2024 Sec 4E/5N Prelim Math Paper 2 Marking Scheme

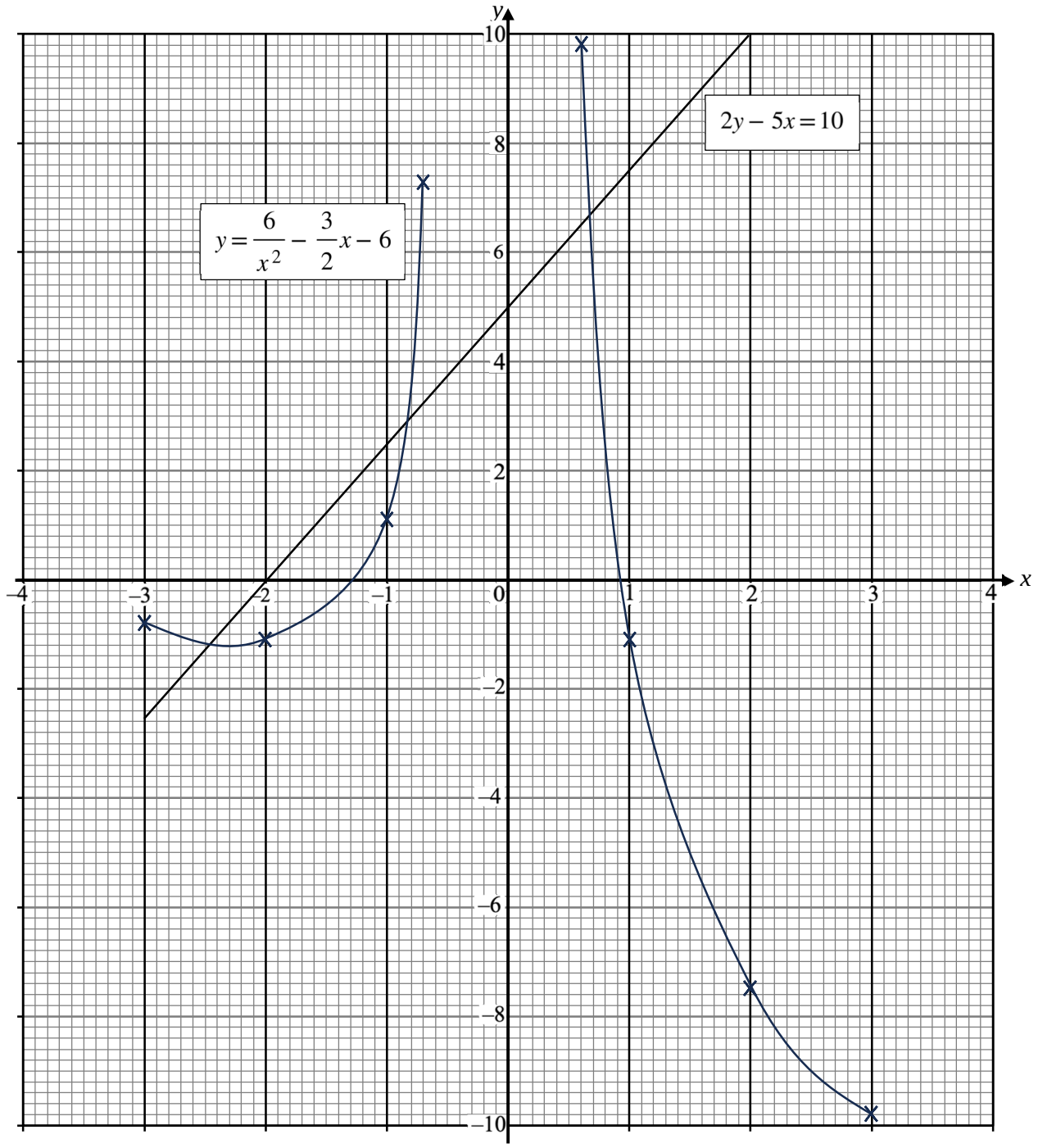
QN	Solution	Marks	AO Level
1a(i)	$g = -6 - \frac{2}{3+2}$ $g = -\frac{32}{5}$ or $-6\frac{2}{5}$ or -6.4	B1	N5 AO1
1a(ii)	$g = f - \frac{p}{3+p}$ $g - f = -\frac{p}{3+p}$ $(g-f)(3+p) = -p$ $3g + gp - 3f - fp = -p$ $gp - fp + p = 3f - 3g$ $p(g-f+1) = 3f - 3g$ $p = \frac{3f-3g}{(g-f+1)}$ or $\frac{3g-3f}{(f-g-1)}$ $o.e$	M1 A1	N5 AO1
1b	$x - 7 > \frac{8x+1}{3}$ $3x - 21 > 8x + 1$ $3x - 8x > 1 + 21$ $-5x > 22$ $x < -\frac{22}{5}$ or $-4\frac{2}{5}$ or -4.4	M1 A1	N7 AO1
1c	$\frac{2x-3}{3} + \frac{x}{4} = 4$ $\frac{4(2x-3)+3x}{12} = 4$ $8x - 12 + 3x = 48$ $11x = 60$ $x = \frac{60}{11}$ or $5\frac{5}{11}$	M1 (common denominator) A1	N7 AO1

