

FORM FOUR CLUSTER KCSE MODEL8

MATHEMATICS PAPER 1 ANSWER

SECTION I (50 Marks)

Answer ALL questions

1.

$$\begin{aligned} &\Rightarrow \frac{(2^9 \times 3^3)^{\frac{1}{3}} \times (5^3 \times 10^{-6})^{\frac{1}{3}}}{(2^4 \times 3^6)^{\frac{1}{2}}} \\ &\Rightarrow \frac{2^3 \times 3 \times 5 \times 10^{-2}}{2^2 \times 3^3} \\ &\Rightarrow \frac{2 \times 5}{3^2 \times 100} = \frac{10}{9 \times 100} \\ &\Rightarrow \frac{1}{90} \end{aligned}$$

2.

$$\begin{aligned} (a^2 - b^2) &= (a+b)(a-b) \quad a = 5x-4, b = (-3x-1) \\ (a+b)(a-b) &= (5x-4+(-3x-1))(5x-4-(-3x-1)) \\ &= (2x-5)(8x-3) \end{aligned}$$

OR

$$\begin{aligned} &\text{Expand } 25x^2 - 40x + 16 - (9x^2 + 6x + 1) \\ &\Rightarrow 16x^2 - 46x + 15 \\ &\Rightarrow 16x^2 - 6x - 40x + 15 = (2x-5)(8x-3) \end{aligned}$$

3.

$$\begin{aligned} \frac{1}{4}x - 1 &< \frac{1}{2}x + 1 \\ -2 &< \frac{1}{4}x \\ -8 &< x \\ \frac{1}{2}x + 1 &\leq \frac{1}{3}x + 4 = \frac{1}{6}x \leq 3 \\ x &\leq 18 \quad -8 < x \leq 18 \end{aligned}$$

Sum of all possible integers prime no.

$$-7 + -5 + -3 + -2 + 2 + 3 + 5 + 7 + 11 + 13 + 17 = 41$$

4.

$$13^x \cdot 13^1 - \frac{13^x}{13^2} = 4824612$$

$$\text{Let } a = 13^x \Rightarrow 13a - \frac{1}{169}a = 4824612$$

$$12^{168/129^a} = 4824612$$

$$a = 371293 = 13^5$$

$$13^x = 371293 = 13^5$$

$$x=5$$

5. Translation vector

$$\Rightarrow \begin{pmatrix} -4 \\ 5 \end{pmatrix} - \begin{pmatrix} 3 \\ -10 \end{pmatrix} = \begin{pmatrix} -7 \\ 15 \end{pmatrix}$$

$$\text{Object} \Rightarrow \begin{pmatrix} -1 \\ -3 \end{pmatrix} - \begin{pmatrix} -7 \\ 15 \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} 6 \\ -18 \end{pmatrix}$$

$$(6, -18)$$

6.

$$y = 3x + 4$$

$$\text{Gradient} = 3$$

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

$$y-4 = 3x-6$$

$$y = 3x - 2$$

7.

$$\sin 3x = \sin (90-2x)$$

$$3x = 90-2x$$

$$5x = 90$$

$$x = 18$$

$$\tan 18^\circ$$

8.

$$\text{c.f } 3, 11, 23, 33, 37, 40$$

$$14.5 + \frac{20-11}{12} \times 5$$

$$14.5 + 3.75 = 18.25$$

9.

$$x + 5x = 180$$

$$x = 30$$

$$\begin{aligned} \text{No of sides} &= \frac{360}{30} \\ &= 12 \end{aligned}$$

10.

$$72 \Rightarrow 2 \times 2 \times 2 \times 3 \times 3$$

$$54 \Rightarrow 2 \times 2 \times 3 \times 3 \times 3$$

$$G.C.D = 2 \times 3 \times 3 = 18$$

$$18 \times 18$$

$$= 324 \text{ cm}^2$$

11.

