NAVAL BASE SECONDARY SCHOOL
PRELIMINARY EXAMINATION, 2024
Paper 2
Marking Scheme

Qns	Solution	Marking Scheme	Remarks
1(a)	$\frac{x}{5}+\frac{2x-3}{4}=-6$ $\frac{4x+5(2x-3)}{20}=-6$ $4x+10x-15=-120$ $14x=-120+15$ $14x=-105$ $x=-7.5$	M1 A1	
1(b)	$\frac{2(p-3q)}{10r}\div\frac{(3q-p)^2}{r}$ $=\frac{2(p-3q)}{10r}\times\frac{r}{(3q-p)^2}$ $=\frac{2(p-3q)}{10r}\times\frac{r}{(p-3q)^2}$ $=\frac{1}{5(p-3q)}$ or $\frac{-1}{5(3q-p)}$ or $\frac{-1}{15q-5p}$	M1 A1	

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1(c)	**Method 1:** $x+1 \le \frac{7x-2}{4} < \frac{5x+19}{5}$ $x+1 \le \frac{7x-2}{4}$ and $\frac{7x-2}{4} < \frac{5x+19}{5}$ $4(x+1) \le 7x-2$ $\quad$ $5(7x-2) < 4(5x+19)$ $4x+4 \le 7x-2$ $\quad$ $35x-10 < 20x+76$ $-3x \le -6$ $\quad$ $35x-20x < 76+10$ $x \ge 2$ $\quad$ $15x < 86$ $x < 5\frac{11}{15}$ $\therefore 2 \le x < 5\frac{11}{15}$ or $2 \le x < \frac{86}{15}$ **OR**	M1 --- $x \ge 2$ M1 --- $x < 5\frac{11}{15}$ A1 --- $2 \le x < 5\frac{11}{15}$	Deduct 1m for $2 \le x < 5.73$ No marks given for $5\frac{11}{15} > x \ge 2$

	Method 2: $x+1 \le \frac{7x-2}{4} < \frac{5x+19}{5}$ $20(x+1) \le 5(7x-2) < 4(5x+19)$ $20x+20 \le 35x-10 < 20x+76$ $20x+30 \le 35x < 20x+86$ $30 \le 15x < 86$ $2 \le x < 5\frac{11}{15}$ or $2 \le x < \frac{86}{15}$	M1 M1 A1	
1(d)	$\frac{2y^2+7y-9}{4y^2-81}$ $= \frac{(2y+9)(y-1)}{(2y+9)(2y-9)}$ $= \frac{y-1}{2y-9}$	M1 --- correct numerator M1 --- correct denominator A1 [10]	Deduct 1m for changing y to x: $\frac{(2x+9)(x-1)}{(2x+9)(2x-9)} = \frac{x-1}{2x-9}$
2(a)(i)	First \$10 000: Interest = $\frac{10000 \times 4 \times 0.05}{100} = \$20$ Next \$20 000: Interest = $\frac{20000 \times 4 \times 0.95}{100} = \$760$ Total amount = \$30 000 + \$20 + \$760 = \$30 780	M1 M1 A1	

2(a)(ii)	Bank *L*: Total amount = $30000\left(1+\frac{0.8}{100}\right)^4$ = \$30 971.58 Since the total amount in Bank *L* > total amount of Bank *H* after 4 years, I <u>disagree</u> with Cheryl's claim.	M1 A1 A1	If 2a(i) or 2a(ii) wrong, no marks given for correct conclusion.

2(b)(i)	**Hong Kong Hotel:** HK$1 = S$0.17 HK$825 = S$(825 x 0.17) = S$140.25 **Guangzhou Hotel:** S$1 = CNY$5.33 CNY$825 = $S\$\frac{825}{5.33}$ =S$154.78 The Hong Kong hotel charges a cheaper rate per night. **OR** HK$1 = S$0.17 S$1 = $HK\$\frac{1}{0.17}$ =HK$5.8823 Since S$1 can get HK$5.8823, by comparison with S$1 = CNY$5.33, CNY$ is stronger than HK$. Thus the Hong Kong hotel charges a cheaper rate per night.	M1 (either $140.25 or $154.78) A1 M1 A1	
2(b)(ii)	Total cost = $(4\times825\times0.17)+(2\times825\times\frac{1}{5.33})$ =561 + 309.5684 = S$870.5684 $k=\frac{890-870.5684}{870.5684}\times100$ $k=2.23\%(3s.f)$	M2 – Total cost in SGD M1 A1 [12]	
3(a)(i)	13	B1	

