ST JOSEPH'S INSTITUTION
PRELIMINARY EXAMINATION 2025
(YEAR 4) MA4052 Paper 1 Solutions

Q/N	Solutions
1	$\underline{26450 \le x \le 26549}$
2	$I = \dfrac{50000 \times r \times \frac{q}{12}}{100}$ $= \underline{\dfrac{125rq}{3}}$ or $\underline{41\frac{2}{3}rq}$
3	$\cos\angle BDC = \dfrac{9^2+10^2-8^2}{2(9)(10)}$ $= \dfrac{13}{20}$ $\underline{\cos\angle BDC = -\dfrac{13}{20}}$
4(a)	P(walks to school) = $1-\dfrac{1}{5}$ $= \underline{\dfrac{4}{5}}$
4(b)	No. of days = $\dfrac{4}{5}(190)$ = $\underline{\mathbf{152}}$
5	$\dfrac{(2n-2)\times 180}{2n} - \dfrac{(n-2)\times 180}{n} = 20$ $(2n-2)(180)-(2n-4)(180) = 40n$ $360 = 40n$ $n = \underline{\mathbf{9}}$
6(a)	Median mark = $\underline{\mathbf{34}}$
6(b)	Max mark $-17 = 32$

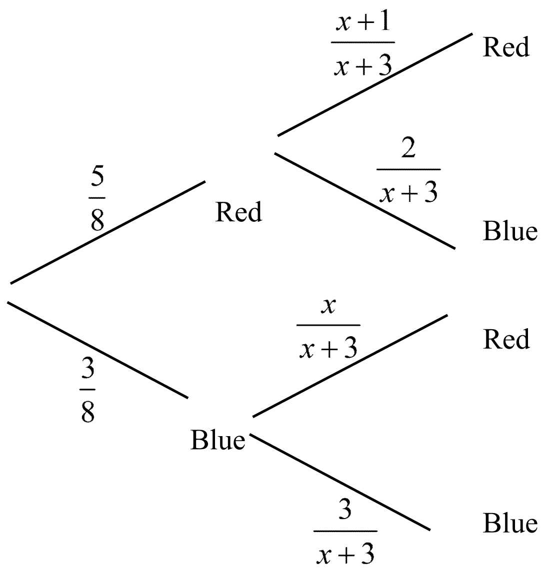
	Max mark $=49$ $\therefore x=\underline{\mathbf{9}}$
7(a)	% reduction = $\dfrac{142-130}{142}\times 100\%$ $= \underline{\mathbf{8.45\%}}$ (to 3 sf)
7(b)	The **<u>graph gives the impression</u>** that water consumption in **<u>2021 doubled</u>** compared to 2018/19, **<u>when the actual increase is only about one-third</u>**. This misinterpretation arises because the **<u>vertical axis does not start from zero</u>**, exaggerating the fluctuations and making **the changes appear more significant than they really are**. **<u>OR</u>** It misleads us into **<u>thinking that there is a gradual downward trend in water consumption</u>** from 2024 to 2030, **<u>which might not be the case.</u>**
8	$\left(\dfrac{16m^6}{9q^8}\right)^{-\frac{3}{2}}=\left(\dfrac{9q^8}{16m^6}\right)^{\frac{3}{2}}$ $=\underline{\dfrac{27q^{12}}{64m^9}}$
9	$18=2\times 3^2$ $N=\left(2\times 3\right)^6$ $=\underline{\mathbf{46\ 656}}$
10	$\dfrac{1}{2-x}-\dfrac{3x+2}{x^2-7x+10}=\dfrac{-1}{x-2}-\dfrac{3x+2}{(x-2)(x-5)}$ $=\dfrac{-x+5-3x-2}{(x-2)(x-5)}$ $=\underline{\dfrac{-4x+3}{(x-2)(x-5)}}$
11(a)	$T_5=17^2+5^2=\underline{\mathbf{314}}$
11(b)	$T_n=(4n-3)^2+n^2$

