

30.3 MATHEMATICS (121)

30.3.1 Mathematics Paper 1 (121/1)



MANYAM FRANCHISE  
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Q1

$$\frac{\sqrt{5184}}{6 \times 18 \div 9 + (5 - 3)}$$
$$= \frac{\sqrt{2^6 \times 3^4}}{6 \times 18 \div 9 + 8}$$
$$= \frac{2^3 \times 3^2}{6 \times 2 + 8}$$
$$= \frac{72}{4}$$
$$= 18$$

(3 marks)

Q2

$$\frac{2\frac{1}{4} + \frac{3}{5} \div \frac{5}{6} \text{ of } 2\frac{2}{5}}{1\frac{7}{10}}$$
$$= \frac{2\frac{1}{4} + \frac{3}{5} \times \frac{6}{5} \times \frac{1}{2}}{1\frac{7}{10}}$$
$$= \frac{2\frac{1}{4} + \frac{3}{5} \times \frac{1}{2}}{1\frac{7}{10}}$$
$$= \frac{2\frac{1}{4} + \frac{3}{10}}{1\frac{7}{10}}$$
$$= \frac{51}{20} \times \frac{10}{17}$$
$$= \frac{3}{2} \text{ or } 1\frac{1}{2} \text{ or } 1.5$$

(3 marks)

Q3

$$x : y = 2 : 3 \Rightarrow \frac{x}{y} = \frac{2k}{3k}$$

(where  $k$  is a constant)

$$x = 2k, y = 3k$$

Thus  $(5x - 2y) : (x + y)$

$$= (5 \times 2k - 2 \times 3k) : (2k + 3k)$$

$$(10 - 6)k : 5k$$

$$4k : 5k$$

$$\Rightarrow 4 : 5$$

**(3 marks)**

Q4 Distance covered by bus

$$= 63 \times (10.45 - 8.15)$$

$$= 63 \times 2.5$$

$$= 157.5$$

Speed of car

$$= \frac{157.5}{1.75}$$

$$= 90 \text{ km/h}$$

**(3 marks)**

Q5 
$$\frac{64^{-\frac{1}{2}} \times 27000^{\frac{2}{3}}}{2^{-4} \times 3^0 \times 5^2}$$

$$= \frac{\frac{1}{64^{\frac{1}{2}}} \times 27000^{\frac{2}{3}}}{\frac{1}{2^4} \times 3^0 \times 5^2}$$

$$= \frac{\frac{1}{\sqrt{64}} \times (\sqrt[3]{27000})^2}{\frac{1}{16} \times 3^0 \times 25}$$

$$= \frac{1}{8} \times \frac{900 \times 16}{25}$$

$$= 72$$

**(4 marks)**

$$\begin{aligned} \text{Q6} \quad AC &= \sqrt{85^2 - 75^2} = \sqrt{1600} \\ &= 40 \end{aligned}$$

Area of quad ABCD

$$\begin{aligned} &= \frac{1}{2} \times 40 \times 75 + \sqrt{75(75-60)(75-50)(75-40)} \\ &= 1500 + \sqrt{984375} \\ &= 1500 + 992 \\ &= 2492 \text{ m}^2 \\ &= 0.25 \text{ ha} \end{aligned}$$

(4 marks)

Q7 Time between Monday 0545 h and Friday 1945 h

$$= 4 \times 24 + 14$$

$$= 110 \text{ h}$$

$$\text{Time lost} = 0.5 \times 110$$

$$= 55 \text{ min}$$

∴ Time shown in 12-hour system

$$= 1945 - 55 = 1850 \text{ h}$$

$$= 6.50 \text{ pm}$$

(3 marks)

$$\text{Q8} \quad \frac{12x^2 + ax - 6a^2}{9x^2 - 4a^2}$$

$$= \frac{(4x + 3a)(3x - 2a)}{(3x + 2a)(3x - 2a)}$$

$$= \frac{4x + 3a}{3x + 2a}$$

$$= \frac{4x + 3a}{3x + 2a}$$

(3 marks)

$$\text{Q9} \quad y = \frac{-2}{5}x + 2$$

$$\therefore \text{gradient} = \frac{-2}{5}$$

$$\frac{k-5}{3-2} = \frac{-2}{5}$$

$$k-5 = -2$$

$$\Rightarrow k = 3$$

(3 marks)

Q10 let exterior  $\angle$  (=  $\angle$  at centre) be  $x^\circ$

$$\therefore 6.5x + x = 180$$

$$7.5x = 180$$

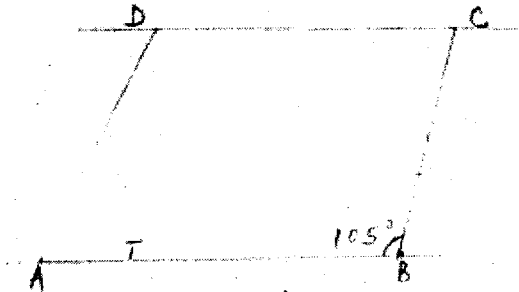
$$x = 24^\circ$$

$$\therefore \text{No. of sides} = \frac{360}{24}$$

$$= 15 \text{ sides}$$

(3 marks)

