

Mathematics Paper 1 (121/1)

1.

$$\begin{aligned}\frac{-8 + (-5) \times (-8) - (-6)}{-3 + (-8) \div 2 \times 4} &= \frac{-8 + 40 + 6}{-3 + -4 \times 4} \\ &= \frac{38}{-19} \\ &= -2\end{aligned}$$

(2 marks)

2.

$$\begin{aligned}\frac{(3^3)^{2/3} \div 2^4}{(2^5)^{-3/5}} &= \frac{3^2 \div 2^4}{2^{-3}} \\ &= \frac{3^2}{2^4 \times 2^{-3}} = \frac{9}{2} \\ &= 4\frac{1}{2} \text{ or } 4.5\end{aligned}$$

(3 marks)

3.

$$\begin{aligned}\frac{a^4 - b^4}{a^3 - ab^2} &= \frac{(a^2 + b^2)(a^2 - b^2)}{a(a^2 - b^2)} \\ &= \frac{a^2 + b^2}{a} \text{ or } a + \frac{b^2}{a}\end{aligned}$$

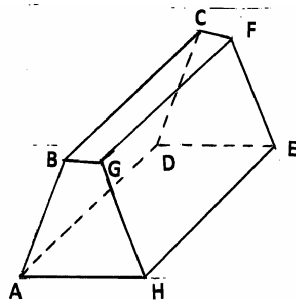
(3 marks)

4.

$$\begin{aligned}23.50 + (7\text{h}15\text{min} + 45\text{min} + 5\text{h}40\text{min}) \\ &= 1330\text{h} \\ &= 1.30 \text{ pm on Monday}\end{aligned}$$

(2 marks)

5.



(3 marks)

6.

Sales: Petrol $-\frac{1}{3} \times 900000$

Diesel $-\frac{2}{3} \times 900000$

Profit $\frac{1}{3} \times \frac{900000}{1000} \times 520 + \frac{2}{3} \times \frac{900000}{1000} \times 480$
 $= 156000 + 288000$
 $= 444000$

(3 marks)

7.

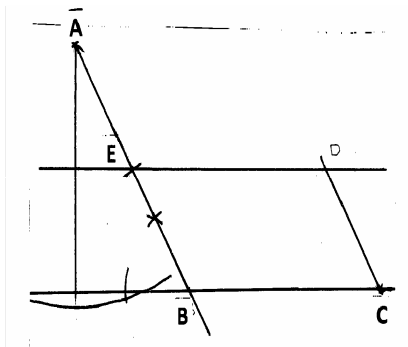
Volume of Liquid $= \frac{384}{0.6}$

Height of Liquid $= \frac{38}{\pi \times 3.2^2}$

$= 19.89$

(3 marks)

8.



$\angle 120^\circ$ constructed at B and completion of ΔABC

Dropping \perp from A to CB produced

Bisection of height and determination of point E

Determination of point D and completion of parallelogram BCDE

(4 marks)

9.

Volume of Sphere $= \frac{4}{3} \pi \times 4.2^3$

\therefore Side of cube $= \sqrt[3]{\frac{4}{3} \pi \times 4.2^3}$

$= 6.77$

(3 marks)

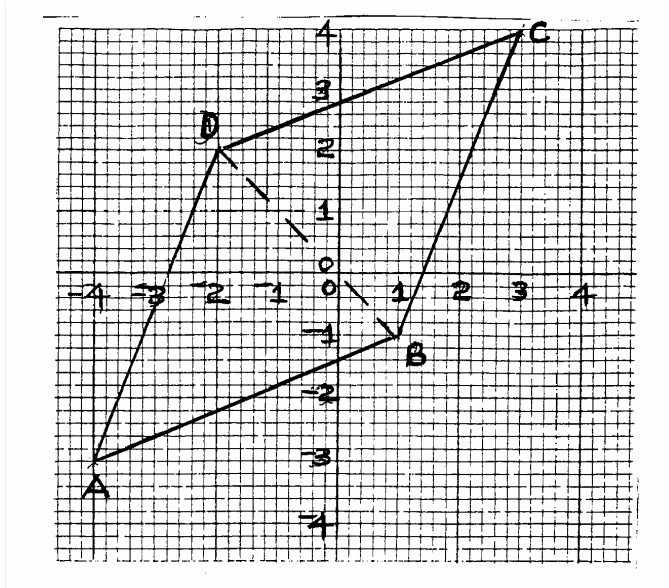
10.

$$\begin{aligned} \text{Radius of circle} &= \frac{23.4}{1.8} \\ &= 13 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Area of Sector} &= \frac{1.8}{2\pi} \times \pi \times 13^2 \\ &= 152.1 \text{ cm}^2 \end{aligned}$$

(4 marks)

11.



