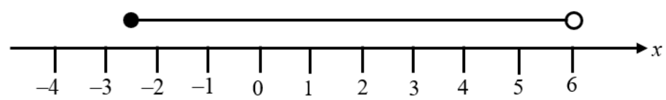
Ngee Ann Secondary School
Secondary 4&5 Mathematics-O
2025 Prelim Examinations Paper 1
Marking Scheme

1		[B1]
2	$-8x-9=6$ $-8x=15$ $x=-\frac{15}{8}$ or $-1\frac{7}{8}$ or -1.875	[B1; no mark for -1.88]
3	$2410\left(1+\frac{r}{100}\right)^6=2660$ $\left(1+\frac{r}{100}\right)^6=\frac{2660}{2410}$ $1+\frac{r}{100}=\left(\frac{2660}{2410}\right)^{\frac{1}{6}}$ $\frac{r}{100}=\left(\frac{2660}{2410}\right)^{\frac{1}{6}}-1$ $r=100\times\left[\left(\frac{2660}{2410}\right)^{\frac{1}{6}}-1\right]$ $r=100\times\left[\left(\frac{2660}{2410}\right)^{\frac{1}{6}}-1\right]$ $=1.66$ (3 s.f.)	[M1] [A1]
4(a)	0.0050500 (5 s.f.)	[B1]
4(b)	5.0500×10^{-3}	[B1; accept 5.05×10^{-3} and allow for ecf]
5	$600=2^3\times3\times5^2$ For the base area to be a square, possible dimensions are $2\times2\times150$, $5\times5\times24$ or $(2\times5)\times(2\times5)\times6$. Smallest possible height is 6 cm.	[M1] [A1]

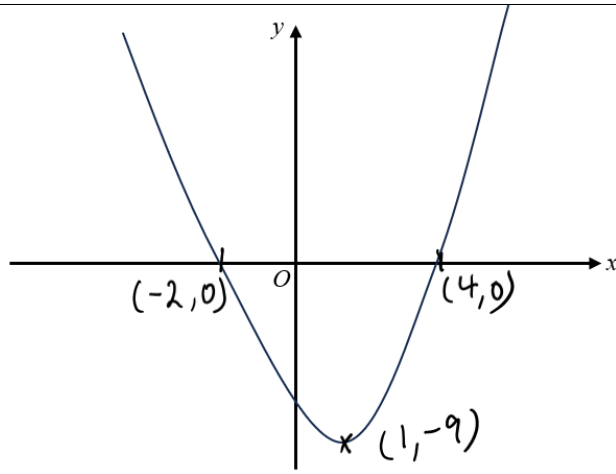
6(a)	$\frac{72}{360}\times 160000$ $=\$32000$	[M1; for $72°\pm 1°$] [A1]
6(b)	<u>The family's annual income in 2024 might be less than that in 2023</u>, such that even though they spent a great proportion of their income on food in 2024 (25% compared to $\frac{72}{360}\times 100\% = 20\%$), the total amount spent on food in 2024 might be less than that in 2023.	[B1; for underlined response. Accept any reasonable response]
7(a)	$-(5x-2y)(-3x+4y)$ $=(-5x+2y)(-3x+4y)$ or $-(-15x^2+20xy+6xy-8y^2)$ $=15x^2-20xy-6xy+8y^2$ $=15x^2-26xy+8y^2$	[M1] [A1]
7(b)	$9ab-12ac+28bc-21b^2$ $=3a(3b-4c)-7b(3b-4c)$ or $3a(3b-4c)+7b(4c-3b)$ $=(3b-4c)(3a-7b)$	[M1] [A1]
8(a)	$2y=3-6x$ $y=-3x+\frac{3}{2}$ Gradient is -3.	[B1]
8(b)	The <u>line in part (a) is parallel to the line in part (b)</u> since they have the same gradient. Also, for the line in part (a), when $x=0$, $y=\frac{3}{2}$. The <u>point (0, 1) does not lie on the line in part (a)</u>. Therefore, the two lines will not intersect.	[B1] [B1; must explain that (0, 1) does not lie on the line in part (a). Accept any reasonable response]
9(a)	$BC=\sqrt{4^2-3^2}$ $=\sqrt{7}$ $=2.65$ cm (3 s.f.)	[M1] [A1]
9(b)	$BC^2=\left(\sqrt{7}\right)^2=7$ $BD^2+CD^2=(2)^2+\left(\sqrt{3}\right)^2=7$ Since $BC^2=BD^2+CD^2$, by the <u>Converse of Pythagoras' Theorem</u>, triangle BCD is right-angled.	[Must be two separate lines of working] [B1; alternative method: use Cosine Rule to find angle BDC exactly $90°$]