	$=16n^2-24n+9+n^2$ $\underline{=17n^2-24n+9}$
12(a)	$x=\underline{\mathbf{9}}$
12(b)	$3+x=8+6+2+1$ $\underline{\mathbf{x=14}}$
13	Let x be the total distance travelled. $\dfrac{x}{\dfrac{0.35x}{20}+\dfrac{0.65x}{30}}=x\div\left[\dfrac{1.05x+1.3x}{60}\right]$ $=x\div\dfrac{2.35x}{60}$ = **<u>25.5 km/h</u>** (to 3 sf)
14(a)	**Set B** has the larger standard deviation. All values in **<u>Set A</u>** are the same, so there is no spread and the **<u>standard deviation is 0</u>**. **<u>Set B's values are spread out around the mean, so its standard deviation is greater than 0</u>**.
14(b)	**<u>14</u>** *Adding 10 to each score does **not** change the standard deviation, so it remains 7. Multiplying every score by 2 **doubles** the standard deviation.*
15(a)	**<u>6, 9, 12, 15, 18, 21, 24</u>**
15(b)	Probability $=\dfrac{9}{24}$ $=\underline{\dfrac{3}{8}}$
16(a)	$\angle BAD=90^\circ$ (tan ⊥ rad) $\angle ACB=90^\circ$ (∠ in semicircle) $\angle ACD=90^\circ$ (adj ∠ s on a str line) $\angle BAD=\angle ACD=90^\circ$ $\angle BDA=\angle ADC$ (common angle) ΔCDA and ΔADB are similar (AA Similarity Test)
16(b)	$\dfrac{x}{9}=\dfrac{25}{x}$ $x^2=225$ $\underline{x=15}$ $(x>0)$

17	$F = kv^2$ $F_{new} = k(v_{new})^2$ $F_{new} = k(0.8v)^2$ Percentage change in $F = \dfrac{k(0.8v)^2 - kv^2}{kv^2} \times 100\%$ $= \underline{-36\%}$
18(a)	$x^2 - 169 = \underline{(x+13)(x-13)}$
18(b)	$1431 = 40^2 - 169$ $= (40+13)(40-13)$ $= (53)\ (27)$ 2 factors are **<u>27</u>** and **<u>53</u>**.
19(a)	6.25 cm^2 rep 1.44 km^2 2.5 cm rep $\sqrt{1.44}$ km 1: $\dfrac{1.2 \times 100000}{2.5}$ **<u>1: 48 000</u>**
19(b)	Length (on the map) = $\dfrac{100x}{48000}$ $= \underline{\dfrac{x}{480}}$ cm
20(a)	$120 = 2^3 \times 3 \times 5$ $84 = 2^2 \times 3 \times 7$ $96 = 2^5 \times 3$ Largest possible length $= 2^2 \times 3$ = **<u>12</u>**
20(b)	No. of cubes = $\dfrac{120}{12} \times \dfrac{84}{12} \times \dfrac{96}{12}$ = **<u>560</u>**

21(a)	$2x^2-4xy-x+2y = 2x(x-2y)-(x-2y)$ $= \underline{(x-2y)(2x-1)}$
21(b)	$2x^2-8x-7=0$ $x^2-4x-\frac{7}{2}=0$ $(x-2)^2-2^2-\frac{7}{2}=0$ $(x-2)^2=\frac{15}{2}$ $x-2=\pm\sqrt{\frac{15}{2}}$ $\underline{x=4.74 \quad \text{or} \quad x=-0.74}$
22(a)	$\angle ADO=\frac{\pi}{8}$ (tangents from ext point where line *OD* bisects $\angle ADB$) $\tan\frac{\pi}{8}=\frac{8}{AD}$ $AD=\frac{8}{\tan\frac{\pi}{8}}$ ≈ 19.3137 = **<u>19.3 cm</u>** (to 3 sf)
22 (b)	Shaded area $= 2\times\frac{1}{2}\times 19.3137\times 8-\frac{1}{2}(8)^2\left(2\pi-\frac{\pi}{2}-\frac{\pi}{2}-\frac{\pi}{4}\right)$ ≈ 79.111 = **<u>79.1 cm</u>**^{2} (to 3 sf)
23(a)	$\underline{\mathbf{N}=\begin{pmatrix}4\\2\\x\end{pmatrix}}$

23(b)	$\mathbf{L}=\begin{pmatrix}2 & 1 & 3\\3 & 2 & 1\\1 & 4 & 2\end{pmatrix}\begin{pmatrix}4\\2\\x\end{pmatrix}$ $=\underline{\begin{pmatrix}10+3x\\16+x\\12+2x\end{pmatrix}}$
23(c)	Matrix L represents **<u>the total litres of red, blue, and yellow base colors, respectively</u>**, **<u>needed by the shop to create the three shades</u>**, A, B, and C. OR $10+3x$ represents the **<u>total litres of red base colour needed by the shop to create the 3 shades</u>**, A, B and C. $16+x$ represents the **<u>total litres of blue base colour needed by the shop to create the 3 shades</u>**, A, B and C. $12+2x$ represents the **<u>total litres of yellow base colour needed by the shop to create the 3 shades</u>**, A, B and C.
23(d)	Each colour must use at most 25 litres. For Red: $10+3x\le 25$ $x\le 5$ For Blue: $16+x\le 25$ $x\le 9$ For Yellow: $12+2x\le 25$ $x\le 6.5$ Largest integer of x = **<u>5</u>**