Equation of line AD

$$= \frac{y - 3}{x - 4} = \frac{5}{2}$$

$$y = \frac{5}{2}x + 7$$

(4 marks)

12.

$$\begin{aligned} AB &= \begin{pmatrix} k & 4 \\ 3 & 2 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} = \begin{pmatrix} k+12 & 2k+16 \\ 3+6 & 6+8 \end{pmatrix} \\ &= \begin{pmatrix} k+12 & 2k+16 \\ 9 & 14 \end{pmatrix} \end{aligned}$$

$$\begin{aligned} \text{Det } AB &= (k+12) \times 14 - (2k+16) \times 9 = 4 \\ 14k + 168 - 18k - 144 &= 4 \\ -4k &= -20 \\ k &= 5 \end{aligned}$$

(3 marks)

13.

$$\begin{aligned}\text{Area of Rectangular part} &= 2 \times 5.2 \times \pi \times 18 \\ &= 187.2\pi\end{aligned}$$

$$\begin{aligned}\text{Area of circular parts} &= 2 \times 5.2 \times \pi \\ &= 54.08\pi \\ &= 241.28\pi\end{aligned}$$

(3 marks)

14.

$$\begin{aligned}\text{Log } 0.096 &= \text{Log}(4^2 \times 6 \times 10^{-3}) \\ &= 2(0.6021) + \bar{3}.7782 \\ &= \bar{2}.9824 \text{ or} \\ &(-1.0176)\end{aligned}$$

(3 marks)

15.

$$2y = 5x + 8$$

$$y = \frac{5}{2}x + 4$$

$$\text{Gradient of } L_1 = \frac{5}{2}$$

$$\begin{aligned}\text{Gradient } L_2 &= \frac{0 - 4}{-5 - 5} = \frac{4}{-10} = -\frac{2}{5} \\ &= \frac{5}{2} \times -\frac{2}{5} = -1\end{aligned}$$

$\therefore L_1$ and L_2 are perpendicular.

(3 marks)

16.

$$\begin{aligned}2 \cos 2\theta &= 1 \\ \cos 2\theta &= \frac{1}{2} \\ \therefore 2\theta &= 60^\circ, 300^\circ \\ &420^\circ, 660^\circ \\ \theta &= 30^\circ, 150^\circ \\ &210^\circ, 330^\circ\end{aligned}$$

(4 marks)

17.

(a) Juma's earnings before increase:
112% \rightarrow 8400

$$\begin{aligned}100\% &\rightarrow 8400 \times \frac{100}{112} \\ &= 7500\end{aligned}$$

Akinyi's earnings before increase:

$$\frac{3}{5} \times 7500 = 4500$$

Increase in Akinyi's earnings

$$\begin{aligned}14100 - 8400 - 4500 \\ = 1200\end{aligned}$$

% increase in Akinyi's earnings

$$\frac{1200}{4500} \times 100$$
$$= 26\frac{2}{3}$$

(b) No. of bags bought

$$\frac{14100}{1175}$$

= 12 bags

$$\text{Profit} = (1762.50 - 1175) \times 12 = 7050$$

Ratio 5700:8400 = 19:28

$$\text{Profit for Akinyi} := 7050 \times \frac{19}{47} = 2850$$

Total earning for Akinyi:

$$5700 + 2850$$

$$= 8550$$

(10 marks)

18.