$$y^2 - 8y + 7 = 0$$

$$y^2 - 7y - y + 7 = 0$$

$$y(y - 7) - 1(y - 7) = 0$$

$$(y - 1)(y - 7) = 0$$

$$y = 1 \quad y = 7$$

$$7^x = 7^0 \quad x = 0$$

$$7^x = 7^1 \quad x = 1$$

$$\frac{35}{35} \text{ will take } \frac{35}{12} \text{ hrs}$$

12. Lydia's Rate of working = $\frac{1}{7} w$ per work

Damaris Rate of working = $\frac{1}{5} w$ per work

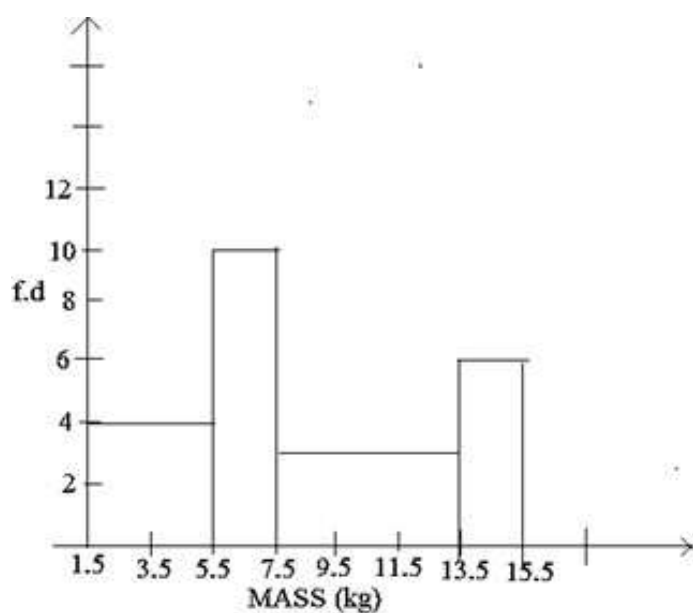
$$\text{Both for 2 hrs work} = 2 \times \left(\frac{1}{7} + \frac{1}{5} \right) = \frac{24}{25} \checkmark$$

$$\text{Rem work} = \frac{11}{35}$$

$$\text{Time taken by Damaris} = \frac{11 \times 5}{35} \checkmark = 1 \frac{4}{7} \text{ hours or } 1 \text{ hr } 34.29 \text{ min}$$

13.

MASS(kg)	f	<u>f.d</u>
$1.5 \leq x \leq 5.5$	16	4
$5.5 \leq x \leq 7.5$	20	10
$7.5 \leq x \leq 13.5$	18	3
$13.5 \leq x \leq 15.5$	14	7



14.

x	-3	-2	-1	0	1	2
y	11	7	5	5	7	11

$$\begin{aligned}
 A &= \frac{1}{2}h(\text{sum of Ends} + 2(\text{sum of middles})) \\
 &= \frac{1}{2} \times 1(11 + 11 + 2(7 + 5 + 5 + 7)) \\
 &= \frac{1}{2}(22 + 2(24)) \\
 &= \frac{1}{2}(70) \\
 &= 35 \text{ square units}
 \end{aligned}$$

15.

$$\det = 8 - 3 = 5$$

$$\frac{1}{5} \begin{pmatrix} 4 & 3 \\ -1 & 2 \end{pmatrix} = \begin{pmatrix} \frac{4}{5} & -\frac{3}{5} \\ -\frac{1}{5} & \frac{2}{5} \end{pmatrix}$$

$$\begin{pmatrix} \frac{4}{5} & -\frac{3}{5} \\ -\frac{1}{5} & \frac{2}{5} \end{pmatrix} \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -\frac{4}{5} & -\frac{3}{5} \\ -\frac{1}{5} & \frac{2}{5} \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 1 & 1 \end{pmatrix}$$

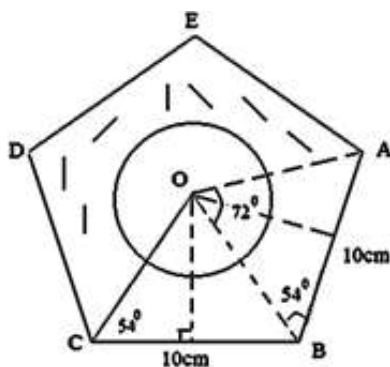
$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \frac{48}{5} & -\frac{33}{5} \\ -\frac{12}{5} & \frac{22}{5} \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \frac{48}{5} \\ -\frac{33}{5} \end{pmatrix}$$

$$x = \frac{48}{5} \quad y = -\frac{33}{5}$$

$$\left(\frac{48}{5}, -\frac{33}{5} \right)$$

16.



