

Yio Chu Kang Secondary School
4E/5N Prelim Mathematics P2 2025
Mark Scheme

Qn	Solutions	Marks	Marker's Comments
1(a)	$-5 < 2x - 3 \leq 7$ $-5 < 2x - 3$ $2x - 3 \leq 7$ $-1 < x$ $x \leq 5$ $-1 < x \leq 5$ Prime numbers are 2, 3, 5.	M1 M1 A1	Many students did not combine final inequality to $-1 < x \leq 5$. Avoid doing by guess-and-check. Form simultaneous inequalities to solve. Those who simply wrote 2, 3, 5 get a maximum of 2 marks. Some still think that negative numbers and '1' are prime.
1(b)	$\frac{18c^3d^3}{5f^3} \div \frac{3c^5d^2}{10f}$ $= \frac{18c^3d^3}{5f^3} \times \frac{10f}{3c^5d^2}$ $= \frac{12d}{c^2f^2}$	B2 (deduct 1 m for 1 error)	No mark awarded for 'keep, change, flip'.
1(c)	$\left(\frac{16y^8}{81x^{12}} \right)^{-\frac{3}{4}}$ $= \left(\frac{3^4x^{12}}{2^4y^8} \right)^{\frac{3}{4}}$ $= \frac{27x^9}{8y^6}$	M1 A1	Cannot have a fraction within another fraction. That is not simplified.

1(d)	$\frac{3x}{(2x-1)^2} - \frac{2}{2x-1}$ $= \frac{3x - 2(2x-1)}{(2x-1)^2}$ $= \frac{3x - 4x + 2}{(2x-1)^2}$ $= \frac{-x + 2}{(2x-1)^2}$	M1 A1	$(2x-1)^2 \neq (2x-1)(2x+1)$ Many still get this Sec 2 identity mixed up.
2 (a)(i)	$\mathbf{T} = 5 \begin{pmatrix} 20 & 32 & 15 \\ 15 & 35 & 18 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$ $\mathbf{T} = 5 \begin{pmatrix} 67 \\ 68 \end{pmatrix}$ $\mathbf{T} = \begin{pmatrix} 335 \\ 340 \end{pmatrix}$	M1 A1	1 mark awarded for matrix multiplication without $\begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$ matrix.
(a)(ii)	The elements represent the <u>total number of mangoes, apples and oranges</u> sold by seller A and B respectively in <u>5 days</u> .	B1	“Weekdays” not allowed. It is ‘5 days’, “weekday” or “weekend” not mentioned. Total number, not average number.
(b)(i)	$\mathbf{C} = \begin{pmatrix} 80 & 70 \\ 50 & 40 \\ 60 & 50 \end{pmatrix} \quad \text{or} \quad \mathbf{C} = \begin{pmatrix} 0.80 & 0.70 \\ 0.50 & 0.40 \\ 0.60 & 0.50 \end{pmatrix}$	B1	
(b)(ii)	$\mathbf{P} = \begin{pmatrix} 20 & 32 & 15 \\ 15 & 35 & 18 \end{pmatrix} \begin{pmatrix} 80 & 70 \\ 50 & 40 \\ 60 & 50 \end{pmatrix}$ $\mathbf{P} = \begin{pmatrix} 4100 & 3430 \\ 4030 & 3350 \end{pmatrix} \quad \text{or} \quad \begin{pmatrix} 41.00 & 34.30 \\ 40.30 & 33.50 \end{pmatrix}$	A1 for 2 correct elements A2 for 4 correct elements	

(b)(iii))	Seller A receives a total of \$41 while seller B receives \$33.50. <u>Seller A made a higher profit.</u>	B1	“Total sales /total revenue ” not “total selling price”
(c)	$\mathbf{N} = \begin{pmatrix} 0.8 & 0 & 0 \\ 0 & 0.9 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 80 & 70 \\ 50 & 40 \\ 60 & 50 \end{pmatrix}$ $\mathbf{N} = \begin{pmatrix} 64 & 56 \\ 45 & 36 \\ 60 & 50 \end{pmatrix}$	M1 A1	Many still do not know that the orders of matrices are important for matrix multiplication.
3(a)	Gradient of $PR = \frac{17 - (-1)}{7 - (-2)}$ $= 2$ Gradient of $SQ = -\frac{1}{2}$ Equation of $SQ: y = -\frac{1}{2}x + c$ Sub $S(20, 3)$ $3 = -\frac{1}{2}(20) + c$ $c = 13$ Equation of $SQ: y = -\frac{1}{2}x + 13$	M1 M1 M1 A1	Error carried forward (ecf) maximum of 2 marks.