(a) Trapezium Rule:

x	-2	-1	0	1
y	7	5	5	7

$$A_c = \frac{1}{2} \times 1 \{ (11+11) + 2(7+5+5+7) \}$$
$$= \frac{1}{2} \{ 22 + 48 \}$$
$$= 35$$

$$A_r = 11 \times 5 = 55$$

$$A = 55 - 35$$

= 20 square units

(b) Mid-ordinates

x	-2.5	-1.5	-0.5	0.5	1.5
y	8.75	5.75	4.75	5.75	8.75

$$A_c = (8.75 + 5.75 + 4.75 + 5.75 + 8.75) \times 1$$
$$= 33.75$$

$$A = 55 - 33.75$$

$$= 21.25$$

$$\text{Difference} = 21.25 - 20$$

$$= 1.25 \text{ sq units}$$

(10 marks)

19.

(a) (i) $BD = q - p$

(ii) $BC = \frac{2}{3}(q - p)$

(iii) $CD = \frac{1}{3}(q - p)$

(iv)

$$AC = p + \frac{2}{3}q - \frac{2}{3}$$

$$= \frac{1}{3}p + \frac{2}{3}q$$

(b) (i)

$$CE = CD + DE$$

$$= \frac{1}{3}q - \frac{1}{3}p + \frac{1}{2}p$$

$$= \frac{1}{3}q - \frac{1}{6}p$$

$$AC = k \left(\frac{1}{3}q + \frac{1}{6}p \right)$$

$$= \frac{1}{3}p + \frac{2}{3}p = \frac{1}{3}kq + \frac{1}{6}kp$$

$$= \frac{1}{6}k = \frac{1}{3} \Rightarrow k = 2$$

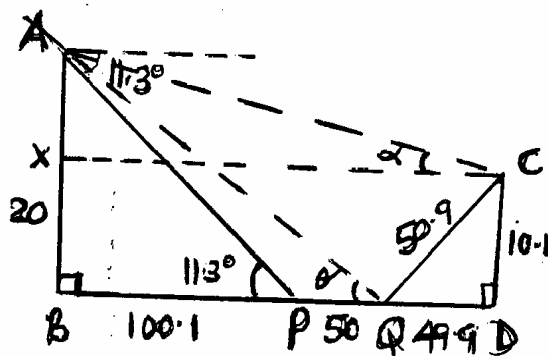
(ii)

$$AC = 2CE$$

$$AC : CE = 2 : 1$$

(10 marks)

20.



(a)

$$\begin{aligned}\tan 11.3^\circ &= \frac{20}{x} \Rightarrow x = \frac{20}{\tan 11.3^\circ} \\ &= \frac{20}{0.1998197} = 100.09022 \\ &\approx 100.1\text{m}\end{aligned}$$

(b)

$$PQ = \frac{36 \times 1000}{60 \times 60} \times 5 = 50\text{m}$$

$$BQ = 100.1 + 50 = 150.1\text{m}$$

$$\tan \theta = \frac{20}{150.1} = 0.1332445$$

$$\theta = 7.5896426$$

$$\theta = 7.59$$

(c) (i)

$$QD = 200 - 150.1 = 49.9$$

$$CD = \sqrt{50.9^2 - 49.9^2}$$

$$= 10.03992$$

$$\approx 10.04\text{m}$$

(ii)

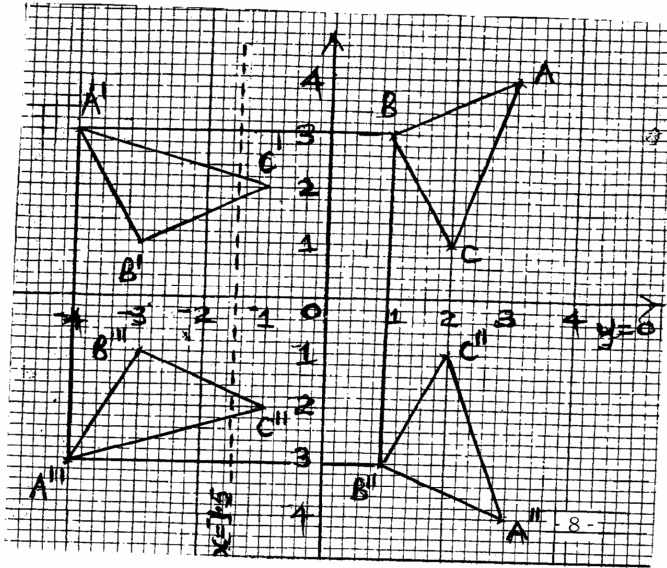
$$AX = 20 - 10.04 = 9.96$$

$$\tan \alpha = \frac{9.96}{200} = 0.0498$$

$$\alpha = 2.8509745$$

$$\alpha \cong 3^\circ$$

(10 marks)



- (a) $\Delta A^1B^1C^1$ correctly drawn
 (b) $\Delta A^{11}B^{11}C^{11}$ correctly drawn
 (c) $\Delta A^{111}B^{111}C^{111}$ correctly drawn
 (d) Reflection in the line $y = x$
 (e)
 $x = -1.5$
 $y = 0$

(10 marks)

22.

