Mathematics Paper 1 Solution

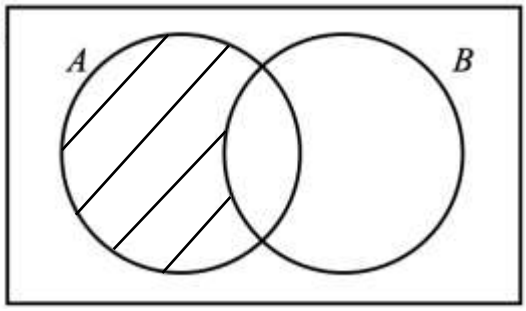
1 **(a)** $y = \frac{a}{x^2}$, where $a > 0$ [1]

(b) $y = ax^3 - 2$, where $a < 0$ [1]

2
$$\left(\frac{p^6}{r^9}\right)^{-\frac{2}{3}} = \left(\frac{r^9}{p^6}\right)^{\frac{2}{3}}$$
$$= \frac{r^6}{p^4}$$ [2]

---

3 **(a)**



[1]

(b) $A' \cup B$ or $(A \cap B')'$ [1]

4
$HCF: 117 = 3^2 \times 13$

$LCM: \quad 2 \times 3^2 \times 13^2$

$m = 2 \times 3^2 \times 13 = 234$

$n = \quad 3^2 \times 13^2 = 1521$ [2]

5
$$\frac{h_1}{h_2} = \sqrt[3]{\frac{1.35}{3.2}} = \sqrt[3]{\frac{27}{64}}$$
$$= \frac{3}{4}$$
$$h_1 = \frac{3}{4} \times 27$$
$$= 20.25 \text{ cm}$$ [2]

6

$$y = \frac{k}{x^n}$$

$$k = yx^n$$

Let $x = a, y = b$. Then $x = 2a, y = \frac{1}{16}b$.

$$ba^n = \frac{1}{16}b(2a)^n$$

$$a^n = \frac{1}{16}(2^n)a^n$$

$$2^n = 16$$

$$2^n = 2^4$$

$$n = 4$$

[3]

---

7 **(a)** $41 - 8n$ [1]

(b) $41 - 8n = -101$

$$8n = 142$$

$$n = 17.75$$

Since n is not an integer, -101 is not a term in the sequence. [2]

---

8 **(a)**

$$n = \frac{1200000}{6}$$

$$= 200000$$

[1]

(b Length scale $6 \text{ cm} : 12 \text{ km} = 1 \text{ cm} : 2 \text{ km}$

Area scale $1 \text{ cm}^2 : 4 \text{ km}^2$

Actual area of park $= 4 \times 0.05$

$= 0.2 \text{ km}^2$

[2]

---

9 **(a)** **(i)**

$$\text{Mean} = \frac{145 + 155(3) + 165(5) + 175(14) + 185(2)}{25}$$

$$= 170.2$$

[1]

(ii) SD = 9.43 [1]

(b)

$$\text{P}(<170 \text{ cm}) = \frac{9}{25} \text{ or } 0.36$$

[1]

10

$$\overrightarrow{EF} = \overrightarrow{DF} - \overrightarrow{DE}$$

$$= \begin{pmatrix} -3 \\ 7 \end{pmatrix} - \begin{pmatrix} 6 \\ -2 \end{pmatrix}$$

$$= \begin{pmatrix} -9 \\ 9 \end{pmatrix}$$

$$EF = \sqrt{(-9)^2 + 9^2}$$

$$\approx 12.7$$

or

$$EF = \sqrt{[6 - (-3)]^2 + (-2 - 7)^2}$$

$$\approx 12.7$$

[3]

---

11 **(a)** $3(2b+d)-5(b-2d)$

$=6b+3d-5b+10d$

$=b+13d$ [1]

(b) $\dfrac{4}{(5-3x)^2}-\dfrac{1}{5-3x}$

$=\dfrac{4-(5-3x)}{(5-3x)^2}$

$=\dfrac{4-5+3x}{(5-3x)^2}$

$=\dfrac{3x-1}{(5-3x)^2}$ [2]

---

12 **(a)** x^2-6x+7

$=(x-3)^2-9+7$

$=(x-3)^2-2$ [2]