Q11



- (a) - Construction of  $105^\circ$   
 - Fixing point c and construction of parallel line AB through C  
 - Completion of trapezium ABCD

- (b) Location of point T

(4 marks)

Q12 Let angle between ground and wire be  $\theta^\circ$

$$\therefore \theta + \frac{1}{3}\theta = 90^\circ$$

$$\Rightarrow \theta = 90 \times \frac{3}{4} = 67.5^\circ$$

Let length of wire be x cm

$$\therefore \cos 67.5 = \frac{6}{x}$$

$$x = \frac{6}{\cos 67.5} \Rightarrow \frac{6}{0.382683432}$$

$$= 15.68 \text{ m or } 1568 \text{ cm or } 15\text{m } 68 \text{ cm}$$

(3 marks)

Q13  $\sin (3x + 30)^\circ = \sin 60^\circ$

$$\sin (3x + 30)^\circ = \sin 120^\circ$$

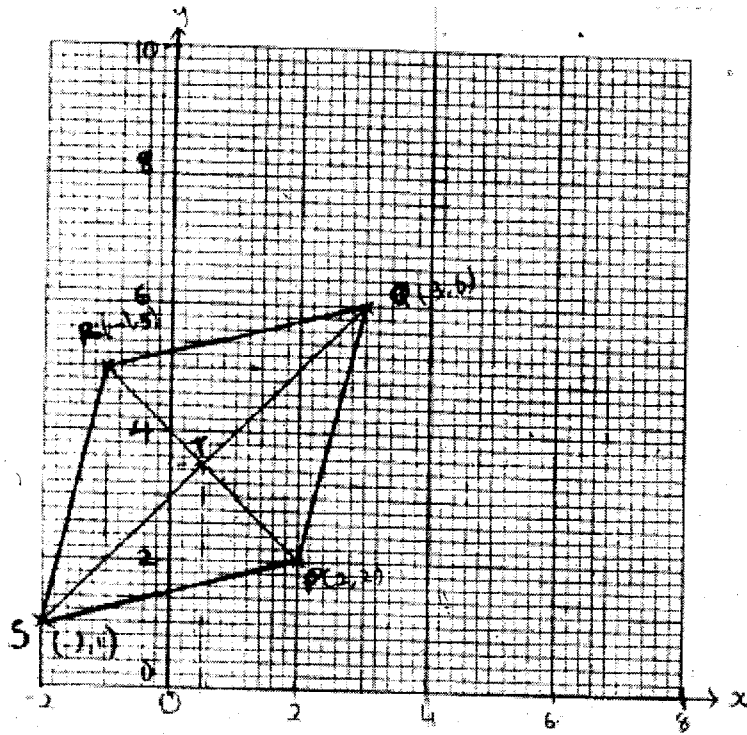
$$3x + 30 = 60^\circ$$

$$3x + 30 = 120^\circ$$

$$\therefore x = 10^\circ; x = 30^\circ$$

(4 marks)

Q14



Rhombus PQRS

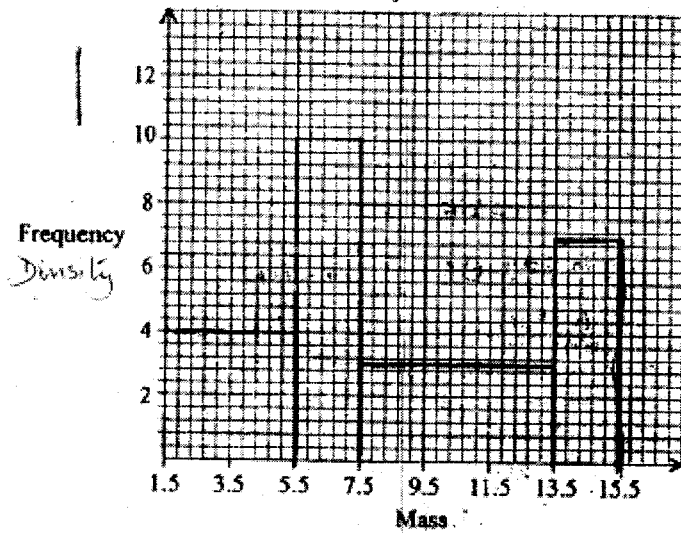
(b) Coordinates of T (0.5, 3.5)

(2 marks)

Q15 Commission earned  
 $0.225 \times 0.2 \times 3800$   
 $= 171$

(2 marks)

Q16



1.5 – 5.5 bar  
 5.5 – 7.5 bar  
 7.5 – 13.5 bar

(3 marks)

Q17 (a)  $BC^2 = 6^2 + 8^2 - 2 \times 6 \times 8 \cos 50^\circ$

$$= \frac{100 - 61.71}{2}$$

$$BC = \sqrt{38.2912} = 6.19$$

(b) Let  $\angle ABC$  be  $\beta^\circ$

$$\frac{\sin \beta^\circ}{6} = \frac{\sin 50^\circ}{6.19}$$

$$\sin \beta = \frac{6 \sin 50^\circ}{6.19}$$

$$\therefore \beta = 47.95^\circ$$

(c) Let  $\angle CAD$  be  $\alpha^\circ$

$$2.82^2 = 7^2 + 6^2 - 2 \times 7 \times 6 \cos \alpha$$

$$\cos \alpha = \frac{49 + 36 - 7.9524}{84}$$

$$\therefore \alpha = 23.48^\circ$$

(d) Area  $\triangle ACD$

$$= \frac{1}{2} \times 7 \times 6 \sin 23.48^\circ$$

$$= 8.37 \text{ cm}^2$$

(10 marks)