(b)	$\sqrt{[5 - (-4)]^2 + (3 - h)^2} = 15$ $9^2 + (3 - h)^2 = 225$ $(3 - h)^2 = 144$ $3 - h = 12 \quad \text{or} \quad 3 - h = -12$ $h = -9 \quad \text{or} \quad h = 15$ Since $h > 0$, $h = 15$	M1 M1 A1	$\sqrt{81 + (h - 3)^2} \neq 9 + (h - 3)!!!$ For example, $\sqrt{81 + 25} = 10.3$ correct $\sqrt{81 + 25} = \sqrt{9 + 5} = \sqrt{14} = 3.74$ incorrect!!!
(c)	$2x + ky - 6 = 0$ $y = -\frac{2}{k} + \frac{6}{k}$ $\frac{6}{k} = -2$ $k = -3$	M1 A1	Many wrote $2x + ky - 6 = -2$!! ‘-2’ is the y-intercept, so you should substitute $(0, -2)$ into the original equation $2x + ky - 6 = 0$.

4(a)	0.66	B1	Quite a few did not follow 2 d.p. required!!
(b)		P2 – pts plotted correctly C1 – smooth curve	Some curved were not even S-shaped! A cubic graph is S-shaped. Usually a result of one or two points incorrectly plotted. Do not extend your graph beyond the first and last points in the table. It is a curve. No part should be linear/straight-line. Many curves were not smooth; some parts had “double lines”. Some were using pencils not sharpened or not dark enough. Some lost marks as curve did not go through the middle of the plotted X.
(c)	$x^3 - 6x^2 + 8x = 12$ $x(x^2 - 6x + 8) = 12$ $\frac{x}{4}(8 - 6x + x^2) = 3$ Draw the line $y = 3$ From the graph, $x = 4.9 \pm 0.1$	M1 A1	Poorly done.

(d)(i)	Line $L : y = -\frac{1}{2}x + c$ Sub (3,1), $1 = -\frac{1}{2}(3) + c$ $c = 2\frac{1}{2}$ $y = -\frac{1}{2}x + \frac{5}{2}$	B1 for eq B1 for drawing line or B2 for drawing line	Poorly done.
(ii)	From the graph, $x = 4.2 \pm 0.1$	B1	Poorly done. Some wrote unreadable answers. You can only read to the accuracy of half the smallest box.
(iii)	$\frac{x}{4}(8 - 6x + x^2) = -\frac{1}{2}x + \frac{5}{2}$ $x(8 - 6x + x^2) = -2x + 10$ $x^3 - 6x^2 + 10x - 10 = 0$ $A = -6, B = 10, C = -10$	M1 A2 for 3 answers	Poorly done.

5(a)	$HB^2 = 5.4^2 + 3.1^2 - 2(5.4)(3.1)\cos 128^\circ$ $HB = \sqrt{59.382346}$ $HB = 7.705994$ $HB = 7.71 \text{ km (to 3 s. f.)}$	M1 A1	
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(b)	$\angle HCA = 180^\circ - 133^\circ = 47^\circ$ $\frac{5.4}{\sin 47^\circ} = \frac{6.5}{\sin \angle CHA}$ $\sin \angle CHA = \frac{6.5 \sin 47^\circ}{5.4}$ $\angle CHA = 61.68256^\circ$ $\angle CAH = 133 - 61.68256^\circ$ $\angle CAH = 71.31744$ $\angle CAH = 71.3^\circ$ (to 1 d.p.) (shown)	M1 M1 A1	When question asks for a number to “show”, you need to show the unrounded number before the rounded number that you are aiming to get.
(c)	Draw North line at A $\angle NAH = 180^\circ - 61.7^\circ = 118.3^\circ$ (int $\angle$ s) Bearing of B from A = $360^\circ - 128^\circ - 118.3^\circ$ $= 113.7^\circ$	M1 A1	Poor presentation in finding bearings. Many still rounded to 3 s.f.
(d)	$\tan 14^\circ = \frac{h}{3.1}$ $h = 0.772917$ km $\tan \theta = \frac{0.772917}{6.5}$ $\theta = 6.8^\circ$ (to 1 d.p.) angle of elevation = 6.8°	M1 M1 A1	A few students have ecf mark(s) here.