3(a)(ii)	Interquartile range = 15 – 10 = 5	 M1 A1	
3(a) (iii)	Percentage $=\frac{500-450}{500}\times 100$ $=10\%$	 M1 A1	
3(b)	Median in February 2021 = 13 is less than median in February 2022 = 16. Hence, the patients generally **stayed longer in February 2022.** Interquartile range in Feb 2021 = 5 is less than interquartile range of Feb 2022 = 12. Hence, the **number of days stayed** in **February 2022 is generally less consistent/more wide spread**.	 B1 B1 B1 – state the figures correctly	If IQR in 3a(ii) wrong, answer will be wrong. Need to state the figures on the answer line.
3(c)	$\frac{450}{500}=\frac{9}{10}$	 B1	
3(d)	Probability $=\left(\frac{125}{500}\times\frac{500-125}{499}\right)+\left(\frac{500-125}{500}\times\frac{125}{499}\right)$ $=\frac{375}{998}$	 M1 A1 [11]	1m given for either of the fractions is correct.
4(a)	<table><tr><td>x</td><td>– 2</td><td>– 1</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>y</td><td>– 3.6</td><td>**0.8**</td><td>2</td><td>1.2</td><td>– 0.4</td><td>– 1.6</td><td>– 1.2</td><td>**2**</td></tr></table>	B2 (B1 for each correct value)	

4(b)	Refer to the graph.	P2 - Plotting of correct points (P1 for at most 2 points plotted incorrectly). C1 - Smooth curve.	
4(c)	Refer to graph for tangent drawn. Using (3, – 2.8) and (5, 0.4), Gradient $= \frac{0.4-(-2.8)}{5-3}$ $= 1.6$ (Accept 1.1 to 2.2)	B1 – tangent drawn B1	
4(d)	$\frac{x^3}{5} - x^2 + 2 = 1$ Refer to graph for $y = 1$ drawn. Using the graph, x = – 0.9 (accept – 0.8 to –1.0) or x = 1.1 (accept 1.0 to 1.2) or x = 4.75 (accept 4.6 to 4.9)	B1 - For drawing of $y = 1$. } B1 B1	
4(e)	True: 3 intersections - $-1.7 < k < 0$ False: $k < -1.7$ Accept all negative values	B1 [11]	
5(a)(i)	$3(\frac{2}{3}\pi r^3) = \pi r^2 h$ $2\pi r^3 = \pi r^2 h$ $2r = h$ (shown)	M1 A1	

5(a) (ii)	$2\pi r^2 + 2\pi r(8-r)$ $= 2\pi r^2 + 16\pi r - 2\pi r^2$ $= 16\pi r$	M1 for either $2\pi r^2$ or $2\pi r(8-r)$ seen A1	
5(b)(i)	$\frac{h_B}{h_C} = \sqrt{\frac{25}{64}}$ $\frac{h_B}{16} = \frac{5}{8}$ $h_B = \frac{5}{8} \times 16$ $h_B = 10$	M1 – Square root A1	
5(b) (ii)	$\frac{V_A}{V_C} = \left(\frac{8}{16}\right)^3$ $\frac{V_A}{450} = \frac{1}{8}$ $V_A = \frac{1}{8} \times 450$ $V_A = 56.25g$	M1 -$\left(\frac{8}{16}\right)^3$ OR $\left(\frac{1}{2}\right)^3$ seen A1 [8]	
6(a)	*AB* = *AD* (tangents drawn from ext. point) angle *BAC* = angle *DAC* (tangents drawn from ext. point) *AC* is a common side. $\Delta ABC \equiv \Delta ADC$ (SAS)	M1 (for only 1 condition) M2 (for all 3 conditions) A1	

6(b)(i)	$\angle ABO = 90^o$ $AB = 8\cos 42.5$ $AB = 5.8982186cm$ Area of triangle $= \frac{1}{2} \times 8 \times 5.8982186 \sin 42.5$ = 15.93911 = 15.9 cm^2 (3s.f) **OR** $OB = 8\sin 42.5$ $OB = 5.40472$ Area of triangle $= \frac{1}{2} \times AB \times OB$ $= \frac{1}{2} \times 5.8982186 \times 5.40472$ $= 15.9cm^2$	M1 (for either *AB* or *OB*) M1 A1 M1 (for either *AB* or *OB*) M1 A1	
6(b) (ii)	$\angle AOB = 180 - 90 - 42.5 = 47.5^o$ $\angle ABO = 90^o$ $OB = 8\sin 42.5$ $OB = 5.404721cm$ Area of sector *OBE*	**OR** $OB = \sqrt{8^2 - 5.8982186^2}$ $OB = 5.404721cm$ [M1] M1 (allow e.c.f)	

