Broadrick Secondary School

4E5N Preliminary Examination 2024

Paper 1 Marking Scheme

1	-0.17898 = -0.1790 (4sf)	B1
2a	Mean = $\frac{228}{100}$ = 2.28 s	B1
b	$\sqrt{\frac{601}{100}-(2.28)^2}$ = 0.901 s (3sf)	B1
3	$\frac{5^x}{2^{2x}\times 5^{3-x}}=2^m5^n$ $2^{-2x}5^{x-(3-x)}=2^m5^n$ $m=-2x$ $n=2x-3$	 B1 B1
4	HCF = $18=2\times 3^2$ LCM = $324=2^2\times 3^4$ X = $2^2\times 3^2$ = 36 Y = 2×3^4 = 162	 B1 B1
5a	1 : 50 000 1cm: 0.5 km Actual dist = 7.5×0.5=3.75 km	 B1
b	1cm: 0.5 km 1 cm^2: 0.25 km^2 Area on map = $2.25\div 0.25$=9 cm^2	 M1 A1
6	Largest density = largest mass/smallest vol = $\frac{115.4\dot{9}}{5.5}=\frac{115.5}{5.5}$ = 21 g/ cm^3	 M1 A1
7	$n=3$ or 5 (any odd integer more than 1) $-1=(1)^3+b$ $b=-2$	B1 B1
8a	$\frac{\sin\angle ACB}{14.6}=\frac{\sin 31}{7.6}$ $\angle ACB=81.6562$ Obtuse $\angle ACB=180-81.6562=98.3438$=98.3° (1dp)	M1 A1

b	Angle *ABC* = $\angle ACB = 180 - 31 - 98.3438$ =50.6562 Area = $\frac{1}{2}(14.6)(7.6)\sin(50.6562)$ =42.9 cm² (3sf)	M1 (formula to find area with their angle) A1
9	In Singapore: Amount of Yen = $\frac{850}{100} \times 11600 = 98600$ In Japan Amount of Yen = $\frac{850}{0.0086} \times 1 = 98837.21$ $98837.21 > 98600$ Her claim is not true. She will receive (237.21 Yen) more if she changes in Japan.	M1 M1 A1
10a	The vertical axis did not start from 0. (Optional: The scores in 2022 looked like it had increased to 6 times but the increase was from 55 to 80 (which is slightly less than double.)	B1
b	I disagree. Although the increase in the height of the bar looks the same from 2022 to 2024 for both classes, the scale of the two graphs are different. It exaggerates the increase in test scores of Class B.	B1
11	$2^p \times 5^q \times \frac{5}{2}$ -- perfect cube (powers are multiples of 3) $p = 4$ $q = 2$	B1 B1
12a	$\left(16y^3\right)^{\frac{3}{2}} = 64y^{\frac{9}{2}}$	B1
b	$5^k = 125\sqrt[3]{5\sqrt{5}}$ $5^k = 5^3\left(5(5)^{\frac{1}{2}}\right)^{\frac{1}{3}}$ $5^k = 5^3\left(5^{\frac{3}{2}}\right)^{\frac{1}{3}}$ $5^k = 5^3\left(5^{\frac{1}{2}}\right)$ $k = 3\frac{1}{2}$	M1 (change either to power of 3) M1 (combine to $5^{\frac{1}{2}}$ or to a single power of 3) A1

13a	A={2,3,4,6,8,12}	B1
b	Since $p \le x < 20$, B={…,11, 13, 17, 19} C={…,9, 16} $(B \cup C) = \{...,9,11,13,16,17,19\}$ $(B \cup C)' = \{12,14,15,18\}$	B1
c	A={2,3,4,6,8,12} C={4,9,16} If $A \cap C = \varnothing$, smallest p = 5	B1
14	$X = \frac{7-5}{5} \times 100\%$ = 40%	M1 A1
15	In triangle *OAP* and *BPA*, * $\angle OPA = \angle BAP$ (alt angle, *AB* // *OP*) Since *OA* = *AP* = *PB* (same radius). * $\angle AOP = \angle PBA$ (base angles of isos triangle) **AP* = *PA* (common side) Therefore $\Delta OPA \equiv \Delta BAP$ (AAS) Hence *AB* = *OP*	B2 (any 2 of the 3 stmts) A1 (conclude AAS and equal sides)
16a	$2y = -4x + 1$ AB: $y = -2x + \frac{1}{2}$ $4y = -9x + 2$ PQ: $y = -\frac{9}{4}x + \frac{1}{2}$ The gradient of *PQ* should be steeper than that of *AB*. Hence she is not correct.	M1 (rearrange to find gradient of either line) A1 (compare both gradient and conclude)

bi	$y=(x+4)(x-1.5)$ $y=x^2+2.5x-6$	M1 A1
bii	Min point (-1.25, -7.5625)	B1, B1
17	$\frac{2x}{3x-1}-\frac{4}{2x+1}$ $=\frac{2x(2x+1)-4(3x-1)}{(3x-1)(2x+1)}$ $=\frac{4x^2+2x-12x+4}{(3x-1)(2x+1)}$ $=\frac{4x^2-10x+4}{(3x-1)(2x+1)}$	M1 A1
18ai	$24a^2b+12ab^2-ab$ $=ab(24a+12b-1)$	B1
aii	$mn-18-9m+2n$ $=mn-9m+2n-18$ $=m(n-9)+2(n-9)$ $=(m+2)(n-9)$	M1 (grouping) A1
b	$(-2x+3q)(x-2q)$ $=-2x^2+4xq+3qx-6q^2$ $=-2x^2+7xq-6q^2$	M1 A1
19a	$A=P(1+\frac{r}{100})^n$ $=20000\left(1+\frac{0.3}{100}\right)^{24}$ =21490.79038 = $21490.79 (2dp)	M1 A1
b	$A=\frac{4A}{5}(1+\frac{r}{100})^{36}$ $\frac{5}{4}=(1+\frac{r}{100})^{36}$ $\sqrt[36]{\frac{5}{4}}=1+\frac{r}{100}$ $\sqrt[36]{\frac{5}{4}}-1=\frac{r}{100}$ r = 0.622%	M1 A1
20		

