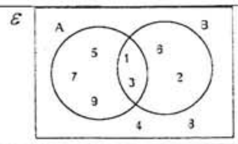
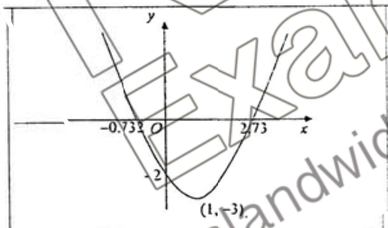
AMKSS MID YEAR EXAMINATION 2019

4E/5N ELEMENTARY MATHEMATICS PAPER 1

NO	SOLUTIONS	MARKS
1a	$x+7-x(2-3x)$ $=x+7-2x+3x^2$ $=3x^2-x+7$	 M1 A1
1b	$4ax+12a-x-3$ $=4a(x+3)-(x+3)$ $=(4a-1)(x+3)$	 M1 A1
	Misleading feature: Chocolate and Almond flavours have equal percentage but the size of the sectors on the pie chart do not look equal. Effect of this feature on the graph It mislead readers into believing that Chocolate cookies is selling better than Almond cookies.	B1 B1
OR	Misleading feature: The title is biased. Effect of this feature on the graph It does not allow readers to make their own judgement.	B1 B1
3a	$X \cap Y'$	B1
3bi		B1
3bii	4, 8	B1
4a	x^2-2x-2 $=x^2-2x+1-2-1$ $=(x-1)^2-3$	B2
4b		turning + shape B1 for ~~x intercepts~~ B1 for y intercept and ~~correct shape.~~
5	$1550 \times 81.7339 \times 1.018$ =¥128967.92	M1 A1
6	$\frac{4}{3-x}+\frac{1}{x^2-3x}$ $=\frac{-4}{x-3}+\frac{1}{x(x-3)}$ $=\frac{1-4x}{x(x-3)}$ or $\frac{4x-1}{x(3-x)}$	
7a	$5 \times 0.6 = 3$ km	B1
7b	$1\text{ cm}^2 : 25\text{ km}^2$ $\frac{5}{25}$ $=0.2\text{ km}^2$	 M1 A1
8	$28+(60\times20\times0.035)+(60\times6\times0.1)$ $=28+42+36$ $=\$106$	M1 A1
9	$\frac{A_y}{A_x}=\frac{4}{1}=\left(\frac{2}{1}\right)^2$ $\frac{V_y}{V_x}=\left(\frac{2}{1}\right)^3=\frac{8}{1}$ $V_y=8\times512=4096\text{ cm}^3$	M1 M1 A1
10a	$PR=\frac{28\times2}{7}=8$ units $R=(0,-3)$	M1 A1
10b	Gradient $=\frac{3}{7}$ $y=\frac{3}{7}x-3$	M1 A1
11	$1.3\times0.8=1.04$ % change = 104 − 100 = 4%	M1 A1
12a	$2^3\times3^2\times5$ Accept $2\times2\times2\times2\times3\times3\times5$	B2
12b	H.C.F. $=2\times3^2=18$	B1
12c	$m=2^2\times3^4\times5^5=1012500$	B1
13	$\frac{9}{\sin 42}=\frac{8}{\sin\angle ACB}$ $\sin\angle ACB=\frac{8\sin42}{9}$ $\angle ACB=36.49714719=36.5°$	M1 A1
14	Area of sector $OCB=\frac{1}{2}\times10^2\times1.2=60\text{ cm}^2$ $\angle CAD=\frac{1.2}{2}=0.6$ rad Area of sector $ACD=\frac{1}{2}\times16^2\times0.6=76.8\text{ cm}^2$ $\Delta OAC=\frac{1}{2}\times10\times6\times\sin0.6=45.17139787\text{ cm}^2$ OCD = sector $ACD-\Delta OAC=31.62860213\text{ cm}^2$ Shaded area = sector $OCB-OCD$ $=28.37139787=28.4\text{ cm}^2$	M1 M1 M1 M1 A1
15ai	30	B1
15aii	36 − 23 = 13	M1 A1
15b	33 (± 1)	B1
16a	630	B1
16b	$\frac{n(n+1)}{2}=1378$ $n^2+n-2756=0$ $(n+53)(n-52)=0$ $n=-53$ or 52 $n=52$	M1 A1 or B2
16c	$T=(1+2+3+\ldots+99)+99(100)$ $=\frac{99(99+1)}{2}+9900$ $=14850$	M1 A1
16d	$P=2(1+2+3+\ldots+50)$ $=2\times\left(\frac{50\times51}{2}\right)$ $=2550$	M1 A1
16e	$\frac{100(101)}{2}-2550=2500$	B1
17a	0.1	B1
17bi	0.015 Accept $\frac{3}{200}$	B1
17bii	$0.9\times0.15\times0.85=0.11475$ Accept $\frac{459}{4000}$	B1
17c(i)	$(0.9)^3=0.729$ Accept $\frac{729}{1000}$	B1
17c(ii)	$1-0.729=0.271$ Accept $\frac{271}{1000}$	B1
18a	$\sqrt{4^2+(-5)^2}=6.403124237$ $=6.40$ (3sf)	B1
18b	$\vec{BC}=\vec{OC}-\vec{OB}$ $\vec{OC}=\begin{pmatrix}-5\\2\end{pmatrix}+\begin{pmatrix}7\\0\end{pmatrix}=\begin{pmatrix}2\\2\end{pmatrix}$ $C=(2,2)$	 M1 A1
19a	$x=\frac{56+64}{2}=60$ $y=\frac{72+76}{2}=74$	B1 B1
19b	60	B1
20	$R^2=(10-R)^2+5^2$ $R^2=100-20R+R^2+25$ $20R=125$ $R=6.25$	M1 M1 A1

