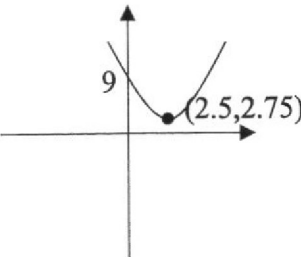


AMKSS 2021 Prelim 4E5N EM P2 Answer Scheme

Qn	Solutions	Marks	Remarks
1a	$\frac{(3ab)^2}{3} \div \frac{2a}{b^0}$ $\frac{9a^2b^2}{3} \times \frac{1}{2a}$ $\frac{3ab^2}{2}$	M1 A1	
1bi	$0.5345224838 = 0.535$	B1	
1bii	$a = \sqrt{\frac{b+2c}{3-b}}$ $a^2 = \frac{b+2c}{3-b}$ $3a^2 - a^2b = b + 2c$ $3a^2 - 2c = b + a^2b$ $b(1+a^2) = 3a^2 - 2c$ $b = \frac{3a^2 - 2c}{1+a^2} \text{ or } b = \frac{2c - 3a^2}{-1-a^2}$	M1 M1 A1	Do not except if students did not state $b =$
1ci	$x^2 - 5x + 9$ $= x^2 - 5x + \left(\frac{-5}{2}\right)^2 + 9 - \left(\frac{-5}{2}\right)^2$ $= \left(x - \frac{5}{2}\right)^2 + \frac{11}{4}$ $= \frac{11}{4} + \left(-\frac{5}{2} + x\right)^2$	M1 A1 or B2	
1cii		min pt and shape B1  y-intercept B1	
1ciii	$x = 2.5$	B1	
			11

2a	$130^2 = 97^2 + 58^2 - 2(97)(58)\cos \angle PRQ$ $-11252 \cos \angle PRQ = 4127$ $\cos \angle PRQ = -\frac{4127}{11252}$ $\angle PRQ = 111.5171212^\circ$ $\angle PRQ = 111.5^\circ$ <p>OR</p> $\cos \angle PRQ = \frac{97^2 + 58^2 - 130^2}{2(97)(58)}$ $\cos \angle PRQ = -\frac{4127}{11252}$ $\angle PRQ = 111.5171212^\circ$ $\angle PRQ = 111.5^\circ$	M1  M1  A1  M1  M1  A1	
2b	<p>Area</p> $= 0.5(97)(58) \sin 111.5 + 0.5(97)(43) \sin 63$ $= 2616.956426 + 1858.194106$ $= 4475.150533 \text{ (based on } 111.5171212)$ $= 4475.458725 \text{ (based on } 111.5)$ $= 4480$	M1 + M1     A1	
2c	$0.5 \times 97 \times h = 1858.194106$ $h = 38.31328054 = 38.3$ <p>OR</p> $\sin 63^\circ = h \div 43$ $h = 38.31328054 = 38.3$	M1 A1  M1 A1	
2d	$\tan 3.9^\circ = \frac{ST}{43}$ $ST = 2.93144591$ $\frac{SR}{\sin 63} = \frac{43}{\sin 26.3}$ $SR = 86.47206439$ $SR = 86.43385477 \text{ (using cosine rule)}$ $\tan \theta_{\min} = \frac{2.93144591}{86.47206439}$ $\theta_{\min} = 1.941611802^\circ \text{ (} 1.942469468^\circ)$ $\tan \theta_{\max} = \frac{2.93144591}{38.31328054}$ $\theta_{\max} = 4.375320211$ $1.9^\circ \text{ to } 4.4^\circ$	M1   M1  M1  M1  A1	
			13