	$\frac{2x^2-5xy-12y^2}{x^2-16y^2}$ $=\frac{(x-4y)(2x+3y)}{(x+4y)(x-4y)}$ $=\frac{2x+3y}{x+4y}$	M1, M1 A1
21a	$PQ=\sqrt{(-3-3)^2+(1-3)^2}$ = 6.32 units (3sf)	M1 A1
b	*R* is (1, −3) By sketching and counting, From Q to P: horizontally -6 and vertically -2 Since y=x is reflection line, From Q to R: horizontally -2 and vertically -6	B1
22	Int angle of pentagon $=\frac{(5-2)\times180}{5}=108°$ Int angle of square = 90° Interior angle of regular polygon = $360-90-108=162°$ Exterior angle = $180-162=18°$ $n=\frac{360}{18}=20$ Since n is a positive integer, it is possible to form a regular polygon, hence a closed loop.	M1 M1 (int or ext of polygon) A1
23a	$\pi r^2h=4\left(\frac{2}{3}\pi\left(\frac{1}{2}r\right)^3\right)$ $\pi r^2h=\frac{8}{3}\pi\left(\frac{1}{8}r^3\right)$ $h=\frac{8}{3}\left(\frac{1}{8}r\right)$ $h=\frac{1}{3}r$	M1, M1 A1
b		M1

	$\frac{4}{9}=\left(\frac{H}{h}\right)^2$ $\frac{H}{h}=\frac{2}{3}$ $H=\frac{2}{3}h=\frac{2}{3}\left(\frac{1}{3}r\right)$ $H=\frac{2}{9}r$	A1
24a	$5n^2-n=n(5n-1)$ When n is odd, 5n is odd and 5n-1 is even Since product of odd and even number is always even, $n(5n-1)$ is even. When n is even, 5n is even and 5n-1 is odd. Since product of odd and even number is always even, $n(5n-1)$ is even. Hence the sum of the first *n* terms in the sequence is always even.	M1 A1
b	1st term: $5(1)^2-1=4$ 2nd term: $5(2)^2-2-4=14$ 3rd term: $5(3)^2-3-14-4=24$ Therefore nth term = $10n-6$	M1 A1
25a	$P=\begin{pmatrix}4 & 3 & 2\\ 2 & 0 & x\end{pmatrix}$	B1
b	$\mathbf{R}=\mathbf{PQ}=\begin{pmatrix}4 & 3 & 2\\ 2 & 0 & x\end{pmatrix}\begin{pmatrix}8 & -1.1\\ 10 & -2.8\\ 11.5 & 1.5\end{pmatrix}$ $=\begin{pmatrix}85 & -9.8\\ 16+11.5x & -2.2+1.5x\end{pmatrix}$	B2 (B1 for any 2 correct)
c	It represents the amount of money Kevin and Molly spent respectively at Bookstore A.	B1
d	$-2.2+1.5x=5.3$ $x=5$	B1

26a	1.5 km/min $= \dfrac{1.5\times 1000}{1\times 60}$ =25 m/s	B1
b	Area = dist travelled $21=\frac{1}{2}(v+1.5)(20)$ $21=10(v+1.5)$ $2.1=v+1.5$ $v=0.6$	M1 A1
c	$\dfrac{speed-0.6}{12}=\dfrac{1.5-0.6}{20}$ $\dfrac{speed-0.6}{12}=0.045$ $speed=1.14km/\min$ = 19m/s OR $acc=\dfrac{1.5-0.6}{20}=0.045$ $speed=0.6+12(0.045)=1.14km/\min=19m/s$	M1 A1
d	Area = dist travelled $92.25=\frac{1}{2}(0.6+1.5)(20)+1.5(40)+\frac{1}{2}(t)(1.5)$ $92.25=21+60+0.75t$ $11.25=0.75t$ $t=15\min$ T is 0915	M1 A1
27a	$3BD = 2DC$ $\quad \dfrac{BD}{DC}=\dfrac{2}{3}$ $\overrightarrow{AD}=\overrightarrow{AB}+\overrightarrow{BD}$ $=\mathbf{m}+\frac{2}{5}\overrightarrow{BC}$ $=\mathbf{m}+\frac{2}{5}(-\mathbf{m}+\mathbf{n})$ $=\frac{3}{5}\mathbf{m}+\frac{2}{5}\mathbf{n}$	 M1 A1
bi		

	$\overrightarrow{AR} = k\overrightarrow{AD} = \frac{3}{5}k\mathbf{m} + \frac{2}{5}k\mathbf{n}$ $\overrightarrow{BR} = \overrightarrow{BA} + \overrightarrow{AR}$ $= -m + \frac{3}{5}k\mathbf{m} + \frac{2}{5}k\mathbf{n}$ $= \left(\frac{3}{5}k - 1\right)\mathbf{m} + \frac{2}{5}k\mathbf{n}$ Since *AC* is parallel to *BR* and $\overrightarrow{AC} = \mathbf{n}$ $\frac{3}{5}k - 1 = 0$ $k = \frac{5}{3}$	M1 M1 A1
bii	$\frac{\text{Area of triangle } ABD}{\text{Area of triangle } RBD} = \frac{AD}{DR}$ $\frac{3}{2}$	A1