$$\tan 54 = \frac{h}{5}$$

$$h = 5 \times \tan 54^\circ$$

$$= 6.882 \text{ cm}$$

Cross sec Area

$$\left(\frac{1}{2} \times 10 \times 6.882 \right) \times 5 - 3.142 \times 3.5^2$$

$$= 172.05 - 38.4895$$

$$= 133.565 \text{ cm}^2$$

$$= 133.6 \text{ cm}^2$$

SECTION II (50 Marks)

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Choose any FIVE questions in this section

17. Distance by the trailer.

$$= 1340 \text{ hrs} - 1125 \text{ hrs}$$

(a) Time taken = 1 hrs 15 mins

$$\text{Distance} = 1 \frac{1}{4} \text{ hrs} \times 60 \text{ km/hr}$$

$$= \frac{5}{4} \times 60 \text{ km}$$

$$= 75 \text{ km}$$

(b) Relative speed

$$= 90 \text{ km/hr} - 60 \text{ km/hr}$$

$$= 30 \text{ km/hr}$$

Time taken to overtake

$$\frac{\text{Distance}}{\text{Relative speed}}$$

$$\frac{75 \text{ km}}{30 \text{ km/hr}}$$

$$= 2 \frac{1}{2} \text{ hrs}$$

$$\text{Time} = 1340$$

$$+ 2 \text{ hr } 30$$

$$1640 \text{ hrs}$$

$$= 4:30 \text{ p.m.}$$

(c) Distance taken by the Bus before it overtook the tracker

$$= 2 \frac{1}{2} \text{ hrs} \times 90 \text{ km/hr}$$

$$= \frac{5}{2} \text{ hrs} \times 90 \text{ km/hr}$$

$$= 225 \text{ km}$$

$$= 500 \text{ km} - 225 \text{ km}$$

$$= 275 \text{ km from Nairobi}$$

(d) Time taken by the bus to reach Nairobi = $\frac{55}{18} \text{ hrs}$

$$= \frac{55}{18} \text{ hrs} \times 60$$

$$= 183.33 \text{ km}$$

$$= 275 - 183.33$$

18.

$$y = x^2 + 6x + 1$$

x	0	1	2	3	4	5	6
y	1	6	9	10	9	6	1
	y_0	y_1	y_2	y_3	y_4	y_5	y_6

$$A = \frac{1}{2}h = [(y_0 + y_6) + 2(y_1 + y_2 + y_3 + y_4 + y_5)]$$

$$\begin{aligned} \text{(a)} \quad A &= \frac{1}{2} \times 1 [(1 + 1) + 2(6 + 9 + 10 + 9 + 6)] \\ &= 0.5 [2 + 80] \\ &= 41 \text{ Sq. units} \end{aligned}$$

$$\begin{aligned} \text{(b) (i) Area} &= \int_0^6 (-x^2 + 6x + 1) dx \\ &= \left[\frac{-x^3}{3} + 3x^2 + 1x + c \right]_0^6 \\ &= \left(\frac{-(6^3)}{3} + 3(6^2) + 6 \right) - \left(\frac{0}{3} + 3x + 0 \right) \\ &= -72 + 108 + 6 \\ &= 42 \text{ sq. units} \end{aligned}$$

$$\begin{aligned} \text{(ii) \% Error} &= \frac{\text{Error}}{\text{Actual Area}} \times 100\% \\ &= \frac{1}{42} \times 100\% \\ &= 2.38075 \\ &= 2.38\% (2dp) \end{aligned}$$

19.