Q18 (a) (i) Model class = 60 – 69

(ii) Class where median mark lies

c.f  
1  
3  
7  
14  
24  
40  
60  
66  
69  
70

Class 50 – 59

(b)

Class centres (x)	Fd	d=x-A
4.5	-49.9	-49.9
14.5	-79.8	-39.9
24.5	-119.6	-29.9
34.5	-139.3	-19.9
44.5	-99.0	-9.9
54.5	1.6	0.1
64.5	20.2	10.1
74.5	120.6	20.1
84.5	90.3	30.1
94.5	40.1	40.1

$$\Sigma f = 70$$

$$\Sigma fd = -33$$

$$\therefore \text{Mean} = 54.4 + \frac{-33}{70}$$

$$= 53.93$$

(10 marks)

Q19 (a) (i) Original Price =  $\frac{16200}{x}$

(ii) Price after discount =  $\frac{16200}{x+3}$

(b) (i)  $\frac{16200}{x} - 60 = \frac{16200}{x+3}$   
 $\Rightarrow \frac{16200 - 60x}{x} = \frac{16200}{x+3}$   
 $\Rightarrow (16200 - 60x)(x+3) = 16200x$

$$16200x + 16200 \times 3 - 60x^2 - 180x = 16200x$$

$$60x^2 + 180x - 48600 = 0$$

$$x^2 + 3x - 810 = 0$$

$$(x+30)(x-27) = 0$$

$$x = -30 \text{ or } x = 27$$

No. of calculators bought = 30

(c) Initial cost of calculators

$$\frac{16200}{27} = 600$$

Discount offered as a percentage

$$\frac{16200 - 16200}{27} \times 100 = 10\%$$

(10 marks)

Q20 (a) (i) ON  $\frac{1}{2} \begin{pmatrix} -8 \\ 5 \end{pmatrix} = \begin{pmatrix} 4 \\ -2\frac{1}{2} \end{pmatrix}$

N is  $\begin{pmatrix} -4, 2\frac{1}{2} \end{pmatrix}$

M =  $\frac{-8+12}{2}, \frac{5+-5}{2}$

M is (2,0)

$$(ii) \quad \mathbf{NM} = \begin{pmatrix} 6 \\ -2\frac{1}{2} \end{pmatrix}$$

$$\begin{aligned} \text{NM} &= \sqrt{6^2 + \left(-2\frac{1}{2}\right)^2} \\ &= 6.5 \end{aligned}$$

$$(b) \quad \mathbf{OB} = \begin{pmatrix} 12 \\ -5 \end{pmatrix}, \quad \mathbf{NM} = \begin{pmatrix} -6 \\ 2\frac{1}{2} \end{pmatrix}$$

$$\therefore \mathbf{NM} = \frac{1}{2} \mathbf{OB}$$

$$(c) \quad \mathbf{OP} = \begin{pmatrix} 2 \\ 0 \end{pmatrix} + 2 \begin{pmatrix} -6 \\ 2\frac{1}{2} \end{pmatrix}$$

$$\mathbf{OP} = \begin{pmatrix} -10 \\ 5 \end{pmatrix} + \begin{pmatrix} -5 \\ 8 \end{pmatrix} = \begin{pmatrix} -15 \\ 13 \end{pmatrix}$$

$\therefore P$  is (-15,13)

(10 marks)

Q21 (a) Volume of water

$$\frac{6}{9+x} = \frac{2}{x} \Rightarrow x = 4.5$$

$$\begin{aligned} \therefore \text{Vol} &= \frac{1}{3} \times 3.142(6^2 \times 13.5 - 2^2 \times 4.5) \\ &= 490.152 \end{aligned}$$

(b) (i) Volume of sphere

Top radius

$$\frac{r}{14.5} = \frac{2}{4.5} = \frac{6}{13.5} \Rightarrow r = 6.444$$

$$\begin{aligned} \text{Vol} &= \frac{1}{3} \times 3.142(6.444^2 \times 14.5 - 6^2 \times 13.5) \\ &= 121.6 \end{aligned}$$

$$(ii) \quad \frac{4\pi r^3}{3} = 121.6$$

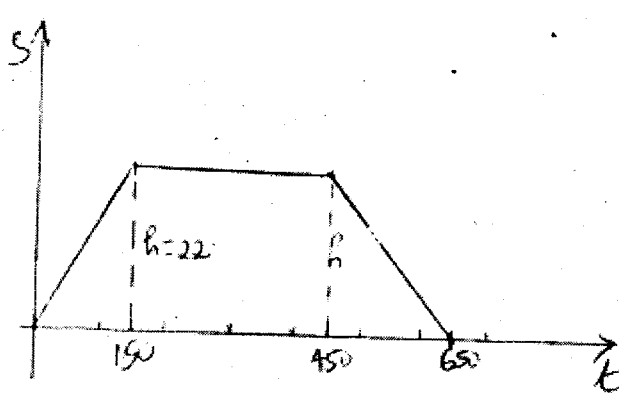
$$r^3 = 121.6 \times \frac{3}{4\pi}$$

$$r = 3.073$$

(10 marks)