24 (a)	
24 (b)	$\frac{5}{8}\times\frac{x+1}{x+3}=\frac{5}{12}$ $\frac{x+1}{x+3}=\frac{2}{3}$ $3x+3=2x+6$ $\underline{x=3}$
24 (c)	As x increases, the **<u>number of red balls in Bag B increases (or decreases)</u>**, while the number of blue balls remains the same. This makes <u>it less likely to draw a blue ball from B.</u> The **<u>probability of drawing 2 blue balls decreases (or increases)</u>** as x increases (decreases).

25(a)	$\underline{x=1}$
25(b)	$m=\dfrac{6-0}{0-6}$ $=\underline{\mathbf{-1}}$
25(c)	The **<u>number of</u>** real **<u>solutions</u>** to the question is **<u>equal to the number of points</u>** where the horizontal line $\underline{y=m}$ **<u>meets the graph</u>**.
25(d)	Draw $y=-0.5x+2.5$ From the graph, $\underline{x=-1 \text{ or } 5}$
26(a)	Lily **<u>stopped</u>** (or rest / not moving / at Town B).
26(b)	Average speed = $\dfrac{30-14}{\frac{48}{60}}$ = **<u>20 km/h</u>**
26(c)	Time taken = $\dfrac{20}{16\frac{2}{3}}$ = 1h 12 min **<u>Correct straight line drawn.</u>**

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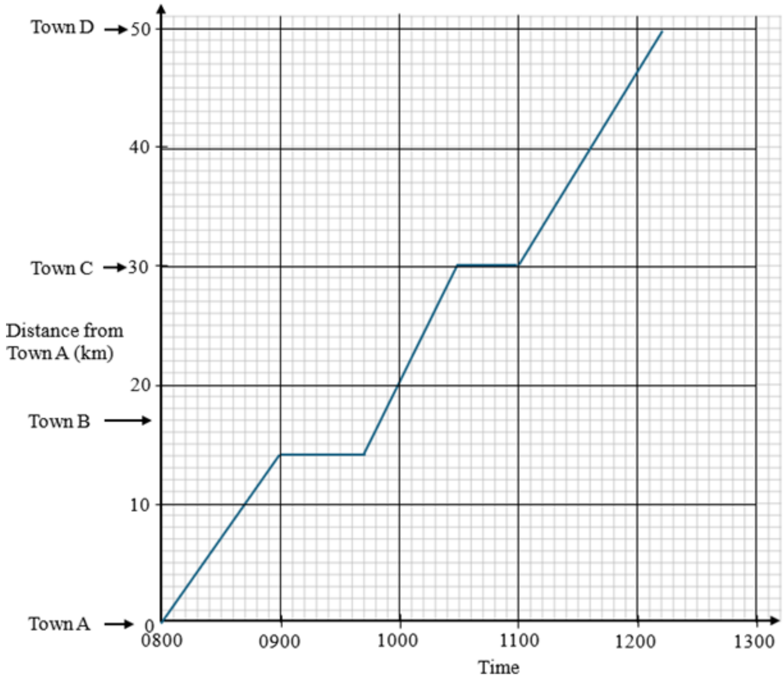

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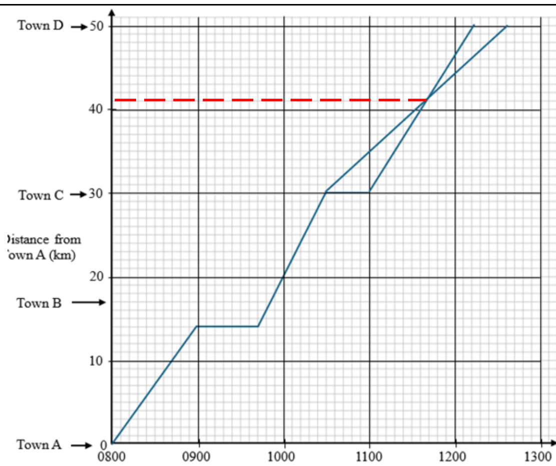
<tr><td>26(d)</td><td>


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<tr><td>26(e)</td><td>Distance from Town D = <u>9 km</u></td></tr>
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