6(a)	Time taken to travel from A to B = $\frac{12}{x-3}$ h Time taken to travel from B to C = $\frac{9}{x+3}$ h $\frac{12}{x-3} + \frac{9}{x+3} = 1\frac{1}{4}$ $\frac{12(x+3) + 9(x-3)}{(x-3)(x+3)} = \frac{5}{4}$ $48x + 144 + 36x - 108 = 5(x^2 - 9)$ $84x + 36 = 5x^2 - 45$ $5x^2 - 84x - 81 = 0 \quad (\text{shown})$	M1 A1 M1 M1 A1	Many students were not able to connect speed, distance and time to form an equation.
(b)	$x = \frac{84 \pm \sqrt{(-84)^2 - 4(5)(-81)}}{2(5)}$ $x = \frac{84 \pm \sqrt{8676}}{10}$ $x = 17.7145$ or -0.91450 $x = 17.71$ or -0.91	M1 A1, A1	Some students failed to give the answers correct to 2 d.p.
(c)	The solution $x = -0.91$ must be rejected, as it results in <u>the speed x km/h, to be a negative value.</u>	B1	Some students took x to be time rather than speed.
(d)	Difference = $\left(\frac{12}{17.7145-3} - \frac{9}{17.7145+3} \right)$ h = 0.381044 h = 22.8626 min = 22 min 52 sec	M1 A1	Some used the 3 s.f. value of 17.7 to find the difference in time. This resulted in inaccurate answer. Some students do not know how to convert minutes to minutes and seconds.

7(a)(i)	$100 < p \leq 120$	B1	Most were able to get the correct interval.
(ii)	125.6 mmHg	B1	Well done
(iii)	20.1 mmHg	B1	Well done
(iv)	The blood pressures of the second group of patients <u>is less consistent than that of the first group of patients, since it has a higher SD compared to the first group.</u>	B1	Good. Many correctly used the terms ‘less consistent’ or ‘more consistent’.
(b)(i)	Group B: 142, 153, y, 157, 158, 160, 162, 164, 178 $Q_3 = \frac{162+164}{2} = 163$ $163 - Q_1 = 10$ $Q_1 = 153$ $Q_1 = \frac{153+y}{2} = 153$ $y = 153$ $x = 3 \quad (\text{shown})$	M1 M1 A1	Poorly done. A number of students gave wrong presentations: 15x means 15 multiplied by x. $Q_1 = \frac{153+15x}{2} = 153$ $15x = 306 - 153$ $15x = 153$ $x = 3$ Wrong interpretation: x is not the height $Q_1 = \frac{153+x}{2} = 153$ $x = 306 - 153$ $x = 153$ $x = 3$
(ii)	$\text{Prob} = \frac{5}{10} = \frac{1}{2}$	B1	$\frac{7}{10}$ was a common answer, not realising that lengths 152 cm and 164 cm are not included.
(iii)	$\text{Prob} = \frac{5}{10} \times \frac{3}{9} + \frac{2}{10} \times \frac{3}{9}$ $= \frac{7}{30}$	M1 A1	Many had only one possible outcome, $\frac{5}{10} \times \frac{3}{9}$, not realizing that there was another possible outcome.