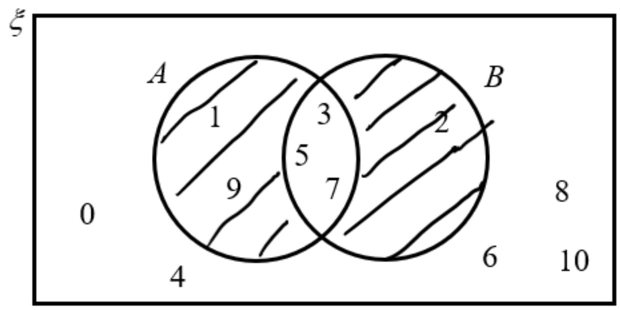
10	$\dfrac{4x^2+19x-30}{32x^3-50x}$ $=\dfrac{(4x-5)(x+6)}{2x(4x-5)(4x+5)}$ or $\dfrac{(4x-5)(x+6)}{x(4x-5)(8x+10)}$ $=\dfrac{x+6}{2x(4x+5)}$	[B1: for numerator] [B1: for denominator] [B1]
11	$\dfrac{x-3}{3}-\dfrac{1-x^2}{2-3x}=1$ $(x-3)(2-3x)-3(1-x^2)=3(2-3x)$ $2x-3x^2-6+9x-3+3x^2=6-9x$ $11x-9=6-9x$ $20x=15$ $x=\dfrac{3}{4}$ or 0.75	[M1: removing denominator] [M1: expand $(x-3)(2-3x)$ correctly] [A1]
12	Each interior angle of pentagon $=\dfrac{(5-2)\times 180}{5}$ $=108°$ Each interior angle of octagon $=\dfrac{(8-2)\times 180}{8}$ $=135°$ Sum of angles of *a*, *b* and *c* $=(360-108)+2(360-108-135)$ $=486°$	 [M1] [M1] [A1]

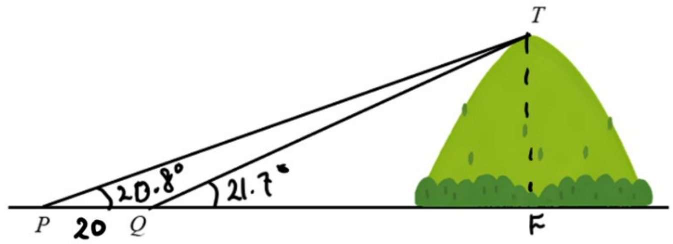
13	$d = kt^2$ $320 = k(8)^2$ $k = \frac{320}{64}$ $k = 5$ $80 = 5t^2$ $t^2 = \frac{80}{5} = 16$ $t = \pm\sqrt{16} = 4$ or -4 (N.A.) $t = 4$	[M1] [A1]
14	Let the amount of money shared by \$$x$. Amy's original share: $\frac{2}{9}x$ Amy's final share: $\frac{3}{4}\left(\frac{2}{9}x\right) = \frac{1}{6}x$ Amy's transferred share: $\frac{1}{4}\left(\frac{2}{9}x\right) = \frac{1}{18}x$ Ben's original share: $\frac{3}{9}x = \frac{1}{3}x$ Ben's final share: $\frac{2}{3}\left(\frac{1}{3}x + \frac{1}{18}x\right) = \frac{7}{27}x$ Ben's transferred share: $\frac{1}{3}\left(\frac{1}{3}x + \frac{1}{18}x\right) = \frac{7}{54}x$ Cal's original share: $\frac{4}{9}x$ Cal's final share: $\frac{4}{9}x + \frac{7}{54}x = \frac{31}{54}x$ Final ratio $= \frac{1}{6}x : \frac{7}{27}x : \frac{31}{54}x$ $= 9 : 14 : 31$	 [M1] [M1] [M1] [A1]

15(a)	$15\times5.8=5\times14.4+10x$ $10x=15$ $x=1.5$	[M1] [A1]
15(b)	Median would be more appropriate because the mean would be affected by the outlier of 50 points. The player who scored 50 points contributed about 69% of all points scored by starting players.	[B1: must mention outlier of 50 points. Accept any reasonable response]
16(a)	$AC=2a$ $BD=2d$ Area of rhombus $=\frac{1}{2}(2a\times2d)$ $=2ad$	[B1]
16(b)	Area of triangle PQS $=\frac{1}{2}(x\times2y)$ $=xy$ $MR=3x$ Area of triangle RQS $=\frac{1}{2}(3x\times2y)$ $=3xy$ Area of kite $=xy+3xy$ $=4xy$	[M1] [A1]

