Tampines Secondary School

Sec 4 Prelim Math Paper 2 2024 Marking Scheme

Total Marks: 90

√ = follow through

No.	Answers	Marks
1a	$\frac{6(a+1)^3}{7b}\times\frac{28b}{9(a+1)}$ $=\frac{2(a+1)^2}{1}\times\frac{4}{3}$ $=\frac{8(a+1)^2}{3}$	B1 (for $(a+1)^2$ seen) B1 (for $\frac{8}{3}$ seen)
1bi	$x=a+\frac{bv^2}{k}$ $x=2+\frac{3(-4)^2}{5}=11.6$	B1
1bii	$x=a+\frac{bv^2}{k}$ $x-a=\frac{bv^2}{k}$ $k(x-a)=bv^2$ $\frac{k(x-a)}{b}=v^2$ $v=\pm\sqrt{\frac{k(x-a)}{b}}$	M1 (elimination of fraction) M1 (square root) A1 (± seen)
1c	$4x+7y=-23$ ------- (1) $6x-2y=3$ ---------- (2) $(1)\times 3: 12x+21y=-69$ ----- (3) $(2)\times 2: 12x-4y=6$ ---------- (4) $(3)-(4): 25y=-75$ $y=-3$ $x=-0.5$	M1 (correct method to eliminate one variable) A1 A1
1d	$\frac{x^2-(x-y)(x+y)}{(x+y)(x-3y)}$ $=\frac{x^2-(x^2-y^2)}{(x+y)(x-3y)}$ $=\frac{y^2}{(x+y)(x-3y)}$	M1 A1 (accept expanded denominator) ***11 marks***

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No.	Answers	Marks
2a	$1500 = \dfrac{25000 \times R \times \frac{9}{12}}{100}$ $R = 8$ Rate is 8%	M1 (or equivalent) A1
2b	\$1 = 26.77 THB \$500 = 500 x 26.77 = 13385 THB Money left = 13385 – 10600 = 2785 THB 26.88 THB = \$1 2785 THB = $\dfrac{2785}{26.88}$ = \$103.61	 M1 (get remaining amount of money left in THB) A1 (nearest cent)
2c	Deposit = $\dfrac{15}{100} \times 2700 = \$405$ Total instalments = 68 x 36 = \$2448 Total paid = 405 + 2448 = \$2853 Interest = 2853 – 2700 = \$153 % required = $\dfrac{153}{2700} \times 100 = 5.67\%$ $(5\frac{2}{3}\%)$	M1 (calculate both deposit & instalments) M1 (their interest √ ÷ cash price x 100) A1
2d	100% → \$180 110% → $\dfrac{110}{100} \times 180 = \$198$ 75% → \$198 100% → $\dfrac{100}{75} \times 198 = \$264$	 M1 (find discounted price) M1 (√ from above discounted price) A1 ***10 marks***

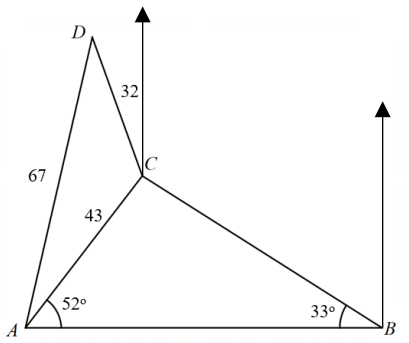
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No.	Answers	Marks
3a	length of box = $3x+1-3-3=(3x-5)cm$ width of box = $x+13-3-3=(x+7)cm$ height of box = $3cm$ $volume = 3(3x-5)(x+7)$ $930 = 3(3x^2+21x-5x-35)$ $310 = 3x^2+16x-35$ $3x^2+16x-345=0$	B1 (Length & width) M1 √ M1 (expansion √) A1 (establish the equation)
3b	$x=\dfrac{-16\pm\sqrt{16^2-4(3)(-345)}}{2(3)}$ $x=8.38$ or $x=-13.72$	B1 B1 B1
3c	Length of box = 3(8.38) – 5 = 20.14cm Width = 8.38 + 7 = 15.38 cm Length of SQ = $\sqrt{20.14^2+15.38^2}=25.3$ cm	M1 (√ find either length or width with Q3b value) M1 & A1 √ ***10 marks***