Q22





$$\begin{aligned}
 \text{(a)} \quad & \frac{1}{2} \times 150h + \frac{1}{2} \times 200h + 300h \\
 & = 10450 \\
 & 475h = 10450 \\
 & h = 22 \text{ m/s}
 \end{aligned}$$

$$\begin{aligned}
 \text{Max. speed} &= \frac{22 \times 60 \times 60}{1000} \\
 &= 79.2 \text{ km/h}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad \text{Acceleration} &= \frac{22 \text{ m/s}}{150 \text{ s}} \\
 &= \frac{11}{75} \text{ m/s}^2 \text{ or } 0.1467 \text{ m/s}^2
 \end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad & \frac{1}{2} \times 100 \times 11 \\
 & = 550
 \end{aligned}$$

(d) Time for half of journey

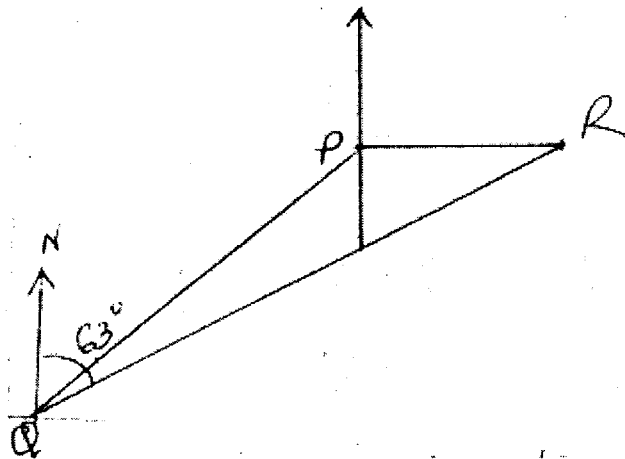
$$\frac{1}{2} \times 22(150 + t + t) = \frac{1}{2} \times 10450$$

$$t = 162.5$$

$$\begin{aligned}
 \text{Total time} &= 150 + 162.5 \\
 &= 312.5
 \end{aligned}$$

(10 marks)

Q23



- (a) Direction and distance of Q and P  
Direction and distance of R and P
- (b) (i) Distance conversion  
 $8.5 \times 40 = 340$
- (ii) north line at Q  
bearing  $063^\circ$
- (c) (i) Distance from top of post at Q to top of post at P  

$$x = \frac{240}{\cos 9^\circ} \text{ or } x \cos 9^\circ = 240$$

$$= 243 \text{ m}$$
- (ii) Speed of bird  

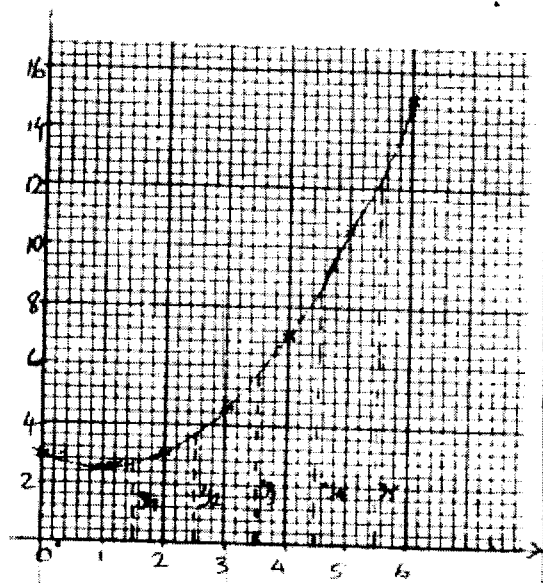
$$= \frac{243 \times 60 \times 60}{100 \times 18}$$

$$= 48.6 \text{ kmh}^{-1}$$

(10 marks)

Q24 (a)

$x$	0	1	2	3	4	5	6
$y = \frac{1}{2}x^2 - x + 3$	3	$2\frac{1}{2}$	3	$4\frac{1}{2}$	7	$10\frac{1}{2}$	15



(b)

$$y_1 = \frac{1}{2} \times 1.5^2 - 1.5 + 3 = 2.625$$

$$y_2 = \frac{1}{2} \times 2.5^2 - 2.5 + 3 = 3.625$$

$$y_3 = \frac{1}{2} \times 3.5^2 - 3.5 + 3 = 5.625$$

$$y_4 = \frac{1}{2} \times 4.5^2 - 4.5 + 3 = 8.625$$

$$y_5 = \frac{1}{2} \times 5.5^2 - 5.5 + 3 = 12.625$$

Approximate area

$$= 1(2.625 + 3.625 + 5.625 + 8.625 + 12.625)$$

$$= 33.125 \text{ sq. units}$$

(b)

$$\text{Area} = \int_0^6 \left( \frac{1}{2}x^2 - x + 3 \right) dx = \left[ \frac{x^3}{6} - \frac{x^2}{2} + 3x \right]_0^6$$

$$= \left[ \frac{6^3}{6} - \frac{6^2}{2} + 3 \times 6 \right] - \left[ \frac{1^3}{6} - \frac{1^2}{2} + 3 \right] = 33.125$$

$$\% \text{ error} = \frac{33.125 - 33.125}{33.125} \times 100$$

$$= 0.625\%$$

(10 marks)