21ai	$\left(x^{-4}y\right)^{-3} = \dfrac{x^{12}}{y^{3}}$	B1
21aii	$\dfrac{18x^{\frac{1}{3}}}{4\sqrt{x}} = \dfrac{18x^{\frac{1}{3}}}{4x^{\frac{1}{2}}}$ $= \dfrac{9}{2x^{\frac{1}{6}}}$	M1 for rewriting as fractional index A1
21b	$2^{5x-1} = 3^{5x-1}$ $\left(\dfrac{2}{3}\right)^{5x-1} = 1$ $\left(\dfrac{2}{3}\right)^{5x-1} = \left(\dfrac{2}{3}\right)^{0}$ $5x - 1 = 0$ $x = \dfrac{1}{5}$	M1 A1
22a	$QR = TS$ (regular polygon) RS is common $\angle QRS = \angle TSR$ (interior $\angle$ of regular polygon) $\Delta QRS \equiv \Delta TSR$ (SAS)	M1 M1
22bi	$n = \dfrac{360}{30} = 12$	B1
22bii	interior $\angle = 180 - 30 = 150$ $\angle RTS = \dfrac{180-150}{2} = 15°$ (base $\angle$s of isos Δ)	M1 A1
22biii	Sum of interior $\angle$s of $PQRST = (5-2)\times 180 = 540°$ $\angle QPT = \dfrac{540 - 3(150)}{2} = 45°$	M1 A1
OR	$\angle AQS = 15 + 30 = 45°$ $\angle QPT = \angle AQS = 45°$ (corresponding $\angle$s)	* must state corresponding $\angle$s

