2022 4E5A Preliminary Examination Paper 1 Mark Scheme

1	$\frac{\sqrt[3]{-5^2-(-5)^2\times 5}}{-5\times\sqrt{5}}=\frac{\sqrt[3]{-25-25\times 5}}{-5\times\sqrt{5}}$ $=\frac{\sqrt[3]{-25-125}}{-5\times\sqrt{5}}$ $=\frac{\sqrt[3]{-150}}{-5\times\sqrt{5}}$ $=0.475235$ $=0.475\ \ (3sf)$	B1
2	$\angle QOS=38\times 2$ ($\angle$at centre = 2 times $\angle$ at circumference) $=76°$ $\angle OSQ=\frac{180-76}{2}$ (base angles of isosceles triangle) $=52°$	M1 A1
3	Diagram 4	B1
4a	The size of the picture is different over the years.	B1 (o.e)
4b	The reader may be misled to think that a bigger picture represents more people.	B1 (o.e)
5a	$27^3=(3^3)^3$ $=3^9$	B1
5b	$\frac{2x^2y^3}{5z}\div\frac{4x^4z}{25y}$ $=\frac{2x^2y^3}{5z}\times\frac{25y}{4x^4z}$ $=\frac{5y^4}{2x^2z^2}$	M1 (for any simplification of constants or variable) A1
6	Worker : Hours : Footbridge 18 : 60 : 3 18 : 20 : 1 1 : 360 : 1 1 : 2520 : 7 63 : 40 : 7 Additional workers = $63-18=45$ workers	 M1 A1
7	6, 6, 9, 11, 18	B1 for any 3 B2 for all 5

8	$\frac{4x+1}{2}-\frac{x}{5}=-1$ $\frac{20x+5}{10}-\frac{2x}{10}=-1$ $18x+5=-10$ $x=-\frac{5}{6}$	M1 M1 A1
9a		B1 for all correct
9bi	$\frac{6}{25}$	B1 (ecf)
9bii	$\frac{5}{25}$	B1 (ecf)
9c	The spinner has to be fair so that the probabilities of obtaining each outcome is equal.	B1 (o.e)
10a	x^2-7x+5 $=x^2-7x+\left(\frac{7}{2}\right)^2-\left(\frac{7}{2}\right)^2+5$ $=\left(x-\frac{7}{2}\right)^2-\frac{29}{4}$ $=\left(x-3\frac{1}{2}\right)^2-7\frac{1}{4}$	M1 A1
10b	$\left(3\frac{1}{2},-7\frac{1}{4}\right)$	B1
11a	$p=7$ q = –2	B1 B1
11b	$7n-2<100$ $7n<102$ $n<14.571$ Largest n is14	B1
12a	4u -> 7.2 1u-> 1.8 3u-> \$5.40	B1
12b	700 : 1750 2 : 5	B1

+	2	3	5	7	11
2	4	5	7	9	13
3	5	6	8	10	14
5	7	8	10	12	16
7	9	10	12	14	18
11	13	14	16	18	22

13a	$\frac{r}{7+q^2}=1$ $\frac{r}{7+(-3)^2}=\frac{1}{1}$ $\frac{r}{16}=1$ $r=16$	B1
13b	$\frac{r}{7+q^2}=1$ $r=7+q^2$ $q^2=r-7$ $q=\pm\sqrt{r-7}$	M1 A1
14	Let the initial cost be \$$x$. Cost price = $1.08x$ Selling price = 1.15 ($1.08x$) = $1.242x$ $1.242x$ -> \$465.75 $1.242x \rightarrow 465.75$ $x \rightarrow \$375$	M2 for $\frac{465.75}{1.08\times1.15}$ (*oe*) B1 for 1.08 or 1.15 (oe seen)
15	$11576.25=P(1+\frac{5}{100})^3$ $11576.25=P(1.05)^3$ $P=\$10000$	B1 for 5% seen B1 for power 3 B1
16ai	3 , 4 , 5 , 7 , 10 , 11	B1
16aii	4 , 10	B1
16b	$(A\cup B)'$ or $A'\cap B'$	B1
17	$8.6^2=5^2+5^2-2(5)(5)\cos\angle DCE$ $\angle DCE=118.63317$ $\angle ACB=180-118.63317$ $=61.36683$ $\cos 61.36683=\frac{8}{AC}$ $AC=16.69449$ $AE=16.69449-5$ $=11.69449$ $=11.7m$	M1 M1 M1 A1