30.3.2 Mathematics Paper 2 (121/2)

Q1. 1 cow feed on  $\frac{480}{2 \times 4}$  kg in 1 day  
 = 60 kg  
 No. of cows to feed on 21060 kg in 6 weeks  
 =  $\frac{20160}{60 \times 6 \times 7}$   
 = 8

(3 marks)

Q2.  $(x - 1.5 - \sqrt{2})(x - 1.5 + \sqrt{2}) = 0$   
 $x^2 - 1.5x + x\sqrt{2} - 1.5x + 2.25 - 1.5\sqrt{2} - x\sqrt{2} + 1.5\sqrt{2} - 2 = 0$   
 $4x^2 - 12x + 1 = 0$

(3 marks)

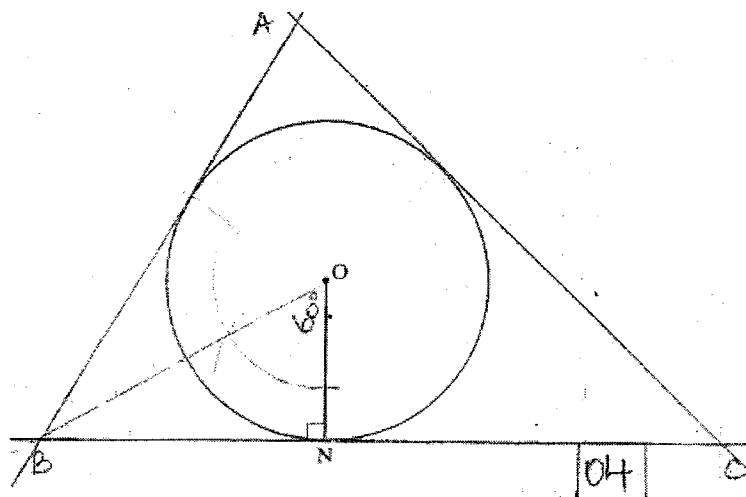
Q3.  $M = c + kt^2$   
 $40 = c + 4k$   
 $65 = c + 9k$   
 $25 = 5k, k = 5$

$40 = c + 4 \times 5$   
 $c = 20$

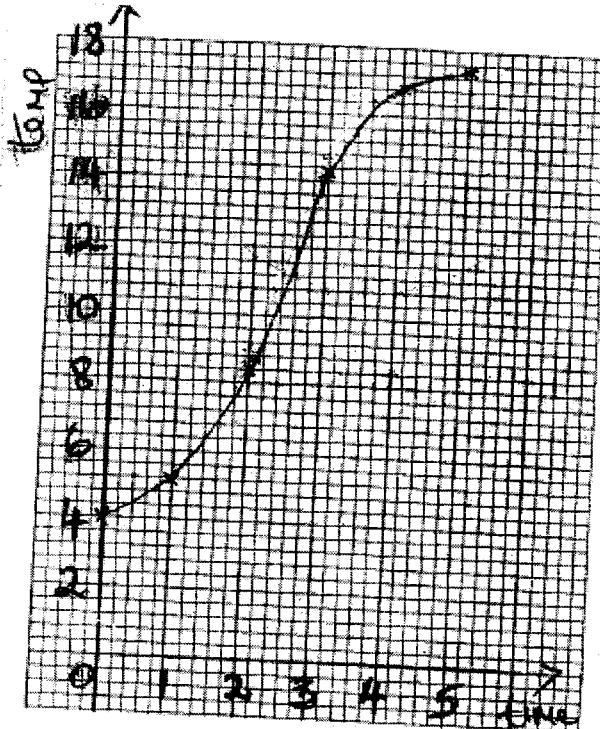
When  $t = 4, M = 20 + 5 \times 16$   
 = 100 kg

(4 marks)

Q4



Q5

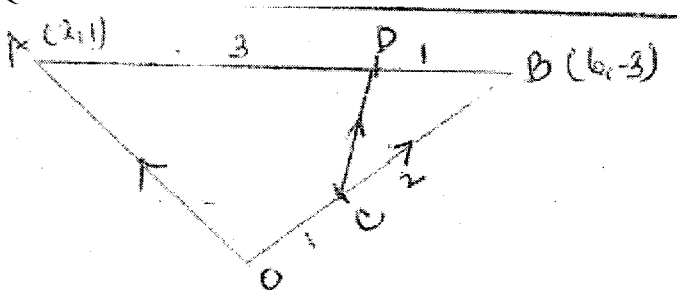


The average rate of change

$$\begin{aligned}
 &= \frac{15.5 - 7.6}{3.4 - 1.8} \\
 &= 4.9375^{\circ} \text{C} / \text{min}
 \end{aligned}$$

(4 marks)