	$=\frac{47.5}{360}\times\pi\times5.404721^2$ $=12.10842$ $=12.1cm^2$ Area of shaded region = 15.93911 – 12.10842 = 3.83 cm^2 (3 s.f.)	M1 (allow e.c.f) A1 [9]	
7(a)	$DV = VB$ $=\frac{1}{2}\sqrt{6^2+8^2}$ $=5$ cm EV $=\sqrt{15^2+5^2}$ $=\sqrt{250}$ $=15.8113883008$ cm =15.8 cm (3s.f) (shown)	M1 A1	
7(b)	EC $=\sqrt{15^2+8^2}$ $=17$ cm **If EV = 15.8 cm** $\cos\angle ACE=\cos\angle VCE$	M1 M1	

7(b)	$15.8^2 = 17^2 + 5^2 - 2(17)(5)\cos\angle VCE$ $-64.36 = -170\cos\angle VCE$ $\angle VCE = \cos^{-1}\frac{64.36}{170}$ $\angle VCE = 67.75373$ $\angle VCE = 67.8^o$ (1d.p) **If** $EV = \sqrt{250}$ **cm** $\cos\angle ACE = \cos\angle VCE$ $\left(\sqrt{250}\right)^2 = 17^2 + 5^2 - 2(17)(5)\cos\angle VCE$ M1 $-64 = -170\cos\angle VCE$ $\angle VCE = \cos^{-1}\frac{64}{170}$ M1 $\angle VCE = 67.88476$ $\angle VCE = 67.9^o$ (1d.p) A1 **OR** In ΔAEC, $EC = \sqrt{15^2 + 8^2}$ =17 cm $AE = \sqrt{15^2 + 6^2}$ $=\sqrt{261}$ cm	M1 A1 M1 --- any 2 lengths correct (*EC*, *AE* or *AC*)	

	$AC = \sqrt{8^2 + 6^2}$ =10 cm Using cosine rule, $\left(\sqrt{261}\right)^2 = 10^2 + 17^2 - 2(10)(17)\cos\angle ACE$ $\cos\angle ACE = \frac{128}{340}$ $\angle ACE = \cos^{-1}\left(\frac{128}{340}\right)$ $\angle ACE = 67.88^o$ $\angle ACE = 67.9^o$ (1d.p)	M1 M1 A1	
7(c)	Volume of cuboid $= 8 \times 6 \times 15$ $= 720 cm^3$ Volume of pyramid $= \frac{1}{3} \times \left(\frac{1}{2} \times 6 \times 8\right) \times 15$ $= 120 cm^3$ Remaining volume of the cuboid = 720 – 120 = 600 cm^3	 M1 M1 A1	
8(a)(i)	Length of *AB*		

	$=\sqrt{(1-(-7))^2+(-4-(-2))^2}$ $=\sqrt{8^2+(-2)^2}$ $=8.25 units^2$ (3s.f)	B1	
8(a)(ii)	$\overrightarrow{OA}=\begin{pmatrix}1\\-4\end{pmatrix}, \overrightarrow{OB}=\begin{pmatrix}-7\\-2\end{pmatrix}$ $\overrightarrow{AB}=\overrightarrow{AO}+\overrightarrow{OB}$ $\overrightarrow{AB}=-\begin{pmatrix}1\\-4\end{pmatrix}+\begin{pmatrix}-7\\-2\end{pmatrix}$ $\overrightarrow{AB}=\begin{pmatrix}-8\\2\end{pmatrix}$	B1	
8(a)(iii)	$\overrightarrow{OC}=\begin{pmatrix}-7\\-2\end{pmatrix}+\begin{pmatrix}5\\4\end{pmatrix}$ $\overrightarrow{OC}=\begin{pmatrix}-2\\2\end{pmatrix}$ $C\ (-2, 2)$	B1	
8(a)(iv)	Gradient $=\frac{-4-2}{1-(-2)}$ $=-2$ Subst $(1, -4)$	M1 (allow e.c.f (a)(iii)) M1	