(b) Min point = (3, –2) [1]

---

13 **(a)** $\text{Median}=\dfrac{30+32}{2}$

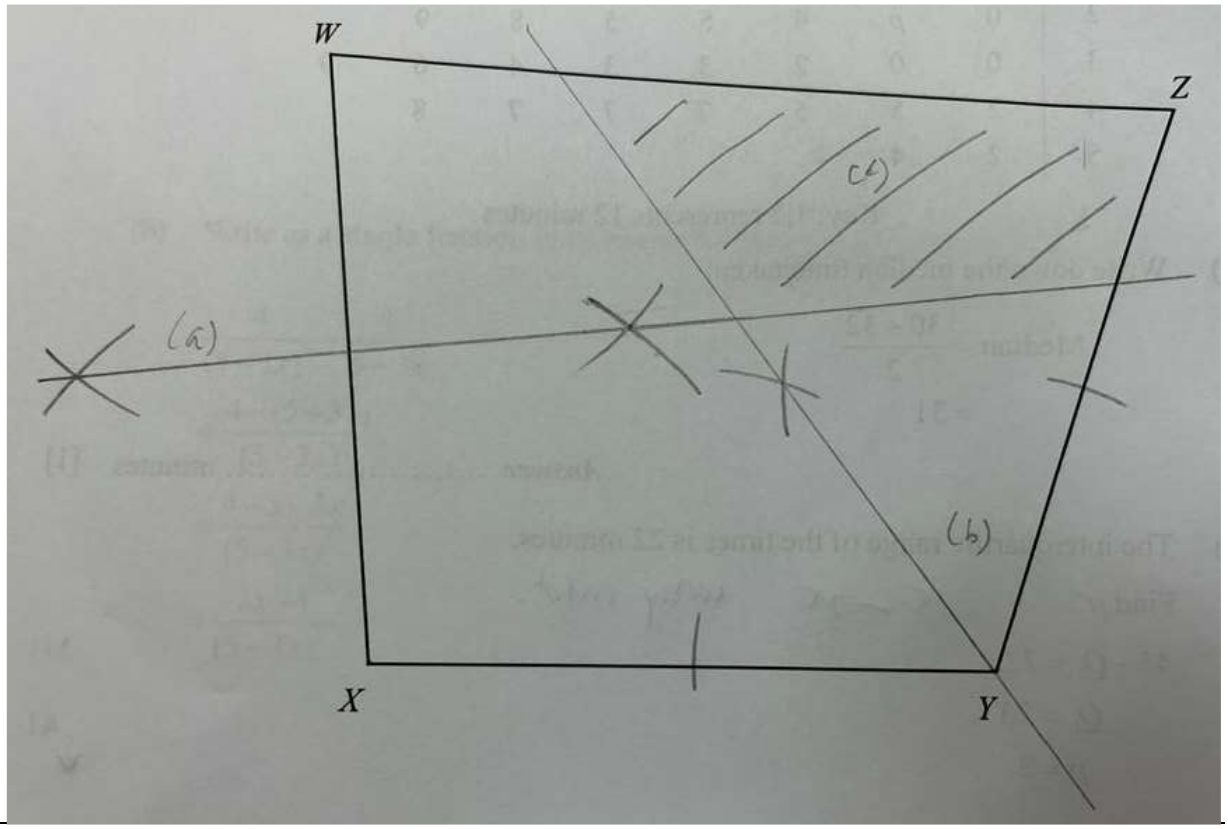
$=31$ [1]

(b) $45-Q_1=22$

$Q_1=23$

$p=3$ [2]

14



15 **(a)** $\dfrac{639\times10^3}{3.99\times10^6}\times100\%$

$=16.015\%$

$\approx16.0\%$ or $16\dfrac{2}{133}\%$ [2]

(b) $3.99\times10^6-639\times10^3$

$=3.99\times10^6-0.639\times10^6$

$=3.351\times10^6$ [2]

---

16 **(a)** $(x-3)^2-25=(x-3+5)(x-3-5)$

$=(x+2)(x-8)$ [2]

(b) $(x-3)^2-25=9191$

$(x-3)^2=9216$

$x-3=96$

$x=99$

The 2 factors are 101 and 91. [2]