Q6



$$CO = -\frac{1}{3} \begin{pmatrix} 6 \\ -3 \end{pmatrix} = \begin{pmatrix} -2 \\ 1 \end{pmatrix} \text{ or } OC = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$$

$$AD = \frac{3}{4} \begin{pmatrix} 4 \\ -4 \end{pmatrix} = \begin{pmatrix} 3 \\ -3 \end{pmatrix}$$

$$CD = CO + OA + AD$$

$$= \begin{pmatrix} -2 \\ 1 \end{pmatrix} + \begin{pmatrix} 2 \\ 1 \end{pmatrix} + \begin{pmatrix} 3 \\ -3 \end{pmatrix}$$

$$= \begin{pmatrix} 3 \\ -1 \end{pmatrix}$$

(3 marks)

Q7 The LCM of 3 and 5 = 15  
In 15 minutes, 8 customers will be served

$$\therefore \text{total time} = \frac{200}{8} \times 15$$

$$= 375 \text{ min.}$$

(3 marks)

Q8 (a)  $(2-x)^7 = 2^7 - 7(2^6)x + 21(2^5)(x^2) - 35(2^4)(x^3) + 35(2^3)(x^4) - 21(2^2)x^5 + 7(2^1)(x^6) - x^7$

$$= 128 - 448x + 672x^2 - 560x^3 + 280x^4 - 84x^5 + 14x^6 - x^7$$

(b)  $(1.97)^7 = (2 - 0.03)^7$

$$= 128 - 448 \times 0.03 + 672 \times (0.03)^2 - 560 \times (0.03)^3$$

$$= 115.14968$$

$$\approx 115.1497$$

(4 marks)

Q9 Image area  $[(4 \times 2) - (5 \times 1)] \times 21$

$$= 63 \text{ sq. units}$$

(3 marks)

Q10  $\frac{\sqrt{3}}{\sqrt{3}-\sqrt{2}} = \frac{\sqrt{3}(\sqrt{3}+\sqrt{2})}{(\sqrt{3}-\sqrt{2})(\sqrt{3}+\sqrt{2})}$

$$= \frac{3+\sqrt{6}}{3-\sqrt{6}}$$

(2 marks)

Q11  $(2-1)^2 + (5-k)^2 = 10$

$$k^2 - 10k + 16 = 0$$

$$(k-2)(k-8) = 0$$

$$k = 2 \text{ or } k = 8$$

Centre at (1,2) or (1,8)

(3 marks)

Q12  $\left(\frac{1}{7} \times \frac{2}{5}\right) + \left(\frac{6}{7} \times \frac{1}{6}\right)$

$$= \frac{7}{35}$$

(2 marks)

Q13 Longitude difference =  $45^\circ + 60^\circ = 105^\circ$   
Distance in km

$$= \frac{105}{360} \times 2 \times 3.142 \times 6370 \cos 40^\circ$$

$$= 8943.7 \text{ km}$$

(3 marks)

Q14  $4 - 4\cos^2 \alpha = 4\sin \alpha - 1$

$$4 - 4(1 - \sin^2 \alpha) = 4\sin \alpha - 1$$

$$4\sin^2 \alpha - 4\sin \alpha + 1 = 0$$

$$(2 \sin \alpha - 1)(2 \sin \alpha - 1) = 0$$

$$\sin \alpha = \frac{1}{2}$$

$$\therefore \alpha = 30^\circ, 150^\circ$$

(4 marks)

Q15  $AT^2 = 9 \times 4$

$$= 36$$

$$\therefore AT = 6 \text{ cm}$$

(2 marks)

Q16  $\int (3t^2 - 6t - 9) dt = t^3 - 3t^2 - 9t + c$

$$[t^3 - 3t^2 - 9t]_1^3 = [3^3 - 3(3^2) - 9(3)] - [1^3 - 3(1)^2 - 9(1)]$$

$$= -16$$

$$[t^3 - 3t^2 - 9t]_3^4 = [4^3 - 3(4)^2 - 9(4)] - [3^3 - 3(3^2) - 9(3)]$$

$$= 7$$

$$\text{Distance travelled} = 16 + 7$$

$$= 23 \text{ m}$$

.....(4 marks)

Q17 (a) Total rate of flow in litres

$$= 120 + 150 = 270 \text{ l/min}$$

$$\text{Time taken} = \frac{18900}{270}$$

$$= 70 \text{ min (1 hr 10 min)}$$

(b) (i) Part of tank filled after 25 min

$$= 270 \times 25$$

$$= 6750$$

Time taken to fill remaining part

$$= \frac{18900 - 6750}{270 - 20}$$

$$= 48.6 \text{ min}$$

$$\text{Total time to fill tank}$$

$$= 25 + 48.6 = 73.6 \text{ min}$$

(ii) Total inflow into tank

$$= 270 \times 73.6$$

$$= 19872$$

$$\text{Water wasted} = 19872 - (542 \times 25 + 6300)$$

$$= 22 \text{ l}$$

(10 marks)