	$y=-2x+c$ $-4=-2(1)+c$ $c=-2$ Equation of line: $y=-2x-2$	A1	
8(b)(i)	$\overrightarrow{OB}=2\boldsymbol{c}+2\boldsymbol{a}$ **OR** $\overrightarrow{OB}=2\boldsymbol{a}+2\boldsymbol{c}$ **OR** $\overrightarrow{OB}=2(\boldsymbol{a}+\boldsymbol{c})$	B1	
8(b)(ii)	$\overrightarrow{OP}=\frac{1}{4}\overrightarrow{OB}$ $\overrightarrow{OP}=\frac{1}{4}(2\underset{\sim}{c}+2\underset{\sim}{a})$ $\overrightarrow{CP}=\overrightarrow{CO}+\overrightarrow{OP}$ $\overrightarrow{CP}=-2\underset{\sim}{c}+\frac{1}{4}(2\underset{\sim}{c}+2\underset{\sim}{a})$ $\overrightarrow{CP}=-\frac{3}{2}\underset{\sim}{c}+\frac{1}{2}\underset{\sim}{a}$ OR $\overrightarrow{CP}=\frac{1}{2}\underset{\sim}{a}-\frac{3}{2}\underset{\sim}{c}$ **OR** $\overrightarrow{CP}=\overrightarrow{CB}+\overrightarrow{BP}$ $\overrightarrow{CP}=2\underset{\sim}{a}-\frac{3}{4}(2\underset{\sim}{c}+2\underset{\sim}{a})$ $\overrightarrow{CP}=-\frac{3}{2}\underset{\sim}{c}+\frac{1}{2}\underset{\sim}{a}$	M1 A1 M1 A1	
8(b)(iii)	$\overrightarrow{CA}=-2\underset{\sim}{c}+\underset{\sim}{a}$ **OR** $\overrightarrow{PA}=\overrightarrow{PO}+\overrightarrow{OA}$ $\overrightarrow{PA}=-\frac{1}{2}\underset{\sim}{c}-\frac{1}{2}\underset{\sim}{a}+\underset{\sim}{a}$ $\overrightarrow{PA}=\frac{1}{2}\underset{\sim}{a}-\frac{1}{2}\underset{\sim}{c}=\frac{1}{2}(\underset{\sim}{a}-\underset{\sim}{c})$	M1	If $\overrightarrow{CP}$ is wrong, then no A1 mark.

	$\overrightarrow{CP} = -\frac{3}{2}\underset{\sim}{c} + \frac{1}{2}\underset{\sim}{a}$ $\overrightarrow{CP} = \frac{1}{2}(-3\underset{\sim}{c} + \underset{\sim}{a})$ Since $\overrightarrow{CA} \neq k\overrightarrow{CP}$, *C*, *P* and *A* do not lie on a straight line.	A1	
8(b)(iv)	$\frac{2}{3}$	B1 [12]	
9(a)	$x = \frac{3.41}{2.92} \times 2.77$ $= \$3.234$ $= \$3.23$ (2d.p) **OR** $x = \frac{3.41}{2.69} \times 2.55$ $= \$3.232$ $= \$3.23$ (2d.p)	B1	Accept 3.26 and 3.27 as answers.
9(b)	Fuel consumption of car $= 47 \times 0.42554$ $= 20.00038 km / l$ Fuel tank capacity	M1 (either fuel consumption of car or fuel tank capacity is correct)	

	$= 11.0952 \times 3.7855$ $= 42.0008796l$ Amount of fuel used $= 30\% \times 42.0008796$ $= 12.60026388l$ Fuel consumption $= \frac{244}{12.60026388}$ $= 19.364 km/l$ $= 19.4 km/l$ (3s.f) < $20.00038 km/l$ Since fuel consumption is lesser, Mrs Ong claim for fuel consumption was incorrect. Total discount $= (\$2.92 - \$2.77) \times 12.60026388$ $= \$1.890039582$ Extra amount of fuel $= \frac{1.890039582}{2.77}$ $= 0.682324758l$ Extra distance **Alternative solution:** Fuel consumption $= \frac{19.364}{0.42554}$ = 45.5 mpg < 47mpg	M1 A1 M1 M1	

	$= 20.00038 \times 0.682324758$ $= 13.64675$ $= 13.6km$ (3s.f) Mrs Ong claim for the extra distance was correct. **OR** Total discount $= (\$2.92 - \$2.77) \times 42.0008796$ $= \$6.30013194$ Extra amount of fuel $= \frac{6.30013194}{2.77}$ $= 2.2744158l$ Extra distance $= 20.00038 \times 2.2744158$ $= 45.489$ $= 45.5km$ (3s.f) Mrs Ong claim for the extra distance was incorrect.	M1 A1 [8] M1 M1 M1 A1	
	Total	**90 marks**	

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Q4(b)