2024 Preliminary Examination
Mathematics (Syllabus 4052/2)
Setter: Mrs Li Geok Eng

1(a)	$\frac{5a^3}{6b} \div \frac{2ab}{4a^2b}$ $= \frac{5a^3}{6b} \times \frac{4a^2b}{2ab}$ $= \frac{5a^4}{3b}$	 B1	
(b)	$\frac{x}{8} = \frac{50}{x}$ $x^2 = 400$ $x = \pm 20$	 B2	
(c)	$\frac{4v^2 - 1}{2pv + p - 10v - 5}$ $= \frac{(2v-1)(2v+1)}{(p-5)(2v+1)}$ $= \frac{2v-1}{p-5}$	 M1 M1 A1	$(2v-1)(2v+1)$ $(p-5)(2v+1)$
(d)	$2x^2 = 3(3x-1)$ $2x^2 = 9x - 3$ $2x^2 - 9x + 3 = 0$ $x = \frac{-(-9) \pm \sqrt{(-9)^2 - 4(2)(3)}}{2(2)}$ $x = 4.14$ or 0.36	 M1 M2 A1	Quadratic eqn formed M1 for $b^2 - 4ac$ correct

<table>
<tr><td>2(a)</td><td>$3\times 3.5\% = 10.5\%$
$10.5\% - \$10374$
$100\% - \frac{10374}{10.5}\times 100$
$= \$98\,800$</td><td>M1

A1</td><td>OR
I = P x r% x T</td></tr>
<tr><td>(b)</td><td>Total petrol consumption
$= \frac{16992}{100}\times 6.7$
$= 1138.464\,l$

Total amount paid
$= 1138.464 \times \$2.72$
$= \$3096.62$</td><td>

M1

A1</td><td></td></tr>
<tr><td>(c)(i)</td><td>The decreased of 5% is compounded.
The value of the car (base) for each year is lower than the previous year.</td><td>

B1</td><td></td></tr>
<tr><td>(c)(ii)</td><td><table><tr><td>Year 0</td><td>120500</td></tr><tr><td>Year 1</td><td>$0.95\times 120500 = \$114\,475$</td></tr><tr><td>Year 2</td><td>0.95 x 114 475 = $108 751.25</td></tr><tr><td>Year 3</td><td>0.95 x 108 751.25 = $103 313.69</td></tr></table>
Ans $103 314 (nearest dollars)</td><td>M1