3a	<p>Japan ¥:</p> $\$1 = ¥81.49$ $\$1299 = 81.49 \times 1299 = ¥105855.51$ <p>Singapore \$:</p> $¥81.49 = \$1$ $¥104280 = 1 \div 81.49 \times 104280 = \$1279.67$ <p>Buy from <u>Japan</u></p> <p>Cheaper by</p> $¥1575.51$ $\$19.33$	M1  A1  A1	Must state cheaper by how much
3b	$999\left(1 + \frac{x}{100}\right)^8 = 1299$ $\left(1 + \frac{x}{100}\right)^8 = \frac{1299}{999}$ $1 + \frac{x}{100} = \sqrt[8]{\frac{1299}{999}}$ $1 + \frac{x}{100} = 1.033369069$ $x = 3.336906861 = 3.34$	M1       A1	
3ci	$196.9 \times 10^6 - 187.2 \times 10^6$ $= 9.7 \times 10^6$	B1	
3cii	$\frac{142-138}{142} \times 100$ $= 2.816901408 = 2.82\%$	M1  A1	
3ciii	$\frac{138}{274} \times 100$ $= 50.36496358 = 50.4\%$	M1  A1	
			10
4a	$p = 39$	B1	
4b	Points, Curve passes through all points, Smooth curve	B1,B1,B1	See graph
4c	$x > 2.5$ (2.4 to 2.6)	B1	
4di	Draw straight line	B2	See graph
4dii	$3y - 29x + 5 = 0$ $3y = 29x - 5$ $y = \frac{29}{3}x - \frac{5}{3}$ $\frac{29}{3}x - \frac{5}{3} = \frac{x^3}{2} + 3x - 5$ $58x - 10 = 3x^3 + 18x - 30$ $3x^3 + 18x - 58x - 30 + 10 = 0$ $3x^3 - 40x - 20 = 0$ (shown)	M1       A1	
4diii	3.75 to 3.95 (3.879652106) -0.6 to -0.4 (-0.5099456443) -3.45 to -3.25 (-3.369706462)	2 correct B1 B2	
			11

5ai	$T_4 = 2 \times 4^2 + 5 = 37$ OR $2 \times 4^2 + 5 = 37$	B1 B1	
5aii	$T_n = 2 \times n^2 + (n + 1)$ or $2n^2 + n + 1$	B1	
5aiii	$2n^2 + n + 1 = 1175$ $2n^2 + n - 1174 = 0$ $n = 23.97937267$ Since $n$ needs to be a positive integer, 1175 cannot be one of the numbers in the sequence	M1 A1	
5b	$S_n = 3n - 1$	B1	
5c	158	B1	
			6
6aia	$\angle STU = 180^\circ - 50^\circ = 130^\circ$ ( $\angle$ s in opps seg)	B1	Minus 1 mark from whole question if no reason or wrong reason
6aib	$\angle SQU = \angle SRU = 50^\circ$ ( $\angle$ s in same seg) $\angle PQU = 180 - 50 = 130^\circ$ ( $\angle$ s on a str line) $\angle POU = 130^\circ \times 2 = 260^\circ$ ( $\angle$ at ctr = $2\angle$ s at circumference)	M1 A1	
6aie	$\angle POU = 360 - 260 = 100^\circ$ $\angle PUO = (180 - 100) \div 2 = 40^\circ$ (isos $\triangle PUO$ )	B1	
6aid	$\angle PUR = 90 - 40 = 50^\circ$ (tangent perpendicular to radius)	B1	
6aie	$\angle SRU = \angle PUR$ (alternate $\angle$ s of parallel lines) $RS$ and $PU$ are parallel	B1	
6bi	Arc length $PQR = 1.31 \times 7$ Arc length $PQR = 9.17$	B1	
6bii	Area of sector = $0.5 \times 7^2 \times 1.31 = 32.095$ Area of $\triangle QST = 0.5 \times 5.2 \times (7 - 3.1) \times \sin 1.31$ Area of $\triangle QST = 9.797115409$ Area of shaded region = $32.095 - 2(9.797115409)$ = $12.50076918 = 12.5 \text{ cm}^2$	M1 M1 A1	
			10

7a	$\frac{2500}{x}$	B1	
7b	$\frac{2500}{x-10}$	B1	
7c	$\frac{2500}{x-10} - \frac{2500}{x} = 4 \times 60$ $\frac{2500}{x-10} - \frac{2500}{x} = 240$ $2500(x) - 2500(x-10) = 240(x)(x-10)$ $2500x - 2500x + 25000 = 240x^2 - 2400x$ $240x^2 - 2400x - 25000 = 0$ $6x^2 - 60x - 625 = 0$	M1     M1    M1	
7d	$x = \frac{-(-60) \pm \sqrt{(-60)^2 - 4(6)(-625)}}{2(6)}$ $x = \frac{60 \pm \sqrt{18600}}{12}$ $x = 16.36515141, -6.365151414$ $x = 16.4, -6.4 \text{ (1 dp)}$	M1  M1 A1	
7e	L+S 1 min $\rightarrow 16.36515141 + 6.36515141 \text{ l}$ L+S 1 min $\rightarrow 22.73030283 \text{ l}$ 1 l $\rightarrow 1 \div 22.73030283$ 2500 l $\rightarrow 1 \div 22.73030283 \times 2500$ Time taken $\rightarrow 109.9853363 \text{ min}$ Time taken $\rightarrow 1 \text{ hour and } 50 \text{ mins}$	M1  M1 A1	
			11