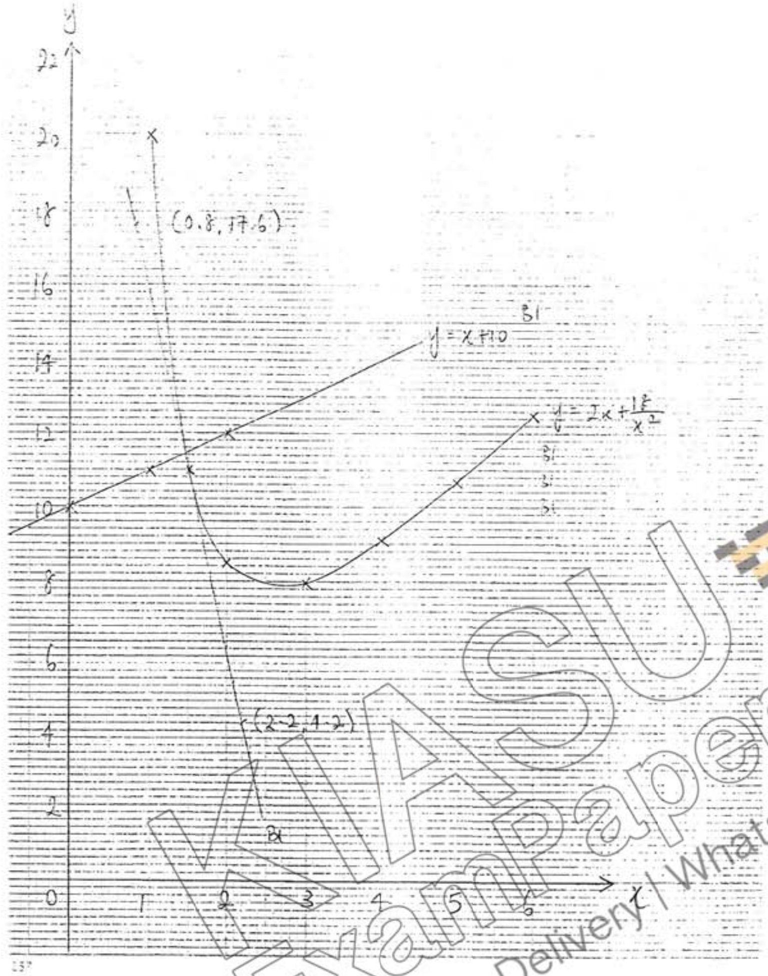
Solutions to 4E EM P2 2019

Qn	Solutions	Marks
1ai	$y + z = \dfrac{4y - 6z}{7x}$ $2 - 1 = \dfrac{8+6}{7x}$ $1 = \dfrac{14}{7x}$ $7x = 14$ $x = 2$	B1
1aii	$y + z = \dfrac{4y - 6z}{7x}$ $7xy + 7xz = 4y - 6z$ $7xz + 6z = 4y - 7xy$ $z(7x+6) = 4y - 7xy$ $z = \dfrac{4y - 7xy}{7x+6}$	M1 for expansion A1
1b	$\dfrac{2a+1}{3} + \dfrac{a-2}{4} = 2$ $\dfrac{4(2a+1)+3(a-2)}{12} = 2$ $8a + 4 + 3a - 6 = 24$ $11a - 2 = 24$ $11a = 26$ $a = 2\dfrac{4}{11}$	M1 for single fraction A1
1c	$\times 5,\ 20p + 15q = 10$ ---(1) $\times 4,\ 20p - 16q = 196$ ---(2) (1) − (2), $31q = -186$ $q = -6$ $p = 5$	M1 for $20p$ or $12q$ for both eq A1 A1
1d	$\dfrac{4h^2 - 36}{4h^2 - 5h - 21}$ $= \dfrac{4(h+3)(h-3)}{(4h+7)(h-3)}$ $= \dfrac{4(h+3)}{4h+7}$	M1 factorise numerator M1 factorise denominator A1
2ai	$-2\mathbf{a} + 6\mathbf{b}$	B1
2aii	$\overrightarrow{OB} = \overrightarrow{OX} + \overrightarrow{XB}$ $= 6\mathbf{b} + 3(-2\mathbf{a} + 6\mathbf{b})$ $= -6\mathbf{a} + 24\mathbf{b}$	M1 for triangle law A1
2aiii	$\overrightarrow{AY} = \overrightarrow{AO} + \overrightarrow{OY}$ $= -2\mathbf{a} + (6\mathbf{b} + 2\mathbf{b})$ $= -2\mathbf{a} + 8\mathbf{b}$	M1 for triangle law A1
2b	$\overrightarrow{OB} = -6\mathbf{a} + 24\mathbf{b}$ $= 3(-2\mathbf{a} + 8\mathbf{b})$ $= 3\overrightarrow{AY}$ OB is parallel to AY and $OB = 3AY$	-1 mark for poor presentation M1 for vector expression A1 for both facts
3a	$\mathbf{D} = \begin{pmatrix} 180 & 240 \\ 90 & 150 \\ 240 & 300 \end{pmatrix}$	B1
3b	$\mathbf{C} = \begin{pmatrix} 2 & 1.8 & 1.4 \end{pmatrix}$	B1
3c	$\mathbf{Q} = \begin{pmatrix} 2 & 1.8 & 1.4 \end{pmatrix}\begin{pmatrix} 180 & 240 \\ 90 & 150 \\ 240 & 300 \end{pmatrix}$ $= \begin{pmatrix} 858 & 1170 \end{pmatrix}$	M1 A1
3d	Elements of Q represent the money collected by each outlet from selling all the pastries in a day.	B1
3e	$\mathbf{E} = \begin{pmatrix} 22 & 0 \\ 0 & 30 \end{pmatrix}$ $\mathbf{F} = \begin{pmatrix} 858 & 1170 \end{pmatrix}\begin{pmatrix} 22 & 0 \\ 0 & 30 \end{pmatrix}$ $= \begin{pmatrix} 18876 & 35100 \end{pmatrix}$	B1 B1