Q18. (a) Value after 9 yrs =  $1240000 \left(1 + \frac{12}{100}\right)^9$

$$\approx 3438617.659$$

$$\approx 3438618$$

(b) (i)  $1240000(1.12)^n = 2741245$

$$n \log 1.12 = \log \left( \frac{2741245}{1240000} \right)$$

$$n = \frac{\log 2.210681452}{\log 1.12}$$

$$n = 7$$

$$(ii) \quad 1240000 \left( 1 + \frac{r}{100} \right)^7 = 2917231$$

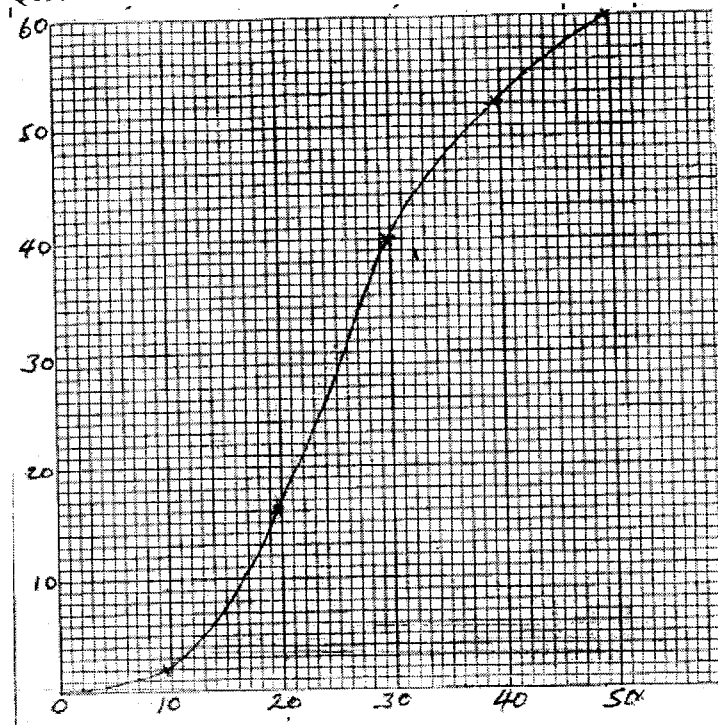
$$1 + \frac{r}{100} = \sqrt[7]{\left( \frac{2917231}{1240000} \right)}$$

$$1 + \frac{r}{100} = 1.130000011$$

$$r = 13\%$$

(10 marks)

Q19.



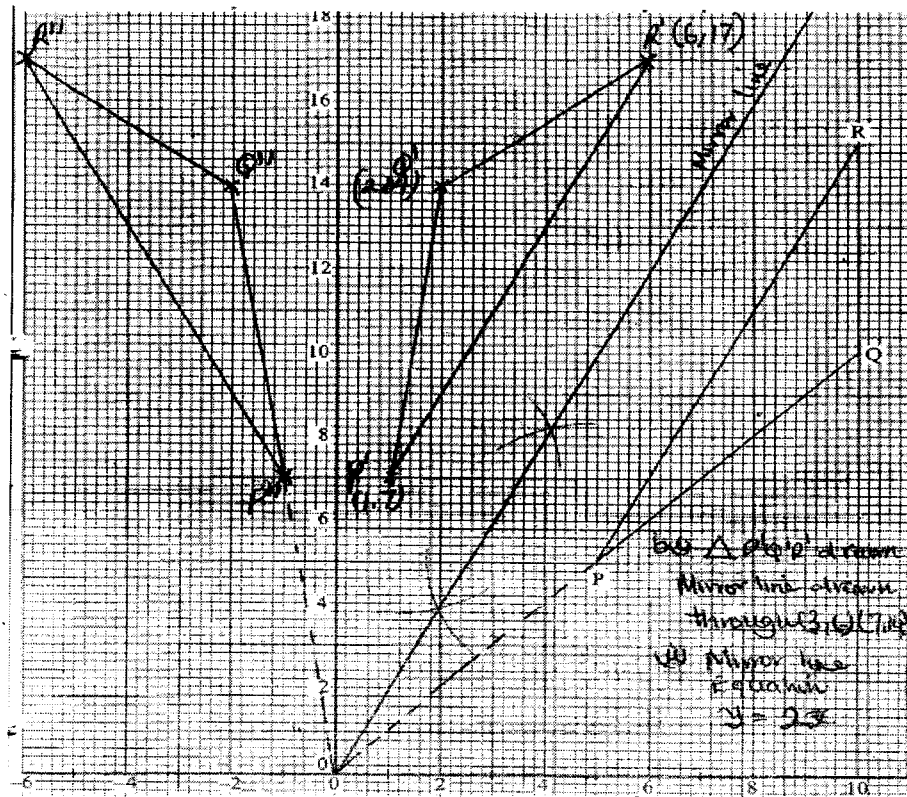
- (b)(i) Median goals =  $25.5 \pm 0.5$   
(ii) number of matches in which scores were between 0 & 37 = 49  
(iii)  $Q_1 = 19 \pm 0.5$   
 $Q_3 = 33 \pm 0.5$   
Inter quartile Range  $33 - 19 = 14$

(10 marks)



Q20. (a) 
$$\begin{pmatrix} -0.6 & 0.8 \\ 0.8 & 0.6 \end{pmatrix} \begin{pmatrix} 5 & 10 & 10 \\ 5 & 10 & 15 \end{pmatrix} = \begin{pmatrix} 1 & 2 & 6 \\ 7 & 14 & 17 \end{pmatrix}$$
  
 $P'(1,7), Q'(2,14), R'(6,17)$

(b)