8(a)(i)	$\angle BAC = \angle DAB$ (common) $\angle ACB = 90^\circ$ (angle in semicircle) $\angle ABD = 90^\circ$ (angle in semicircle) $\angle ACB = \angle ABD$	}	M1 A1 (only if both proofs are given)	Poorly done. Instead of proving 2 pairs of equal angles, answers such as AB is common were seen. Some proved 1 pair of equal angles only and concluded that the 2 triangles were similar.
(ii)	$\frac{AB}{AC} = \frac{AD}{AB}$ $\frac{AB}{6} = \frac{18}{AB}$ $AB^2 = 108$ $AB = 10.4$ cm (to 3 s. f.)		M1 A1	Poorly done. Didn't apply ratio of sides to find AB. Some correctly used Pythagoras Theorem. Diameter, $AD = 18$ cm Radius, $PB = 9$ cm, $CP = 3$ cm Found CB and AB
(b)	$OD = 12$ cm $\angle OCD = 90^\circ$ (tangent perpendicular to radius) $\cos \angle COD = \frac{8}{12}$ $\angle COD = 0.841069$ rad Area of sector $COE = \frac{1}{2}(8)^2(0.841069)$ $= 26.9142$ cm ² Area of $\triangle COD = \frac{1}{2}(8)(12) \sin 0.841069$ $= 35.7771$ cm ² Shaded area $= 2 \times (35.7771 - 26.9142)$ $= 17.7$ cm ² (to 3 s.f.)		M1 M1 M1 M1 A1	Some wrongly assumed $\angle AOB = \angle BOC = \angle COD = 60^\circ$. Some wrongly calculated Area of $\triangle COD = \frac{1}{2}(8)(12)$. Many left this question blank.

9(a)(i)	Average monthly usage $= \frac{1007.8 + 1166.3 + 1133.6 + 1249 + 1248.5 + 1282.6}{6}$ $= 1181.3 \text{ kWh}$			M1 A1	Most were able to get this right. Some approximated the correct answer to 3 s.f.
(ii)	Average monthly cost = $1181.3 \times \$0.2812 \times 1.09$ $= \$362.08$ (2 d.p.)			M1 A1	Many were able to do this. Some left the answer in cents, even though answer line showed dollar sign.
(b)			Total number of solar panels	M1 A1	Few got the correct number of solar panels. Many wrongly divided (9 m by 4 m) with (1.65 m by 1 m) and got an answer of $21.8 \approx 21$ or 22 panels.
	9 m $\div$ 1.65 m = 5.4545 $\approx$ 5	4 m $\div$ 1 m = 4	5 $\times$ 4 = 20		
	9 m $\div$ 1 m = 9	4 m $\div$ 1.65 m = 2.4242 $\approx$ 2	9 $\times$ 2 = 18		
	Maximum number of solar panels = 20				
(c)	Amount of electricity produced by solar panels per month $= 45 \text{ kWh} \times 20 \text{ solar panels} = 900 \text{ kWh}$ Average amount of electricity used per month after installation $= 1181.3 \text{ kWh} - 900 \text{ kWh} = 281.3 \text{ kWh}$ Average cost of electricity per month after installation $= 281.3 \text{ kWh} \times \$0.2812 \times 1.09 = \$86.22$ Average cost of solar panels per month $= \frac{10250 \times 2}{25 \text{ years} \times 12 \text{ months}} = \68.33 Total average cost of electricity per month after installation $= \$86.22 + \68.33 $= \$154.55 < \362.08 (from ii) Since the average cost of electricity per month paid by Chan after installing the solar panels will be less than what he is currently paying, he should go ahead and install the solar panels.			EU1 EC1 SP1 CE1 A1	Ecf from parts (a) and (b) There were some students who got full 5 marks from Ecf. Some left this question blank.

<u>Solution (values calculated per year)</u> Amount of electricity produced by solar panels per year = 10800 kWh Average amount of electricity used per year after installation = 3375.6 kWh Average cost of electricity per year after installation = \$1034.64 Average cost of solar panels per year = $\frac{10250 \times 2}{25 \text{ years}} = \\820 Total average cost of electricity per year after installation = \$1034.64 + \$820 = \$1854.64 < \$362.08 × 12 (from ii) Since the average cost of electricity per year paid by Chan after installing the solar panels will be less than what he is currently paying, he should go ahead and install the solar panels. <u>Solution (values calculated for 25 years)</u> Amount of electricity produced by solar panels for 25 years = 270000 kWh Average amount of electricity used for 25 years after installation = 84390 kWh Average cost of electricity for 25 years after installation = \$25866 Average cost of solar panels for 25 years = \$20500 Total average cost of electricity for 25 years after installation = \$25866 + \$20500 = \$46366 < 108624 Since the average cost of electricity for 25 years paid by Chan after installing the solar panels will be less than what he is currently paying, he should go ahead and install the solar panels.		
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