QN	Solution	Marks	AO Level
1d	$\frac{7}{x+2}-\frac{4}{3-2x}=5$ $\frac{7(3-2x)-4(x+2)}{(x+2)(3-2x)}=5$ $21-14x-4x-8=5(3x-2x^2+6-4x)$ $-18x+13=5(-2x^2-x+6)$ $-18x+13=-10x^2-5x+30$ $10x^2-13x-17=0$ $x=\frac{13\pm\sqrt{(-13)^2-4(10)(-17)}}{2(10)}$ $x=\frac{13\pm\sqrt{849}}{20}$ $x=\frac{13+\sqrt{849}}{20}$ *or* $\frac{13-\sqrt{849}}{20}$ $x=2.10688$ *or* -0.80688 $x=2.11\ (2dp)$ *or* $-0.81\ (2dp)$	M1 M1 (Form Quadratic Eqn) M1 A1,A1	N7 AO2
2a	Total Cost $\$1800+\$150=\$1950$ % profit $\frac{120\times45-1950}{1950}\times100\%$ $=176.923\%$ $=177\%\ (3sf)$	B1 B1	N3 AO1
2b	Total Amount $5000\left(1+\frac{2.55}{100}\right)^2$ $=\$5258.25$ Interest $\$5258.25-\$5000=\$258.25$	M1 A1	N10 AO1

QN	Solution	Marks	AO Level
2c(i)	1.22×10^{10}	B1	N1 AO1
2c(ii)	$\frac{12163000000}{5.637\times 10^{6}}\div 12$ $=\$\ 179.81$ $=\$\ 180\ (\ nearest\ dollar)$	M1 A1	N1 AO1
2d(i)	Shenzhen Hotel (3N) $(\ 2550\times 3)\ \times 1.1=CNY8415$	B1	N3 A01
2d(ii)	Shenzhen Hotel in SGD $\frac{8415}{100}\times 18.64=SGD1568.556$ Hong Kong Hotel(2N) $(\ 2550\times 2)\ =HKD5100$ In SGD with conversion fees $\frac{5100}{5.75}\times 1.015=SGD900.260$ Total Cost $SGD1568.556+\ 900.260$ $=SGD2468.81$ $=SGD2469\ (\ nearest\ dollar)$	M1 M1 A1	N3 A02