(c) (ii) 
$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} 5 & 10 & 10 \\ 5 & 10 & 15 \end{pmatrix} = \begin{pmatrix} -1 & -2 & -6 \\ 7 & 14 & 17 \end{pmatrix}$$
  

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 0.6 & -0.8 \\ 0.8 & 0.6 \end{pmatrix}$$

(iii) Rotation about (0,0) thro' angle  $53^\circ$

(10 marks)

Q21. (a) Tax on Kshs 9680 =  $9680 \times \frac{10}{100} = 968$   
 Tax on Kshs (18800 - 9680) =  $9120 \times \frac{15}{100}$   
 $= 1368$   
 Tax on Kshs (24200 - 18800) =  $5400 \times \frac{20}{100}$   
 $= 1080$   
 Total tax = Kshs (968 + 1368 + 1080)  
 $= 3416$

$$(b) \quad \text{Tax paid} = 3416 - \left(1056 + 2400 \times \frac{15}{100}\right) \\ = 2000$$

$$(c) \quad \text{Increase in tax paid} = 2000 \times \frac{36.3}{100} \\ = 726$$

$$\therefore \text{increase in earnings} = 726 \times \frac{100}{20} \\ = 3630$$

$$\% \text{ increase} = \frac{3630}{24200} \times 100\% \\ = 15\%$$

(10 marks)

Q22. (a)  $AC = \sqrt{(15\sqrt{2})^2 + (15\sqrt{2})^2} = 30\text{cm}$

(b) Identification of  $\theta$   
 $\tan \theta = \frac{8}{30}$   
 $\theta = 14.93^\circ$

(c) Pyramid height  $= \sqrt{(17\sqrt{2})^2 - 15^2}$   
 $= 18.79\text{cm}$   
 $VO = 18.79 + 8$   
 $= 26.79\text{cm}$

(d) Identification of  $\alpha$   
 $\tan \alpha = \frac{18.79}{7.5\sqrt{2}}$   
 $\alpha = 60.55^\circ$

(10 marks)

Q23. (a)(i)  $\frac{8}{2} \{2 \times 2 + (8-1)d\} = 156$   
 $d = 5$

(ii)  $\frac{n}{2} \{2 \times 2 + (n-1)5\} = 416$   
 $5n^2 - n = 832$   
 $5n^2 - n - 832 = 0$   
 $(5n + 64)(n - 13) = 0$   
 $n = 13$

(b)(i) 1<sup>st</sup> three terms of the G.P;  $a + 2d, a + 4d, a + 7d$   
 These terms are;  $a + 6, a + 12$  and  $a + 21$

$$r = \frac{a+12}{a+6} = \frac{a+21}{a+12}$$

$$(a+12)^2 = (a+6)(a+12)$$

$$a^2 + 24a + 144 = a^2 + 27a + 126$$

$$a = 6$$

$$\therefore 1^{\text{st}} \text{ term} = 6 + 6 = 12$$

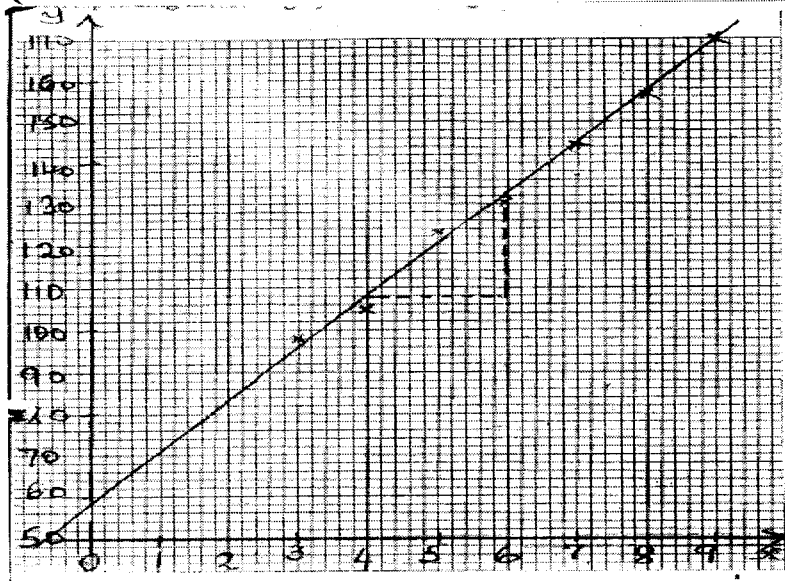
$$(ii) \quad r = \frac{6+12}{6+6} = \frac{3}{2}$$

$$S_9 = 12 \frac{\left(\left(\frac{3}{2}\right)^9 - 1\right)}{\frac{3}{2} - 1}$$

$$= 898.6 \text{ (to 4 sf)}$$

(10 marks)

Q24.



- (a) (i) Scale  
(ii) Plotting  
(iii) Line of best fit

- (b)(i) Average volume of ball bearing

$$= \frac{133 - 108}{6 - 4}$$

$$= 12.5$$

$$(ii) \quad \frac{y - 133}{x - 6} = 12.5$$

$$y = 12.5x + 58$$

- (c) Volume of water in cylinder is the volume  
of  $y$  when  $x = 0$   
 $y = 12.5 \times 0 + 58$   
 $= 58$

**(10 marks)**