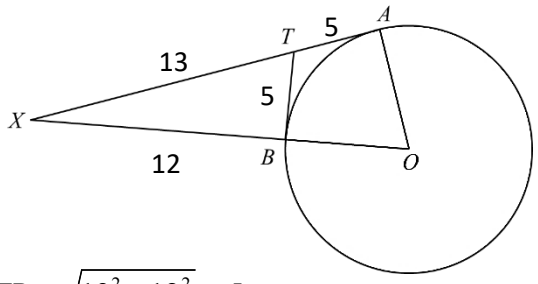
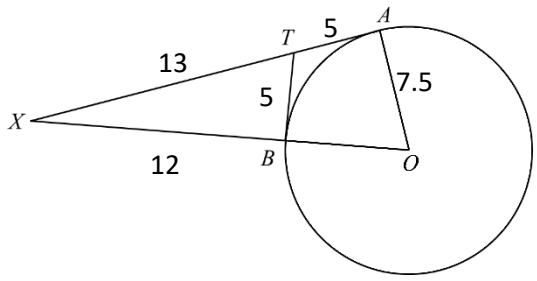
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No.	Answers	Marks
4ai	$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$ $= \begin{pmatrix} -3 \\ -7 \end{pmatrix} + \begin{pmatrix} 13 \\ -8 \end{pmatrix}$ $= \begin{pmatrix} 10 \\ -15 \end{pmatrix}$ $\left\lvert \begin{pmatrix} 10 \\ -15 \end{pmatrix} \right\rvert = \sqrt{10^2 + (-15)^2} = 18.0$	M1 or use length formula A1
4aii	$\overrightarrow{BA} = 2\overrightarrow{AP}$ $\begin{pmatrix} -10 \\ 15 \end{pmatrix} = 2(\overrightarrow{AO} + \overrightarrow{OP})$ $\begin{pmatrix} -5 \\ 7.5 \end{pmatrix} = \begin{pmatrix} -3 \\ -7 \end{pmatrix} + \overrightarrow{OP}$ $\overrightarrow{OP} = \begin{pmatrix} -2 \\ 14.5 \end{pmatrix}$ P (-2, 14.5)	M1 A1
4b(i)	$\overrightarrow{CP} = \frac{3}{4}\overrightarrow{CB}$ $= \frac{3}{4}(-4\underline{a} + 2\underline{b})$ $= -3\underline{a} + \frac{3}{2}\underline{b}$	B1 for $\overrightarrow{CB}$ B1
4b(ii)	$\overrightarrow{AP} = \overrightarrow{AC} + \overrightarrow{CP}$ $= 2\underline{a} - 3\underline{a} + \frac{3}{2}\underline{b}$ $= -\underline{a} + \frac{3}{2}\underline{b}$	B1
4b(iii)	$\overrightarrow{AD} = -2\underline{a} + 3\underline{b}$ $\overrightarrow{AD} = 2(-\underline{a} + \frac{3}{2}\underline{b})$ $= 2\overrightarrow{AP}$ $\overrightarrow{AD}$ is a scalar multiple of $\overrightarrow{AP}$, AD and AP are parallel with A as the common point. $\therefore$ A, D and P lie on the same straight line.	B1 (or find $\overrightarrow{PD}$) M1 (express one vector as a scalar multiple of the other) A1
4b(iv)	$AreaOCB : AreaCBD : AreaCPD$ 2 : 1 4 : 3 Answer: $\frac{8}{3}$	B1 ***11 marks***