3f	Scheme A: 0.9 ~~0.8~~ × Q = ~~0.8~~ × (558 1170) = (722.2 1053) 0.9 = ~~(446.4 936)~~ Scheme B: $(0.8\times2 \quad 1.8 \quad 1.4)\begin{pmatrix}180 & 240\\ 90 & 150\\ 240 & 300\end{pmatrix}$ = (786 1074) Scheme B allows both outlets to have a larger amount of money collected from the sale of all pastries.	B1 for the money collected from each outlet for each scheme B1
4a	ΔFCG or ΔFBA	B1
4b	$\angle OEF = 90°$ (rad ⊥ tan) $\angle ABF = 90°$ (angle in a square) $\angle OEF = \angle ABF$ $\angle F$ is common. $\angle EOF = \angle BAF$ ($\angle$ sum of Δ) Since all corresponding angles are equal, ΔOEF is similar to ΔABF.	M1, M1 for each angle
4c	$\frac{EF}{BF} = \frac{OE}{AB}$ $\frac{EF}{12+4} = \frac{6}{12}$ $EF = 8\ cm$	M1 A1
4di	Triangles share same height. $\frac{4}{12} = \frac{1}{3}$	B1
4dii	$\frac{Area\ \Delta OEF}{Area\ \Delta ABF} = \left(\frac{OE}{AB}\right)^2 = \left(\frac{6}{12}\right)^2 = \frac{1}{4}$ $\frac{Area\ \Delta OEF}{Area\ ABOE} = \frac{1}{3}$	M1 A1 or B2
5a	Xavier – xt m Yves – $(x+3)t$ m	B1 B1
5b	$xt + (x+3)t = 400$ $xt + xt + 3t = 400$ $2xt + 3t = 400$ $t(2x+3) = 400$	M1 equate sum of distances to 400 and expand
5c	Yves – xT m Zed – $(x-1)T$ m $xT + (x-1)T = 400$ $xT + xT - T = 400$ $T = \frac{400}{2x-1}$	B1
5d	$T - t = 20$ $\frac{400}{2x-1} - \frac{400}{2x+3} = 20$ $\frac{400(2x+3)-400(2x-1)}{(2x-1)(2x+3)} = 20$ $\frac{800x+1200-800x+400}{4x^2+6x-2x-3} = 20$ $1600 = 20(4x^2+4x-3)$ $1600 = 80x^2+80x-60$ $80x^2+80x-1660 = 0$ $\div 20,\ 4x^2+4x-83 = 0$	M1 for correct difference of time M1 for single fraction M1 for expansion and cross multiply
5e	$x = \frac{-4\pm\sqrt{16+1328}}{8} = \frac{-4\pm\sqrt{1344}}{8}$ = 4.082575695 or −5.082575695 = 4.08 or −5.08	M1 A1, A1 for each answer
5f	$\frac{400}{4.082575695}$ = 97.97736279 = 98.0s	B1
6a	$AC^2 = 23^2 + 35^2 - 2(23)(35)\cos 42°$ = 557.536831 $AC = 23.61221783 = 23.6m$	M1 M1 A1
6b	$\tan\theta = \frac{8}{AC}$ $\theta = \tan^{-1}\frac{8}{23.61221783} = 18.71677335 = 18.7°$	M1 A1
6c	Area = $\frac{1}{2}(23)(35)\sin 42°$ = 269.3250691 = 269 m	M1 A1
6d	Area of triangle ABC = Area of triangle ABD $269.3250691 = \frac{1}{2}\times35\times d$ $d = 15.39000395 = 15.4m$	M1 A1
6e	Top + Bottom Areas = $2\times\frac{1}{2}\times15.39000395\times(17+35) = 800.2802052m^2$ Vertical sides = $(20+17+23+35)\times8 = 760m^2$ Total surface area = 1560.2802052 = 1560 m²	M1 M1 A1
7a	$\angle BXZ = 47°$ (angles in same segment) $\angle BZA = 90°$ (angle in semi-circle) $\angle BZY = 180° - 90°$ (angles on a straight line) $\angle BZX = 180 - 47 - 90 - 23 = 20°$ (angle sum of Δ)	M1 M1 Minus 1mark if any above reasons missing A1
7bi	109° (corresponding angle)	Minus 1mark from entire qn if any underlined reasons missing B1
7bii	$\frac{180-114}{2} = 33°$ (EF = FG as sides of rhombus and base angles of isosceles triangle)	M1 A1
7biii	$\angle EBM = 180 - 109 = 71°$ (interior angles) $\angle EMB = 180 - 71 - 33 = 76°$ (angle sum of Δ)	M1 A1
8ai	3, 6, 6, 3, 3, 11	B1 for any 3 B1 for next 3
8aii	$\frac{6}{16} = \frac{3}{8}$	B1
8aiii	$\frac{6}{16} = \frac{3}{8}$	B1
8aiv	$\frac{14}{16} = \frac{7}{8}$	B1
8bi	89 – 43 = 46	B1
8bii	60	B1
8biii	$\frac{1}{23}\times100\% = 4.35\%$	B1
8biv	Add 2 points across all score => median increased by 2 or median changed to 62.	B1
8bv	11.46062545=11.5 (3sf)	B2
8bvi	The group with the lower standard deviation of 7.96 points has players with more consistent scores.	B1
9a	$a = 8.5$	B1
9b	Refer to graph (3m)	
9c	x = 1.4 and 5.7 (accept 1.3 to 1.5 and 5.6 to 5.8) (calculator 1.399 and 5.73)	B1 each