M1

A1</td><td>Year 1

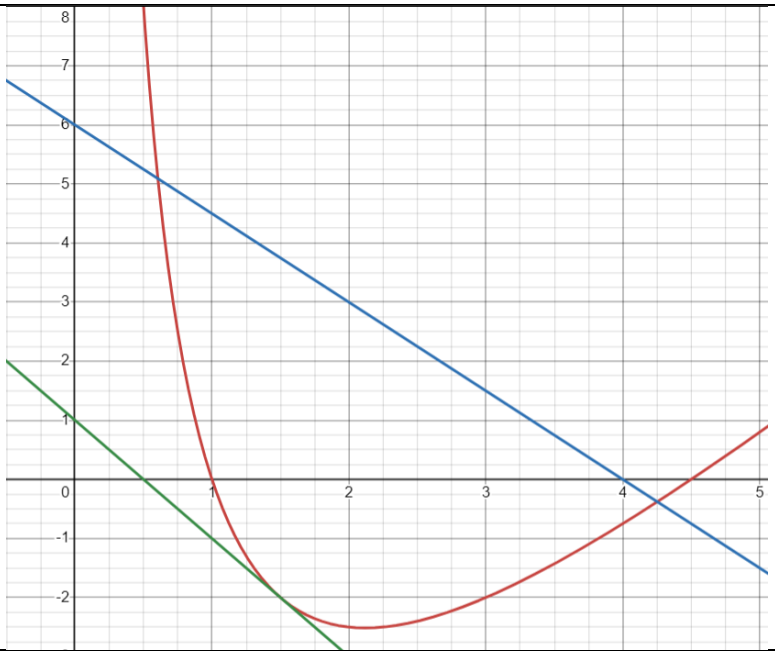
Year 2</td></tr>
</table>

3(a)(i)	$A = \{2, 3, 5, 7, 11, 13\}$ $B = \{3, 6, 9, 12\}$ $(A \cup B)' = \{4,8,10,14\}$	B1	
(a)(ii)	$(A \cap B) = \{3\}$	B1	
(a)(iii)	Any subset with 3 elements from {2,5,7,11,13}	B1	
3(b)(i)	$\left(\frac{d_1}{24}\right)^3 = \frac{1}{2}$ $d = 19.0$	M1 A1	
(b)(ii)	Let r be the radius of cone P. Volume of cone P, $v = \frac{1}{3}\pi r^2(24) = 8\pi r^2 \text{cm}^3$ Volume of cone T $= \frac{1}{3} \times \pi(2r)^2(\frac{1}{3} \times 24)$ $= = \frac{4}{3} \times 8\pi r^2$ $= \frac{4}{3}v \quad \text{cm}^3$	M1 A1	
(c)	CD is common. $DA = DB$ (tangent from an external point) Since, angle CAB = angle CBA $\Rightarrow$ triangle CAB is isosceles, Hence, $AC = BC$. Therefore, triangle ACD and triangle BCD are congruent (SSS).	B1 B1 B1	

4(a)	$(18-r)^2+12^2=r^2$ $324-36r+r^2+144=r^2$ $36r=468$ $r=13cm$	M1 A1	
(b)	Angle AOB $=2\times\tan^{-1}\left(\frac{12}{5}\right)$ $=134.76^{o}$	M1 A1	Or ½ absinC
(c)	Reflex angle AOB = $360^{o}-134.76^{o}=225.24^{o}$ Area of major sector = $\frac{225.24}{360}\times\pi(13)^2$ Area of triangle AOB = $\frac{1}{2}\times13^2\times\sin134.76$ Area of segment = $\frac{225.24}{360}\times\pi(13)^2+\frac{1}{2}\times13^2\times\sin134.76$ = 392.18 = 392 cm^2	M1 A1 M1 A1	R
(d)	Volume of water = $392.18\times40=15687.2\,cm^3$ $h=\frac{15687.2}{\pi(13)^2}$ $h=29.547\,cm$ $h=29.5\,cm$	M1 A1	

5(a)(i)	$Gradient = -8$ $3 = -8(2) + c$ $c = 19$ $y = -8x + 19$	M1 A1	
(a)(ii)	$\sqrt{(2-3)^2 + (3+5)^2}$ $= 8.06$ units OR $\overrightarrow{AB} = \begin{pmatrix} 3 \\ -5 \end{pmatrix} - \begin{pmatrix} 2 \\ 3 \end{pmatrix} = \begin{pmatrix} 1 \\ -8 \end{pmatrix}$ $\left\|\overrightarrow{AB}\right\| = \sqrt{1^2 + (-8)^2} = 8.06$	M1 A1 M1 A1	
(a)(iii)	$\overrightarrow{OC} = \begin{pmatrix} 3 \\ -5 \end{pmatrix} + \begin{pmatrix} -4 \\ 3 \end{pmatrix} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$ $C(-1, -2)$	M1 A1	
5(b)(i)	$\overrightarrow{OB} = 2\mathbf{a} + 3\mathbf{c}$	B1	
5(b)(ii)	$\overrightarrow{OT} = \frac{2}{3}(3\mathbf{c} + 2\mathbf{a})$	B1	
(b)(ii)	$\overrightarrow{AT} = -2a + \frac{2}{3}(3\mathbf{c} + 2\mathbf{a})$ $\overrightarrow{AT} = 2\mathbf{c} - \frac{2}{3}\mathbf{a}$ $\overrightarrow{AT} = \frac{2}{3}(3\mathbf{c} - \mathbf{a})$ $\overrightarrow{AM} = 3\mathbf{c} - \mathbf{a}$ $\overrightarrow{AT} = \frac{2}{3}\overrightarrow{AM}$ AT is parallel to AM and A is common. Therefore A, T and M lies on a straight line.	 M1 M1 A1	 $\overrightarrow{AT}$ or $\overrightarrow{AM}$ or $\overrightarrow{TM}$ $\overrightarrow{AT} = k\overrightarrow{AM}$

6(a)	$LB^2 = 60^2 + 37.5^2 - 2(60)(37.5)\cos 63^o$ $LB = 54.436$ $LB = 54.4\text{m}$	M2 A1	
(b)	$\frac{\sin \angle LBA}{37.5} = \frac{\sin 63}{54.436}$ $\angle LBA = 37.865$ $\angle LBA = 37.9^o$	M1 A1	
(c)	$\frac{LT}{37.5} = \tan 10^o$ $LT = 6.6123\text{m}$ $LT = 6.61\text{m}$	M1 A1	
(d)	$\frac{3}{d} = \sin 60^o$ $d = \frac{3}{\sin 60}$ $d = 3.46\text{m}$	M1 A1	