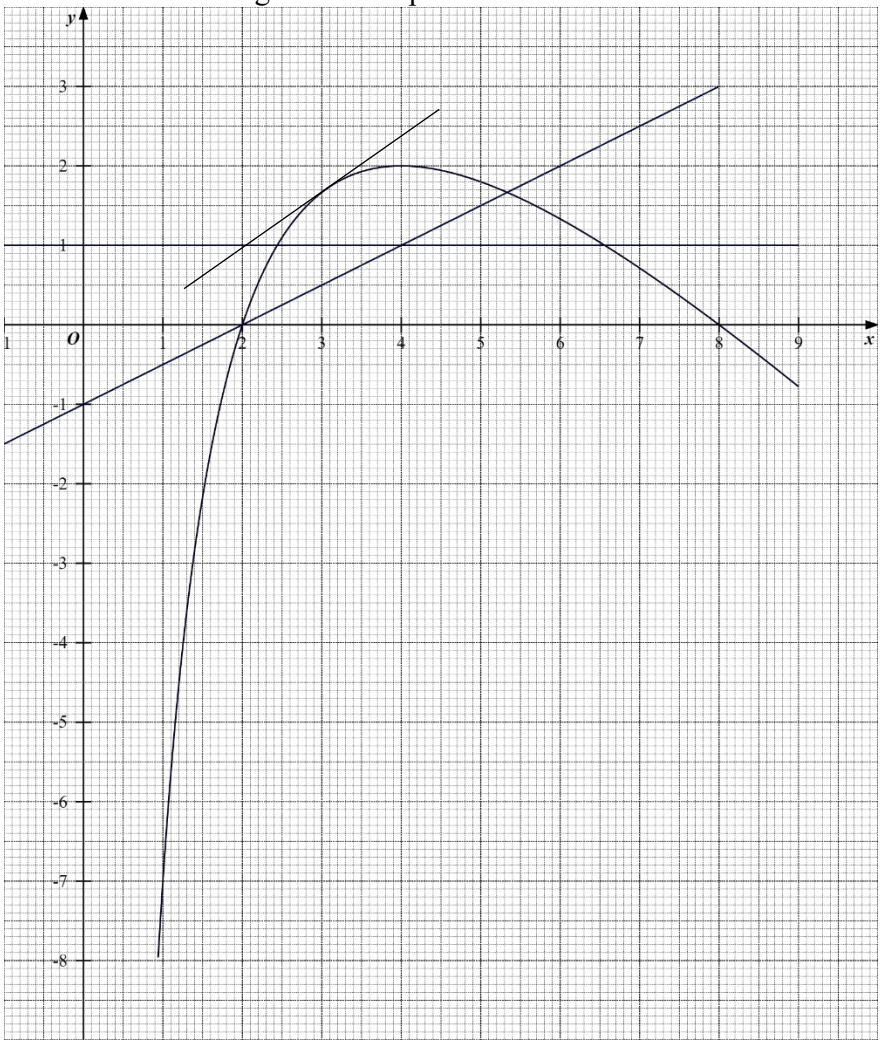
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No.	Answers	Marks
5a	 Bearing of B from C = 180 – (90 – 33) =123°	M1 A1
5b	$\frac{AB}{\sin(180-52-33)^o}=\frac{43}{\sin 33^o}$ $AB=78.65=78.7m(3sf)$	M1 A1
5c	$\cos\angle CDA=\frac{67^2+32^2-43^2}{2(67)(32)}$ $\angle CDA=31.297=31.3^o(1dp)$	M2 A1
5d	$\tan\theta=\frac{60}{67}$ $\theta=41.84=41.8^o(1dp)$	M1 A1 ***9 marks***

