \text{ cm}^2 = 25.1 \text{ cm}^2$                                                                                                                                    | A1     |
| 20a | $\frac{\text{area of raised stage}}{\text{area of central stage}} = \left(\frac{2}{3.5}\right)^2 = \frac{16}{49}$                                                              | B1     |
|     | $\frac{\text{area of raised stage}}{\text{area of water stage}} = \frac{16}{49 - 16} = \frac{16}{33}$                                                                          | A1     |
| 20b |                                                                                                                                                                                |        |

|     |                                                                                                          |                  |
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|     |                                                                                                          | B1               |
|     |                                                                                                          | A1               |
| 21a | By Pythagoras' Thm, $AC^2 = BC^2 + AB^2$                                                                 |                  |
|     | $BC^2 = 110^2 - 70^2 = 7200$                                                                             |                  |
|     | $BC = 84.8528 = 84.9 \text{ km}$                                                                         | A1               |
| 21b | $\text{Angle } BAC = \cos^{-1}\left(\frac{70}{110}\right) = 50.479^\circ$                                | M<br>1           |
|     | The bearing of $B$ from $A = 90^\circ - \text{Angle } BAC = 39.5^\circ$                                  | M<br>1<br>A<br>1 |
| 22  | $\text{Gradient of the line } AB = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - 1}{6 - (-2)} = -\frac{3}{4}$ | M<br>1<br>B1     |
|     | Equation of $AB$ is $y = -\frac{3}{4}x + q$ ..... (1)                                                    |                  |
|     | Sub $(6, -5)$ into (1)                                                                                   |                  |
|     | $-5 = -\frac{3}{4}(6) + q$                                                                               |                  |
|     | $q = -\frac{1}{2}$                                                                                       | B1               |
|     | Thus, equation of $AB$ is $y = -\frac{3}{4}x - \frac{1}{2}$                                              |                  |
|     | When $y = 0$ , $0 = -\frac{3}{4}p - \frac{1}{2}$                                                         |                  |
|     | $p = -\frac{2}{3}$                                                                                       | B1               |
|     | The $y$ -coordinate of $E = -\frac{1}{2} - \frac{2}{3} = -\frac{7}{6}$                                   |                  |
|     | Thus, $y$ -intercept of $CD$ is $-\frac{7}{6}$                                                           |                  |
|     | Since $CD$ is parallel to $AB$ , they have the same gradient.                                            |                  |
|     | Thus, the equation of $CD$ is $y = -\frac{3}{4}x - \frac{7}{6}$                                          | A1               |
| 23a | Interquartile range $= Q_3 - Q_1 = 56 - 38$                                                              | M<br>1           |
|     | $= 18$                                                                                                   | A1               |

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| 23b | $P(\text{obtained a distinction grade}) = \frac{200-180}{200}$                                                                                                                                                      | M<br>1                         |
|     | $= \frac{20}{200} = \frac{1}{10}$                                                                                                                                                                                   | A1                             |
| 23c | The shape of the cumulative frequency curve of the second group of students will similar with the one of the first group of students in steepness in the middle 50% of the data , but <b>shifted to the right</b> . | A1                             |
| 24a | $\text{angle } ODC = \frac{180^\circ - 82}{2} = 49^\circ$<br>(base $\angle$ s of isos. $\Delta$ )                                                                                                                   | A1                             |
| 24b | $\text{angle } CED = \frac{\angle COD}{2} = \frac{82^\circ}{2} = 41^\circ$<br>(angle at the centre = 2 x angle at circumference)                                                                                    | B1                             |
|     | $\text{angle } AEC = 180^\circ - \text{angle } ABD - \text{angle } CED \text{ (}\angle\text{s in opp. segments)}$                                                                                                   |                                |
|     | $= 180^\circ - 55^\circ - 41^\circ = 84^\circ$                                                                                                                                                                      | A1                             |
| 24c | Let angle $BDC$ be $y$ .                                                                                                                                                                                            |                                |
|     | angle $DBC + x^\circ + \text{angle } OCD + y = 180^\circ$ ( $\angle$ sum of $\Delta$ )                                                                                                                              |                                |
|     | $41^\circ + x^\circ + 49^\circ + y = 180^\circ \dots\dots\dots(1)$                                                                                                                                                  |                                |
|     | angle $BAE + x^\circ + \text{angle } CDE - y = 180^\circ$ ( $\angle$ s in opp. segments)                                                                                                                            |                                |
|     | $70^\circ + x^\circ + 49^\circ - y = 180^\circ \dots\dots\dots(2)$                                                                                                                                                  | M<br>1                         |
|     | $(1) + (2), 209^\circ + 2x^\circ = 360^\circ$                                                                                                                                                                       | M<br>1                         |
|     | $x^\circ = 75.5^\circ$                                                                                                                                                                                              | A1                             |
| 25a | $12.7 = \frac{10 + 2x^3 + 20 + 9 + 13 + 7 + 14}{7}$<br>$88.9 = 73 + 2x^3$<br>$x = \sqrt[3]{\frac{88.9 - 73}{2}} = 1.995 = 2$                                                                                        | M<br>1<br><br>M<br>1<br><br>A1 |
| 25b | Standard Deviation = \$7.74                                                                                                                                                                                         | A1                             |
| 25c | 1. The mean expense of Paul is more than Susan's, implying that he has spent more than Susan.                                                                                                                       | A1                             |
|     | 2. The standard deviation of Susan's expenses is lower than Paul's, indicating a more consistent in her spending.                                                                                                   | A1                             |
| 26a |                                                                                                                                                                                                                     |                                |

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|     | Coordinates of $P$ is $(-11, 3)$                                                                                                                                                                                                                         | A1                             |
| 26b | $\sqrt{(a - (-5))^2 + (2 - 4)^2} = \sqrt{148}$ $(a + 5)^2 + (-2)^2 = 148$ $(a + 5)^2 = 148 - 4 = 144$ $(a + 5) = 12 \text{ or } -12$ $a = 7 \text{ (rejected) or } -17$ <p>Thus, <math>a = -17</math></p>                                                | M<br>1<br><br>M<br>1<br><br>A1 |
| 26c | <del>Given</del><br>$\vec{RT} = \begin{pmatrix} 18 \\ 3 \end{pmatrix}$                                                                                                                                                                                   |                                |
|     | <del>Given</del> <del>Given</del> <del>Given</del><br>$\vec{RQ} = \vec{OQ} - \vec{OR} = \begin{pmatrix} -5 \\ 4 \end{pmatrix} - \begin{pmatrix} -17 \\ 2 \end{pmatrix} = \begin{pmatrix} 12 \\ 2 \end{pmatrix} = 2 \begin{pmatrix} 6 \\ 1 \end{pmatrix}$ |                                |
|     | <del>Given</del><br>$\vec{RT} = \begin{pmatrix} 18 \\ 3 \end{pmatrix} = 3 \begin{pmatrix} 6 \\ 1 \end{pmatrix}$                                                                                                                                          |                                |
|     | <del>By observation,</del><br>$\vec{RQ} = \frac{2}{3} \vec{RT}$                                                                                                                                                                                          | M<br>1                         |
|     | <del>Since</del> <del>Since</del><br>1. Since $\vec{RT} = k \vec{RQ}$ and $R$ is the common point of both vectors, $R$ , $Q$ and $T$ lie on the same straight line.                                                                                      | A1                             |
|     | 2. The magnitude of $RT$ is 2 times of the magnitude of $RQ$ .                                                                                                                                                                                           | A1                             |
|     |                                                                                                                                                                                                                                                          |                                |