8a	Radius of the hemisphere = 10 m Height of structure = 10 + 15 = 25 m	B1	
8b	Volume of hemisphere $= \frac{1}{2} \times \frac{4}{3} \pi 10^3 = \frac{2000}{3} \pi = 2094.395102$ Volume of cuboid $= 20 \times 20 \times 15 = 6000$ Volume = 2094.395102 + 6000 Volume = 8094.395102 = 8090 m <sup>3</sup>	M1 M1 A1	
8c	SA of cuboid $= 20 \times 20 + 4(20 \times 15) + [20 \times 20 - (\pi \times 10^2)]$ $= 2000 - 100\pi$ $= 1685.840735$ SA of hemisphere $= 0.5 \times 4 \times \pi \times 10^2$ $= 200\pi$ $= 628.3185307$ Total SA $= 1685.840735 + 628.3185307$ $= 2314.159265$ $= 2310 \text{ m}^2$	M1 M1 A1	
8d	$AC^2 = 20^2 + 20^2$ $AC = \sqrt{800} = 28.28427125$ $\tan \theta = \frac{25}{\sqrt{800} \div 2}$ $\theta = 60.5037915 = 60.5^\circ$	M1 M1 A1	
			10
9ai	$30 \div 100 \times 40 = 12$	B1	
9aii	Median = 3	B1	
9aiii	Range = 5 - 0 = 5	B1	
9aiv	Interquartile range = 4 - 2 = 2	B1	
9bi	$1 - \frac{1}{12} - \frac{1}{4} - \frac{1}{3} = \frac{1}{3}$	B1	
9bii	$\left(\frac{1}{12} + \frac{1}{3}\right) = \left(\frac{1}{4} + \frac{1}{3}\right) - x$ $x = \frac{1}{6}$ $\frac{1}{6} \times 60 = 10$ OR no. of living = $60 \left(\frac{1}{12} + \frac{1}{3}\right) = 25$ no. of non-living = $60 \left(\frac{1}{4} + \frac{1}{3}\right) = 35$ $35 - 25 = 10$	M1 A1 M1 A1	
			7

10a	<p>Let <math>h</math> = height of small cone</p> $\frac{h}{h+165} = \frac{60}{84}$ $84h = 60h + 9900$ $h = 412.5$ <p>Total height = <math>412.5 + 165 = 577.5</math></p> <p>Volume of the cup</p> $= \left( \frac{1}{3} \pi \times 42^2 \times 577.5 \right) - \left( \frac{1}{3} \pi \times 30^2 \times 412.5 \right)$ $= 339570\pi - 123750\pi$ $= 1066790.617 - 388772.0909$ $= 678018.5265 = 678019 \text{ (shown)}$	<p>Ha1</p> <p>Ha2</p> <p>V1</p>	
10a	<p>Slant height<sub>Small</sub> = <math>\sqrt{412.5^2 + 30^2}</math></p> <p>Slant height<sub>Small</sub> = 413.5894704 mm</p> <p>Slant height<sub>Big</sub> = <math>\sqrt{577.5^2 + 42^2}</math></p> <p>Slant height<sub>Big</sub> = 579.0252585 mm</p> <p>SA of cone<sub>Small</sub> = <math>\pi \times 30 \times 413.5894704</math></p> <p>SA of cone<sub>Small</sub> = 38979.88925 mm<sup>2</sup></p> <p>SA of cone<sub>Big</sub> = <math>\pi \times 42 \times 579.0252585</math></p> <p>SA of cone<sub>Big</sub> = 76400.58293 mm<sup>2</sup></p> <p>SA of circle = <math>\pi \times 30^2 = 900\pi = 2827.433388 \text{ mm}^2</math></p> <p>SA<sub>Paper</sub> = <math>76400.58293 - 38979.88925 + (2 \times 2827.433388)</math></p> <p>SA<sub>Paper</sub> = 37420.69368 + 5654.866776</p> <p>SA<sub>Paper</sub> = 43075.56046 mm<sup>2</sup></p> <p>Paper sheets needed = <math>1500 \times \frac{43075.56046}{1000000}</math></p> <p>Paper sheets needed = 64.61334069</p> <p>Cost of Paper = <math>64.61334069 \times \\$0.62</math></p> <p>Cost of Paper = 40.06027123 = \$40.06</p> <p>OR</p> <p>Cost of Paper = <math>65 \times \\$0.62 = \\$40.30</math></p> <p>Use <u>Plastic</u> because it is \$0.82 (\$1.06 if use 65 sheets of plastic) cheaper for the material cost.</p>	<p>Ss1</p> <p>Sb1</p> <p>SAs1</p> <p>SAb1</p> <p>SAPa1</p> <p>PaS1</p> <p>CPa1</p> <p>A1</p>	
			11