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No.	Answers	Marks
6a	$\angle OAT = \angle OBT = 90^o$ (radius $\perp$ tangent) $\therefore \angle OAX = \angle TBX = 90^o$ $\angle AXO = \angle BXT$ (common angle) $\angle AOX = \angle BTX$ (3^{rd} angle in triangle) $\therefore \Delta OAX$ and ΔTBX are similar.	B2 for the first 3 or all statements seen (B1 for one correct pair of angles with reason)
6bi	 $TB = \sqrt{13^2 - 12^2} = 5$ $TA = TB = 5cm$ (tangents from external point) $\frac{OA}{5} = \frac{18}{12}$ $OA = 7.5$	M1 (TB = 5 seen) M1 (form ratio to find OA oe) A1
6bii	$\frac{area\ \Delta TBX}{area\ \Delta OAX} = \left(\frac{12}{18}\right)^2 = \frac{4}{9}$ $\frac{area\ \Delta TBX}{area\ \text{quad}\ OATB} = \frac{4}{5}$	B1 A1
6biii	 $\tan \angle AOX = \frac{18}{7.5}$ $\angle AOX = 67.38^o$ Reflex $\angle AOB = 360 - 67.38 = 292.62^o$ In radian, $\frac{292.62}{180} \times \pi = 5.11 rad$ (3sf)	M1 (oe for $\angle AOX$) M1 (conversion) A1 ***10 marks***

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7a	2	B1
7b	Smooth curve through 9 correct points  	B3 Or (B2FT for 9 points correct) Or (B1FT for 7 or 8 points correct)
7c	Gradient value between 0.6 to 0.9 [exact value is $\frac{7}{9} = 0.\dot{7}$]	M1 tangent line at x = 3 A1
7d	$9 - x - \frac{16}{x} = 0$ $10 - x - \frac{16}{x} = 1$ $y = 1$ $x = [2.3 - 2.5]$ or $x = [6.5 - 6.7]$	A1 A1
7e(i)	$10 - x - \frac{16}{x} = mx - 1$ $10x - x^2 - 16 = mx^2 - x$ $mx^2 + x^2 - 11x + 16 = 0$ $(m+1)x^2 - 11x + 16 = 0$	M1 [elimination of fraction] B1
7e(ii)	$\frac{1}{2}$	B1 ***11 marks***

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8a(i)	48 g	B1
8a(ii)	51 – 45 or 51.5 – 45 = 6 g = 6.5 g	B1 (for LQ or UQ) A1
8a(iii)	40 g	B1
8b	$260 - 200 = 60$ $\frac{60}{300} \times \frac{59}{299} = \frac{59}{1495}$	M1 A1 (accept 0.0395)
8c(i)	1st batch of eggs: interquartile range = 6 g (6.5g) 2nd batch of eggs: interquartile range = 10 g Since 6 g < 10 g, the mass of the 1st batch varies less widely, hence the mass is more consistent.	B1
8c(ii)	The mass of the top 25% varies more widely than the bottom 25%.	B1 ***8 marks***
9a	p = 0.2979 (4 dp) r = 11.03 (2 dp) s = 133.62 (2 dp)	B3 (for each answer)
9b	July National average electricity usage = 505 kWh Current July usage = 289 kWh Additional usage = 505 – 289 = 216 kWh Additional amount = 216 x 0.2979 (rate) = \$64.3464 = \$64.35 Monthly cost (from air-con) must be < \$64.35 *4 & 5 ticks model selected* <u>Model</u> <u>monthly cost (\$)</u> <u>LCC (\$)</u> B 616 ÷ 12 = **51.33** 2749 + 616 x 7 = **7061** C 789 ÷ 12 = 65.75 1989 + 789 x 7 = 7512 D 552 ÷ 12 = **46** 3499 + 552 x 7 = **7363** E 594 ÷ 12 = **49.50** 3305 + 594 x 7 = 7463 Chen should opt for Model D which has the lowest monthly cost (< \$64.35) and the LCC is the second lowest among the four models. Estimated August bill = 1.09 x (122.59 + 46) = \$183.76	M1 M1 M1 M1 (monthly cost) M1 (LCC) Calculated for BCDE or DE A1 A1 ***10 marks***

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