17(a)	$\left(\dfrac{625x^4}{y^8}\right)^{-\frac{1}{4}}$ $=\dfrac{\frac{1}{5}x^{-1}}{y^{-2}}$ $=\dfrac{y^2}{5x}$	[M1: for either $\frac{1}{5}$, x^{-1}, y^{-2}] [A1]
17(b)	$243^a=3^8+3^8+3^8$ $3^{5a}=3^8(1+1+1)$ $3^{5a}=3^8(3)$ $3^{5a}=3^9$ By comparing indices, $5a=9$ $a=\dfrac{9}{5}$ or $1\dfrac{4}{5}$ or 1.8	[M1: for getting 3^{5a} or 3^9] [A1]
18(a)	When $x\neq h$, $(x-h)^2>0$ and $y=(x-h)^2+k>k$. When $x=h$, $(x-h)^2=0$ and $y=(x-h)^2+k=k$. (Or mention that coeff of x^2 is positive) So, y has its minimum value of k when $x=h$.	[B1: for highlighted part]
18(b)	Since the graph of $y=(x-h)^2+k$ is symmetrical about the vertical line passing through its minimum point, $h=\dfrac{-2+4}{2}$ $h=1$ (shown)	[B1]
18(c)	Sub $x=4$, $y=0$, $h=1$, $0=(4-1)^2+k$ $k=-9$ Min. value of y is -9.	[B1]

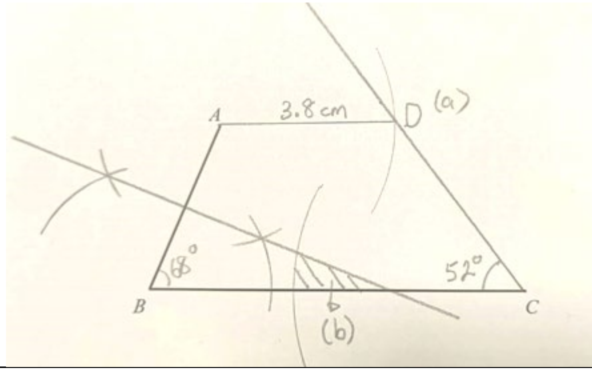
18(d)		[C1: correct shape] [P1: correct coordinates for x-intercepts and min pt; <u>must be coordinates</u>]
19(a)	When $n=1$, $\frac{3}{2}(1)(1-3)=-3$ So, $T_1=-3$ When $n=2$, $\frac{3}{2}(2)(2-3)=-3$ So, $T_1+T_2=-3$ $-3+T_2=-3$ $T_2=0$ When $n=3$, $\frac{3}{2}(3)(3-3)=0$ So, $T_1+T_2+T_3=0$ $-3+0+T_3=0$ $T_3=3$ First 3 terms: −3, 0, 3	[B1: one correct term] [B1: all terms correct]
19(b)	$T_1=-3$ Common difference = 3 $T_n=-6+3n$	[B1]
19(c)	Since $T_n=-6+3n=3(n-2)$, each term in the sequence is a multiple of 3.	[B1: must show factorization]

20	$\angle CDA = 180° - 119°$ ($\angle$s in opp. segments) $= 61°$ $\angle OAT = 90°$ (tan $\perp$ rad) $\angle OAD = 29°$ (base $\angle$s of isos. Δ) So, $\angle DAT = 90° - 29°$ $= 61°$ Since $\angle CDA = \angle DAT$, they are <u>alternate angles</u> and lines CD and ST are parallel	[B1: with reason] [B1: with reason for tan $\perp$ rad] [A1]
21(ai)	$A' \cap B' = \{0, 4, 6, 8, 10\}$	[B1]
21(aii)		[B1]
21(bi)	12, 16	[B1: do not accept {12, 16}]
21(bii)	$P = \{16\}$ $Q = \phi$ $R = \{12, 16\}$ So, $(P \cup Q) \cap R' = \phi$ $\therefore \text{n}\left[(P \cup Q) \cap R'\right] = 0$	 [B1]