---

17 **(a)** $5000+\dfrac{5000\times1.25\times n}{100}>5200$ $\qquad$ $5000+\dfrac{5000\times1.25\times n}{100}=5200$

$62.5n>200$ or $62.5n=200$

$n>3.2$ $\qquad$ $n=3.2$

$n=4$ $\qquad$ $n\approx4$ [2]

(b) $3200\div1.08\times1000$

$=2962962.9$

≈2963000 [2]

---

18 **(a)** <u>The median is a better measure as it is not affected by the extreme value of 20;</u>

<u>OR the mean is affected by the extreme value of 20.</u> [1]

(b) **(i)** $2x+2<11$ and $13-x<11$ [1]

(ii) $2x+2<11$ $\qquad$ $13-x<11$

$2x<9$ and $2<x$

$x<4.5$ $\qquad$ $x>2$

$2<x<4.5$

$x=3,\ 4$ [2]

---

19 **(a)** $\mathbf{F} = \begin{pmatrix} 0.37 \\ 0.90 \\ 1.15 \end{pmatrix}$ [1]

(b) $\mathbf{O} = \begin{pmatrix} 30 & 25 & 8 \\ 42 & 35 & 4 \end{pmatrix} \begin{pmatrix} 0.37 \\ 0.90 \\ 1.15 \end{pmatrix}$

$= \begin{pmatrix} 42.80 \\ 51.64 \end{pmatrix}$ [2]

(c) Company A spends a total of \$42.80 on postage and Company B spends a total of \$51.64 on postage.

or The amount of money that Company A and B spend on postage is \$42.80 and \$51.64 respectively. [1]

---

20 **(a)** $\text{P (both caramel)} = \frac{10}{18}\left(\frac{9}{17}\right)$

$= \frac{5}{17}$ [1]

(b) $\text{P (NN, CN)} = \frac{8}{18}\left(\frac{7}{17}\right) + \frac{10}{18}\left(\frac{8}{17}\right)$

$= \frac{4}{9}$ [2]

(c) $\text{P (NC, CN)} = \frac{8}{18}\left(\frac{10}{17}\right) + \frac{10}{18}\left(\frac{8}{17}\right)$ or $\frac{8}{18}\left(\frac{10}{17}\right) \times 2$

$= \frac{80}{153}$ [2]

---

21 **(a)** $\text{Retardation} = \frac{20}{15}$

$= \frac{4}{3}\ \text{m/s}^2$ or $1\frac{1}{3}\ \text{m/s}^2$ [1]

(b) $\frac{1}{2}(20)(10+30) = \frac{1}{2}v(30-5)$

$800 = 25v$

$v = 32$ [2]

(c) $\text{Acceleration of Car } N = \frac{32}{15-10}$

$= 3.2\ \text{m/s}^2$

$\text{Time taken} = \frac{20}{3.2}$

$= 6.25\ \text{s}$

$\text{Time met} = 5 + 6.25$

$= 11.25\ \text{s}$ [3]

---

22 **(a)** $AB = \dfrac{120 \times 2}{12}$

$= 20$

y-coordinate of $A = 20 - 5 = 15$

$A\ (0,15)$ [2]

(b) $q = 15$,

$p = -\dfrac{15}{12}$

$= -1.25 \quad \text{or} \quad -1\dfrac{1}{4}$ [2]

(c) $BC = \sqrt{5^2 + 12^2}$

$= 13$

Let d be the shortest distance.

$\dfrac{1}{2} \times d \times 13 = 120$

$d = \dfrac{240}{13}$

$= 18\dfrac{6}{13} \quad \text{or} \quad \approx 18.5$ [3]

---

23 **(a)** **(i)** $\cos \angle PRQ = \dfrac{24}{25}$ [1]

(ii) $PQ = \sqrt{25^2 - 24^2}$

$= 7 \text{ cm}$

$\sin \angle PRS = \sin \angle PRQ$

$= \dfrac{7}{25}$ [2]

(b) $\angle PRQ = \sin^{-1}\left(\dfrac{7}{25}\right)$

$= 16.26°$

$\angle PRS = 180° - 16.26°$

$\approx 163.7°$ [2]

End of Paper