QN	Solution	Marks	AO Level
3a(i)	136 cm	B1	S1/AO1
3a(ii)	LQ = 132 UQ = 142 IQR = 142 – 132 = 10	 M1 for LQ/UQ A1	S1 AO1
3b	No of girls = 2 $\frac{2}{120} \times 100\% = 1.67\% \ (3sf) \ or \ 1\frac{2}{3}\% \ o.e$	 B2	S1 AO1
3c	1. Casa Sec Sch girls **<u>are shorter</u>** as the median height is lesser than Landmark Sec Sch or vice versa 2. Casa Sec Sch has a **<u>smaller/larger spread of height</u>** as the interquartile range is lesser than Landmark Sec Sch or vice versa	A1 Must state median A1 Must state spread. Accept more consistent if smaller spread is stated	S1 AO3
3di	Prob both had weekly allowance that is less than $25 $\frac{18}{45} \times \frac{17}{44} = \frac{17}{110}$	 B1	S2 AO1
3dii	Prob one had at least $30 of weekly allowance and the other had less than $20 of weekly allowance $\frac{12}{45} \times \frac{5}{44} + \frac{5}{45} \times \frac{12}{44}$ $= \frac{2}{33}$	 M1 A1 or B2	S2 AO2
4a	–1.5 (1dp)	B1	N6/AO1
4b	See page 5	P2 all points plotted correct P1 for 7 points plotted correct else P0 C1	N6/AO1
4c(i)	See page 5	P1 L1	N6/AO1

4b and 4c(i)



QN	Solution	Marks	AO Level
4cii	$x = -2.45 \pm 0.2, -0.85 \pm 0.1, 0.65 \pm 0.1$	B2 for all B1 for 2 correct	N6 AO1
4c(iii)	$2\left(\frac{6}{x^2} - \frac{3}{2}x - 6\right) - 5x = 10$ $\frac{12}{x^2} - 3x - 12 - 5x = 10$ $\frac{12}{x^2} - 8x - 22 = 0$ $12 - 8x^3 - 22x^2 = 0$ $8x^3 + 22x^2 - 12 = 0$ $4x^3 + 11x^2 - 6 = 0$ $A = 11, B = -6$	M1 B1, B1	N7 AO2
5a	$\overrightarrow{PQ} = \begin{pmatrix} 6 \\ 2 \end{pmatrix} - \begin{pmatrix} 8 \\ -4 \end{pmatrix} = \begin{pmatrix} -2 \\ 6 \end{pmatrix}$ $\overrightarrow{PR} = \begin{pmatrix} 2 \\ h \end{pmatrix} - \begin{pmatrix} 8 \\ -4 \end{pmatrix} = \begin{pmatrix} -6 \\ h+4 \end{pmatrix}$ $\begin{pmatrix} -2 \\ 6 \end{pmatrix} = k\begin{pmatrix} -6 \\ h+4 \end{pmatrix}$ $-2 = -6k$ $k = \frac{1}{3}$ $6 = \frac{1}{3}(h+4)$ $h = 14$	 M1 A1 A1	G7 AO1

QN	Solution	Marks	AO Level
5b(i)	$\overrightarrow{OS}=\overrightarrow{OP}+\overrightarrow{PS}$ $\overrightarrow{OS}=4\mathbf{b}+\frac{m}{13}\overrightarrow{PR}$ $\overrightarrow{OS}=4\mathbf{b}+\frac{m}{13}(-4\mathbf{b}+2\mathbf{a})$ $\overrightarrow{OS}=\frac{2m}{13}\mathbf{a}+\left(4-\frac{4m}{13}\right)\mathbf{b}$	M1 A1	G7 AO1
5(ii)	$\overrightarrow{OS}=\frac{4}{13}\overrightarrow{OT}$ $\overrightarrow{OS}=\frac{4}{13}(4\mathbf{b}+5\mathbf{a}-\mathbf{b})$ $\overrightarrow{OS}=\frac{20}{13}\mathbf{a}+\frac{12}{13}\mathbf{b}$ $2m=20$ $m=10$	M1 A1 A1	G7 AO2
5b(iii)	$\overrightarrow{OU}=\overrightarrow{OR}+\overrightarrow{RU}$ $\overrightarrow{OU}=2\mathbf{a}+\frac{2}{3}(7\mathbf{a}+6\mathbf{b})$ $\overrightarrow{OU}=2\mathbf{a}+\frac{14}{3}\mathbf{a}+\frac{12}{3}\mathbf{b}$ $\overrightarrow{OU}=\frac{20}{3}\mathbf{a}+\frac{12}{3}\mathbf{b}$ $\overrightarrow{OU}=\frac{4}{3}(5\mathbf{a}+3\mathbf{b})$ $\overrightarrow{OS}=\frac{4}{13}(5\mathbf{a}+3\mathbf{b})$ Since vector *OU* and *OS* are scalar multiple of each other with the common point *O*, therefore *O, S, and U* lies on a straight line.	M1 A1 –1M from whole qn if there is no vector notation B1	G7 AO3