(a) $\frac{1}{3} \times \frac{22}{7} \times 21 \times 21 \times 30 = 13860$

(b) (i)

$$\frac{r}{21} = \frac{36}{30}$$

$$r = \frac{36 \times 21}{30} = 25.2 \text{ cm}$$

(ii)

$$\frac{1}{3} \times \frac{22}{7} \times 25.2 \times 25.2 \times 36$$

$$= 23950.08 - 13860$$

$$= 10090.08 \text{ cm}^3$$

(iii)

$$\frac{4}{3} \times \frac{22}{7} \times r^3 = 10090.08$$

$$r^3 = \frac{10090.08 \times 21}{4 \times 22}$$

$$r = \sqrt[3]{2407.86}$$

$$= 13.40\text{cm}$$

(10 marks)

23.

(a) Let the original number be n

$$\text{Amount per member originally} = \frac{2000000}{n}$$

$$\text{Amount per member after withdrawal of 40} = \frac{2000000}{n - 40}$$

$$\frac{2000000}{n - 40} - \frac{2000000}{n} = 2500$$

$$2000000n = (n - 40)(2500n + 2000000)$$

$$2000000n = 2500n^2 + 2000000n - 1000000n - 80000000$$

$$n^2 - 40n - 32000 = 0$$

$$(n - 200)(n + 160) = 0$$

$$n = 200$$

(b) New total contribution by members

$$= \frac{55}{100} \times \frac{2000000}{160} = 6875$$

(c) Actual cash contribution by members

$$= \frac{55}{100} \times 2000000 \times \frac{19}{25} = 836000$$

(10 marks)

24.

(a)

$$\frac{ds}{dt} = 3t^2 - 12t + 9$$

$$\frac{ds}{dt}(0.5) = 3(0.5)^2 - 12(0.5) + 9$$

$$= 3.75$$

(b)

$$\frac{ds}{dt} = 0 \Rightarrow 3t^2 - 12t + 9 = 0$$

$$t^2 - 4t + 3 = 0$$

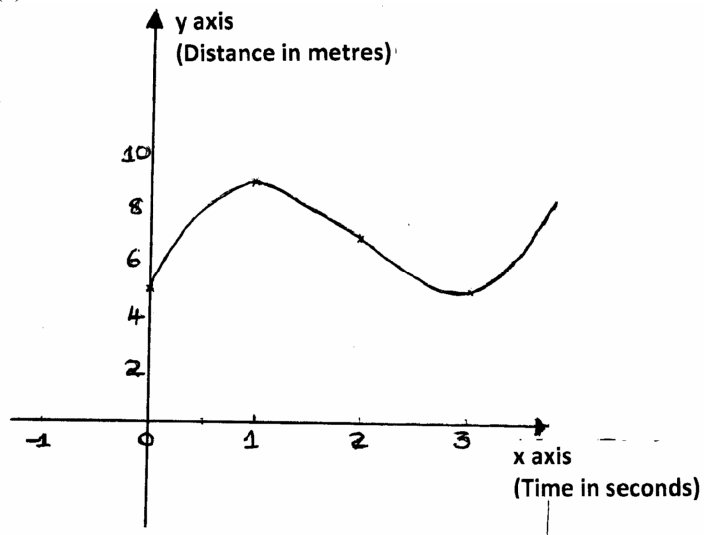
$$(t-3)(t-1) = 0$$

$$t = 3 \text{ or } t = 1$$

$$\text{When } t=3, s=3^3-6 \times 3^2+9 \times 3+5=5$$

$$\text{When } t=1, s=1^3-6 \times 1+9 \times 1+5=9$$

(c)



(10 marks)