22	 **Method 1** Let distance QF be x m. $\tan 20.8° = \dfrac{TF}{20+x}$ $(20+x)\tan 20.8° = TF$ $x = \dfrac{TF - 20\tan 20.8°}{\tan 20.8°}$ $\tan 21.7° = \dfrac{TF}{x}$ $x = \dfrac{TF}{\tan 21.7°}$ So, $\dfrac{TF - 20\tan 20.8°}{\tan 20.8°} = \dfrac{TF}{\tan 21.7°}$ $TF\tan 21.7° - 20\tan 20.8°\tan 21.7° = TF\tan 20.8°$ $TF\tan 21.7° - TF\tan 20.8° = 20\tan 20.8°\tan 21.7°$ $TF(\tan 21.7° - \tan 20.8°) = 20\tan 20.8°\tan 21.7°$ $TF = \dfrac{20\tan 20.8°\tan 21.7°}{\tan 21.7° - \tan 20.8°}$ = 167 m (3 s.f.)	[M1] [M1] [M1] [A1]
	Method 2: $\angle PQT = 180° - 21.7°$ (adj $\angle$s on a st. line) $= 158.3°$ $\angle PTQ = 180° - 158.3° - 20.8°$ ($\angle$sum of Δ) $= 0.9°$ By Sine Rule, $\dfrac{PT}{\sin 158.3°} = \dfrac{20}{\sin 0.9°}$ $PT = \dfrac{20\sin 158.3°}{\sin 0.9°}$ $= 470.79555$	[M1] [M1]

	$\sin 20.8° = \dfrac{TF}{470.79555}$ $TF = 470.79555 \sin 20.8°$ = 167 m (3 s.f.)	[M1] [A1]
23(a)	$\mathbf{P} = \begin{pmatrix} 5 & 4 & 6 \\ 8 & 7 & 9 \end{pmatrix}$	[B1]
23(b)	$\mathbf{T} = \begin{pmatrix} 5 & 4 & 6 \\ 8 & 7 & 9 \end{pmatrix}\begin{pmatrix} 120 \\ 80 \\ 100 \end{pmatrix}$ $= \begin{pmatrix} 1520 \\ 2420 \end{pmatrix}$	[B2: B1 for each of the element]
23(c)	The elements in **T** represent the <u>total cost</u> ($1520) and the <u>total revenue</u> ($2420; or selling price) <u>respectively</u> of the cakes <u>sold</u> by the shop <u>in July</u>.	[B1: not necessary to state the values of the elements; <u>do not accept the term "earnings"</u>]
23(d)	$\mathbf{Q} = \begin{pmatrix} -1 & 1 \end{pmatrix}$	[B1]
24(a)	Volume of one cup $= \dfrac{1}{3}\pi\left(\dfrac{6.9}{2}\right)^2(9.1)$ $= 113.4248$ $= 113 \text{ cm}^3$ (3 s.f.)	 [B1]
24(b)	18.9 l = 18 900 cm^3 Max number of cups $= \dfrac{18900}{113.4248}$ = 166.63 = 166 cups that are completely filled	 [M1] [A1]
24(c)	Let the curved surface area of smaller cone (i.e. cup) be A_1, t and that of larger cone (i.e. cup + frustrum) be A_2. By similar cones, $\left(\dfrac{d_2}{d_1}\right)^2 = \dfrac{A_2}{A_1} = 2$ $\dfrac{d_2}{d_1} = \sqrt{2}$	 [M1]

	$\frac{V_2}{V_1}=\left(\frac{d_2}{d_1}\right)^3$ $=\left(\sqrt{2}\right)^3$ $V_2=\left(\sqrt{2}\right)^3\times 113.4248$ $=320.81378$ Volume of frustrum shaped cup $=320.81378-113.4248$ $=207\ \text{cm}^3$ (3 s.f.)	 [M1] [M1] [A1]
25(a)	Position of median $=\frac{22+1}{2}$ $=11.5$ Median $=\frac{2+3}{2}$ $=2.5$	 [B1]
25(b)	The student's claim is <u>true</u> because there are <u>6 missing data</u> in the dot diagram. If all the 6 students scored 0 goal (or 1 goal), the modal number of goals scored would be 0 (or 1) instead of 2.	[B1: student <u>must provide an example where the mode is 0 or 1</u>]
25(ci)	0	[B1]
25(cii)	$\frac{4}{22}=\frac{2}{11}$	[B1]
25(ciii)	$\frac{11}{22}=\frac{1}{2}$	[B1]

26(a)	1 cm : 20 000 cm 1 cm: 200 m 3.8 cm : 760 m 	[M1: construction of $52°$ line or 3.8 cm arc from *A*] [A1: complete quadrilateral and labeling of *D*]
26(b)	Refer to diagram above.	[M1: construction of perpendicular bisector or 5 cm arc from *C*] [A1: correct shaded region]
26(c)	$\angle ABC = 68°$ Length of pathway $= \frac{68}{360} \times 2\pi(400)$ $= 475\,\text{m}$ (3 s.f.)	[M1] [A1]