QN	Solution	Marks	AO Level
6(a)(i)	angle *BAD* = 180º – 98º (angles in the opp segment) = 82º angle *BAO* = 82º – 30º = 52º angle *BOA* = 180º – 2(52º) (angle sum of isos triangle) = 76º angle *OAE* = 90º (tangent perpendicular to radius) angle *OEA* = 180º – 90º – 76º (angle sum of triangle) = 14º	B1 B1 B1 minus 1 mark if no/wrong reason given	G3 AO1
6(a)(ii)	Since angle *OAE* = 90º (tangent perpendicular to radius), it formed **a right angle in a semicircle** therefore a circle with diameter *OE* will passes through *A*.	AG1	G3 AO3
6(b)	R: angle *QTS* = angle *TRU* (rt angle in semicircle) H: *QS* = *TU* (diameter of 2 equal circles) S: *QT* = *TR* (radii of 2 equal circles) By RHS, triangles *STQ* and *URT* are congruent OR A: angle *QTS* = angle *TRU* (rt angle in semicircle) S: *QT* = *TR* (radii of 2 equal circles) A: angle *TQS* = angle *RTU* (equilateral triangle *TQR*) By ASA, triangles *STQ* and *URT* are congruent OR A: angle *QTS* = angle *TRU* (rt angle in semicircle) A: angle *TQS* = angle *RTU* (equilateral triangle *TQR*) S: *QS* = *TU* (diameter of 2 equal circles) By AAS, triangles *STQ* and *URT* are congruent	M2 for RHS –1 if no/wrong reason AG1	G2 AO3

QN	Solution	Marks	AO Level
7a	Volume of inner core $\frac{4}{3}\pi(3x)^3$ $=\frac{4}{3}\pi(27x^3)$ $=36\pi x^3$ (shown)	Must show AG1	G5 AO3
7b	Volume of cylinder $\pi(4x)^2 h = 16\pi h x^2$ $16\pi h x^2 = 200 \times 36\pi x^3$ $h = 450x$	M1 A1	G5 AO2
7c	$16\pi h x^2 = 2024363\pi$ $16(450)x^3 = 2024363$ $x = \sqrt[3]{\frac{2024363}{16 \times 450}}$ $x = 6.551166413$ $x = 6.55(3sf)$	M1 A1	G5 AO2
7d	Radius golf ball $= 3x + y$ $= 19.6534 + 1.8$ $= 21.4534\ mm$ Surface Area of golf ball $= 4\pi(21.4534)^2$ $= 5783.6516\ mm^2$ Number of golf balls $= \frac{(620 \times 920)}{5783.6516}$ $= 98.622$ $= 98\ golf\ \ balls\ (round\ down)$	B1 M1 M1 for area of plastic sheet A1	G5 AO2