7(a)	0.8	B1	
(b)		P2 P1 C1	Plot all points correctly Plot at least 6 points correctly Smooth curve
(c)	Tangent drawn correctly -2 ± 0.2	M1 A1	
(d)(i)	Straight line passing through (0,6) and (4,0)	B1	
(d)(ii)	0.6 ± 0.05, 4.2 ± 0.05	B1 B1	
(d)(iii)	$2(2x + \frac{9}{x} - 11) = 12 - 3x$ $4x + \frac{18}{x} - 22 = 12 - 3x$ $4x^2 + 18 - 22x - 12x + 3x^2$ $7x^2 - 34x + 18 = 0$ $A = -34$ $B = 18$	M1 M1 A1	

<table>
<tr><td>8(a)</td><td><table>
<tr><th>Year</th><th>Lower quartile</th><th>Median</th><th>Upper quartile</th><th>Interquartile range</th></tr>
<tr><td>2022</td><td>150.5</td><td></td><td>157</td><td>6.5</td></tr>
<tr><td>2023</td><td></td><td>151</td><td></td><td></td></tr>
</table></td><td>M1
A1
B1</td><td>LQ or UQ
IQR
Median</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>(b)</td><td>No, I do not agree.
The mean time for the runners in 2023 is lower than the mean time in 2022.</td><td>B1</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>(c)</td><td><table>
<tr><th>Time (minutes)</th><th>Frequency</th></tr>
<tr><td>$135 < t \leq 140$</td><td>4</td></tr>
<tr><td>$140 < t \leq 145$</td><td>26</td></tr>
<tr><td>$145 < t \leq 150$</td><td>32</td></tr>
<tr><td>$150 < t \leq 155$</td><td>28</td></tr>
<tr><td>$155 < t \leq 160$</td><td>21</td></tr>
<tr><td>$160 < t \leq 165$</td><td>9</td></tr>
</table></td><td>B1

B1</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>8(b)(i)(a)</td><td>$\frac{1}{3} \times \frac{2}{3} = \frac{2}{9}$</td><td>B1</td><td></td></tr>
<tr><td>(b)(i)(b)</td><td>$\left(\frac{1}{3} \times \frac{1}{3}\right) + \left(\frac{2}{3} \times \frac{2}{3}\right)$
$= \frac{5}{9}$</td><td>M1

A1</td><td></td></tr>
<tr><td>(b)(ii)</td><td>$\frac{2}{9} + \left(\frac{5}{9} \times \frac{2}{9}\right)$
$= \frac{28}{81}$</td><td>M1

A1</td><td></td></tr>
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10(a)	Amount paid before GST $= \frac{(737+692+749)}{3} \times 0.2989$ $= 726 \times 0.2989$ $= \$217$	M1 A1	
(b)	$9 \div 1.65 \approx 5$ $4 \div 1 = 4$ $5 \times 4 = 20$	M1 A1	
(c)	Average amount of electricity produced = 20 x 19 = 380 kWh	P1	
	Average cost per month after solar energy savings = (726-380) x \$0.2989 =\$103.42	C1	
	Average cost of installing & maintenance of solar panel per month $= (2 \times \$5950 + 20 \times \$500) \div (20 \times 12)$ $= \$91.25$	I1	
	Total average amount paid per month after installation =\$103.42 + \$91.25 =\$194.67 (< \$217)	T1	
	Since the average amount paid by Mr Faizal after installing the solar panels is less than what he is currently paying, he should proceed with the installation.	A1	Conclusion
	Assumption: The average electricity consumption remains the same, The price of tariff did not increase.	A1	Either one

Method 2 (Total cost based on 20 years)

(c)	Average amount of electricity produced = 20 x 19 = 380 kWh	P1
	Cost for 20 years before installation = \$217x20x12= \$52080	C1
	Cost of installation & maintenance $= (2 \times \$5950 + 20 \times \$500)$ =\$21900	I1
	Total cost for 20 years after installation =(726-380) x \$0.2989x12x20 +21900 = 46720.66 < \$52080	T1
	Since the total amount paid by Mr Faizal after installing the solar panels is less than what he is currently paying, he should proceed with the installation.	A1