18a	$4.8 \ \ cm^2 \ \ (map) \rightarrow 7.5 \ \ km^2 \ \ (actual)$ $\sqrt{4.8} \ \ cm \ \ (map) \rightarrow \sqrt{7.5} \ \ km \ \ (actual)$ $\sqrt{4.8} \ \ cm \ \ (map) \rightarrow \sqrt{7.5} \times 1000 \times 100 \ \ cm \ \ (actual)$ $1 \ \ cm \ \ (map) \rightarrow \frac{\sqrt{7.5} \times 1000 \times 100}{\sqrt{4.8}} \ \ cm \ \ (actual)$ $1:125000$	M1 A1
18b	$\sqrt{4.8} \ \ cm \ \ (map) \rightarrow \sqrt{7.5} \ \ km \ \ (actual)$ $1 \ \ cm \ \ (map) \rightarrow \frac{\sqrt{7.5}}{\sqrt{4.8}} \ \ km \ \ (actual)$ $9 \ \ cm \ \ (map) \rightarrow \frac{\sqrt{7.5}}{\sqrt{4.8}} \times 9 \ \ km \ \ (actual)$ $= 11.25 \ \ km$	 B1
19a	$2(2x - \frac{1}{3}y) - 5(\frac{x}{2} - 4y)$ $= 4x - \frac{2}{3}y - \frac{5x}{2} + 20y$ $= \frac{3}{2}x + \frac{58}{3}y$	M1 A1
19b	$4am - 5bm - 16an + 20bn$ $= m(4a - 5b) - 4n(4a - 5b)$ $= (4a - 5b)(m - 4n)$	M1 A1
20ai	$495 = 3^2 \times 5 \times 11$	B1
20aii	$495 = 3^2 \times 5 \times 11$ $N = ?$ HCF $15 = 3 \times 5$ LCM $4950 = 2 \times 3^2 \times 5^2 \times 11$ $N = 2^1 \times 3^1 \times 5^2 \times 11^0$ $N = 150$	 M1 (HCF) M1 (LCM) A1
20b	LCM of 50, 60 and 72 = 1800 No of can C = $\frac{1800}{72} = 25$	M1 A1

21ai	Exterior angle $= 204 - 180$ $= 24°$ Number of sides $= \frac{360}{24}$ $= 15$	 M1 A1
21aii	$\angle RQT$ $= 180 - 156$ (interior angles) $= 24°$	 B1
21bi	$\frac{(n-2)\times 180}{(2n-2)\times 180} = \frac{5}{11}$ $\frac{n-2}{2n-2} = \frac{5}{11}$ $11n - 22 = 10n - 10$ $n = 12$	M1 A1
21bii	Exterior angle for Polygon Y $= \frac{360}{2(12)}$ $= 15°$	 B1
22a	$QT = TP$ (given) (S) $TS = PR$ (opposite sides of parallelogram are equal) (S) $\angle STQ = \angle RPT$ (alt. ∠s, base ∠s of ΔPTQ) (A) $\therefore \Delta TPR \equiv \Delta QTS$ (SAS congruence test)	 M1 A1
22bi	$\frac{DE}{12} = \frac{4}{16}$ $DE = 3$ cm	 B1
22bii	$\angle DXE = \angle CXB$ (vertically opposite $\angle s$) (A) $\angle DEX = \angle CBX$ (alt. ∠s, $DE//BC$) (A) $\therefore \Delta DXE$ is similar to ΔCXB by AA similarity test	 M1 A1
23a	$Mean = \frac{(10\times 10)+(30\times 20)+(50\times 40)+(70\times 60)+(90\times 20)}{10+20+40+60+20}$ $Mean = \frac{8700}{150} = 58$	B1
23bi	From the diagram, 150 – 24 = 126 students scored more than 36 marks.	B1
23biia	$\frac{126}{150}\times\frac{125}{149} = \frac{105}{149}$	B1 (ecf)

23biib	Number of students who scored at most 64 marks = 82 students Number of students who scored more than 80 marks = 150 – 130 =20 students $\frac{82}{150}\times\frac{20}{149}\times 2=\frac{328}{2235}$	M1 for 82 or 20 seen A1
24a	$\overrightarrow{BC}=\begin{pmatrix}1\\3\end{pmatrix}-\begin{pmatrix}4\\4\end{pmatrix}$ $=\begin{pmatrix}-3\\-1\end{pmatrix}$	B1
24b	$\overrightarrow{CB}=\begin{pmatrix}3\\1\end{pmatrix}$ $\overrightarrow{OA}=\begin{pmatrix}6\\2\end{pmatrix}$ $=2\begin{pmatrix}3\\1\end{pmatrix}$ Since $\overrightarrow{OA}=2\overrightarrow{CB}$, OA and CB are parallel and thus $OABC$ is a trapezium.	M1 A1 (A0 if $\overrightarrow{OA}=2\overrightarrow{CB}$ is not mentioned)
24ci	$\overrightarrow{AX}=\begin{pmatrix}-6\\-2\end{pmatrix}+k\begin{pmatrix}1\\3\end{pmatrix}$ $=\begin{pmatrix}k-6\\3k-2\end{pmatrix}$	M1 A1
24cii	$\begin{pmatrix}k-6\\3k-2\end{pmatrix}=\begin{pmatrix}-4\\4\end{pmatrix}$ $k-6=-4$ $k=2$	B1
24ciii	$\frac{\text{area of }\Delta OAX}{\text{area of }\Delta CBX}=4$	B1