QN	Solution	Marks	AO Level
8a	$0.9^2 = 1.2^2 + 1.4^2 - 2(1.2)(1.4)\cos\angle BAC$ $\cos\angle BAC = \dfrac{0.9^2 - 1.2^2 - 1.4^2}{-2(1.2)(1.4)}$ $\angle BAC = \cos^{-1}\left(\dfrac{0.9^2 - 1.2^2 - 1.4^2}{-2(1.2)(1.4)}\right)$ $\angle BAC = 39.57121$ $\angle BAC = 39.6°\ (1dp)$	M1 M1 A1	G4 AO1
8b	$\dfrac{AD}{\sin 25°} = \dfrac{1.4}{\sin 122°}$ or $\dfrac{CD}{\sin 33°} = \dfrac{1.4}{\sin 122°}$ $AD = \dfrac{1.4}{\sin 122°} \times \sin 25°$ or $CD = \dfrac{1.4}{\sin 122°} \times \sin 33°$ $AD = 0.697679$ $CD = 0.899117$ Let DX be the shortest distance from the foot of D to AC. $\sin 33° = \dfrac{DX}{0.697679}$ $\sin 25° = \dfrac{DX}{0.899117}$ $DX = \sin 33° \times 0.697679$ or $DX = \sin 25° \times 0.899117$ $DX = 0.379983$ $DX = 0.379983$ $DX = 0.380\ (3sf)$ $DX = 0.380\ (3sf)$	M1 M1 A1	G4 AO2
8c	Let θ be the angle of depression $\tan\theta = \dfrac{0.3}{0.379983}$ $\theta = \tan^{-1}\left(\dfrac{0.3}{0.379983}\right)$ $\theta = 38.2914$ $\theta = = 38.3°\ (1dp)$	M1 A1	G4 AO2
8d	Bearing of A from B $180° + (90° - 39.57°)$ $270° - 39.57°$ $= 230.43°$ or $= 230.43°$ $= 230.4°\ (1dp)$ $= 230.4°\ (1dp)$	B1	G4 AO1

QN	Solution	Marks	AO Level
9(a)	Area of 3 bedrooms: = Master Bedroom + Bedroom 2 + Bedroom 3 = 3800×4850 +(2400+1600)(6800–2500) + 3800×4400 = 52 350 000 mm^2 = 52.35 m^2 Or $(3.8)(4.85)+(2.4+1.6)(6.8-2.5)+(3.8)(4.4)$ $=52.35\ m^2$	M1 A1 M1 A1	G5 AO1
9b	Volume 52.35×0.05 $=2.6175\ m^3$	B1/FT1	G5 AO1
9c	Amount of cement-sand mixture 2.6175×1400 $=3664.5\ kg$ Number of pre-mix bags $3664.5\div 40$ $=91.6125$ $=92\ (roundup)$ Cost of Pre-mix bags $92\times 18.50=\$\ 1702$ Number of planks required $\frac{52.35}{0.06\times 0.3}$ $=2908.33$ $=2909\ (roundup)$ Number of boxes required $\frac{2909}{50}$ $=58.18$ $=59\ (round\ up)$ Cost of Planks $59\times 35.50=\$\ 2094.50$	SC1 for both# $their\times 1400$# $their\div 40$# SC1 $their\times 18.50$ PC1 for both* $\frac{their}{60\times 300}$* $\frac{their}{50}$* PC1 $their\times 35.50$	G8 AO3

QN	Solution	Marks	AO Level
	<u>Cost of Manpower</u> Cement screed construction = 4 × 1 × 8 × \$5 = \$160 Timber construction = 2 × 3 × 8 × \$10 = \$480 Total = \$160 + \$480 = \$640 Total Cost = \$1702 + \$2094.50 + \$640 = \$4436.50 Total Floor size (sq foot) = 52.35 ÷ 0.09203 = 568.836 $sq\ ft$ Cost per sq ft =\$4436.50 ÷ 568.836 = \$7.80 Kent should charge at \$10 per sq ft	MC1 (must be \$640) SF1 *their* ÷ 0.09203 SP1 (any amount more than total cost)	