−7.5 to −11

9d	Refer to graph (1m) Gradient = $\frac{4.2-17.6}{2.2-0.8} = -9.57$ (accept −7.0 to −11) (calculator −8.667)	A1
9e	Refer to graph (1m)	
9ei	$x = 1.45$ (accept 1.35 to 1.55) (calculator 1.45)	A1
9eii	$x + 10 = 2x + \frac{18}{x^2}$ $x^3 + 10x^2 = 2x^3 + 18$ $0 = x^3 - 10x^2 + 18$ $A = -10, B = 0$	M1 for sub eq A1 for both answer
10a	Mean = $\frac{538+611+613+287+472+698}{6} = 536.5$ kWh There is an extreme lower value in Dec as compared to the other 5 months' figures so this will make the mean value inaccurate.	A1 A1
10bi	42.80×10 = $428	M1 A1
10bii	Feb – 698 kWh iSwitch: $\frac{17.62\times698}{100}\times\frac{1}{100}$ = $1.23 Sembcorp: $5.35 Sembcorp is more expensive	M1 to calc iSwitch A1 for correct comparison
10biii	Usage = 1170 kWh Chope the rate: $\frac{17.62\times1170}{100} = \$206.15$ Super Saver Discount: $\frac{100-22.80}{100}\times\frac{21.85}{100}\times1170 = \$197.35794$ Add 7% GST = 1.07 × $197.35794 = $211.17 He should choose the fixed rate Chope the rate scheme as it is cheaper and he can save $5.05	M1 for fixed rate M1 for discount off M1 to include GST A1 only for correct accurate comparison



y
(0.8, 17.6)
y = x + 10
y = 2x + 18/x²
(2.2, 4.2)
x