(a) Bag A & $P(\text{Red}) = \frac{4}{6}$

$$P(\text{yellow}) = \frac{2}{6}$$

Bag B $P(\text{Red}) = \frac{2}{5}$

$$P(\text{yellow}) = \frac{3}{5}$$

Both balls are some colour

$$P\left(\frac{2}{6} \text{ and } \frac{3}{5}\right) \text{ or } P\left(\frac{4}{6} \text{ and } \frac{2}{5}\right)$$

$$P\left(\frac{2}{6} \times \frac{3}{5}\right) \text{ or } P\left(\frac{4}{6} \times \frac{2}{5}\right)$$

$$= \frac{3}{15} + \frac{4}{15}$$

$$P(R \text{ or } Y) = \frac{7}{15}$$

(b) (i) $P(\text{RED})$

$$A = \frac{4}{6} \times \frac{3}{5} = \frac{2}{5}$$

Or

$$B = \frac{2}{5} \times \frac{1}{4} = \frac{1}{10}$$

$$= \frac{2}{5} + \frac{1}{10}$$

$$= \frac{4+1}{10}$$

$$= \frac{5}{10} \rightarrow \frac{1}{2}$$

$$P(\text{Both balls are red}) = \frac{1}{2}$$

(ii) $P(\text{All four balls are red})$

$$= \frac{2}{5} \text{ and } \frac{1}{10}$$

$$= \frac{2}{5} \times \frac{1}{10}$$

$$= \frac{1}{25}$$

$$a) \quad AX = 3\vec{b} + \frac{4}{13}\vec{c} - \frac{30}{13}\vec{b}$$

$$= \frac{9}{13}\vec{b} + \frac{4}{13}\vec{c}$$

$$AM = \frac{2}{3}\left(\frac{2\vec{c}}{3}\right) + \frac{3}{5}\left(\frac{3\vec{b}}{5}\right)$$

$$= \frac{4}{5}\vec{c} + \frac{9}{5}\vec{b}$$

b) Divide the scalars of $\vec{b}$ on both AX & AM

$$\text{i.e. } \frac{9}{5} \div \frac{9}{13} = \frac{13}{5}$$

$$\therefore \frac{13}{5}AX = AM$$

$\Rightarrow AX \parallel AM$ Share a common point A

$\Rightarrow A, X,$ and M are collinear

$\Rightarrow AX : XM = 5 : 8$

$$c) \quad BN = \frac{13}{10}BX = \frac{13}{10}\left(\frac{4}{13}\vec{c} - \frac{30}{13}\vec{b}\right) = \frac{2}{5}\vec{c} - 3\vec{b}$$

$$\therefore AN = 3\vec{b} + \frac{2}{5}\vec{c} - 3\vec{b} = \frac{2}{5}\vec{c}$$

$$AC = \frac{2}{1}\vec{c} = 2\vec{c}$$

$$\therefore \frac{AN}{AC} = \frac{2}{5} \div 2 = \frac{1}{5}$$

$$\therefore AN : NC = 1 : 4$$

21. At 10:45 $\Rightarrow$ Bus had done $3\frac{3}{4}$ hrs

$$\frac{15}{4} \times 85 = 318.75 \text{ km}$$

Assume bus had a head start of t hrs.

$\therefore$ car caught up in $\left(3\frac{3}{4} - t\right)$ hr

$$\therefore \frac{85t}{40} = \left(3\frac{3}{4} - t\right)$$

$$1.25t = 150$$

$$t = 1\frac{1}{5} \text{ hr} = 1 \text{ hr } 12 \text{ min}$$

$$\text{Bus had covered } 85 \times \frac{6}{5} = 102 \text{ km}$$

Car left at 8:12am

b) If car used W hrs to B then bus used $(W+1)$ hr of travel.

$$\Rightarrow 85(W+1) = 125W$$

$$W = 2\frac{1}{8} \text{ hrs}$$

$$\text{Distance covered 2}^{nd} \text{ phase} \Rightarrow 2\frac{1}{8} \times 125 = 265.625$$

$$\therefore AB = 265.625 + 318.75$$

$$= 584.375 \text{ km}$$

$$\frac{85}{40} \times \frac{1}{2} \text{ Time to catch} = 1\frac{1}{16} = 1 \text{ hr } 3 \text{ min } 48 \text{ sec}$$

$$\Rightarrow 10.45$$

$$0.30$$

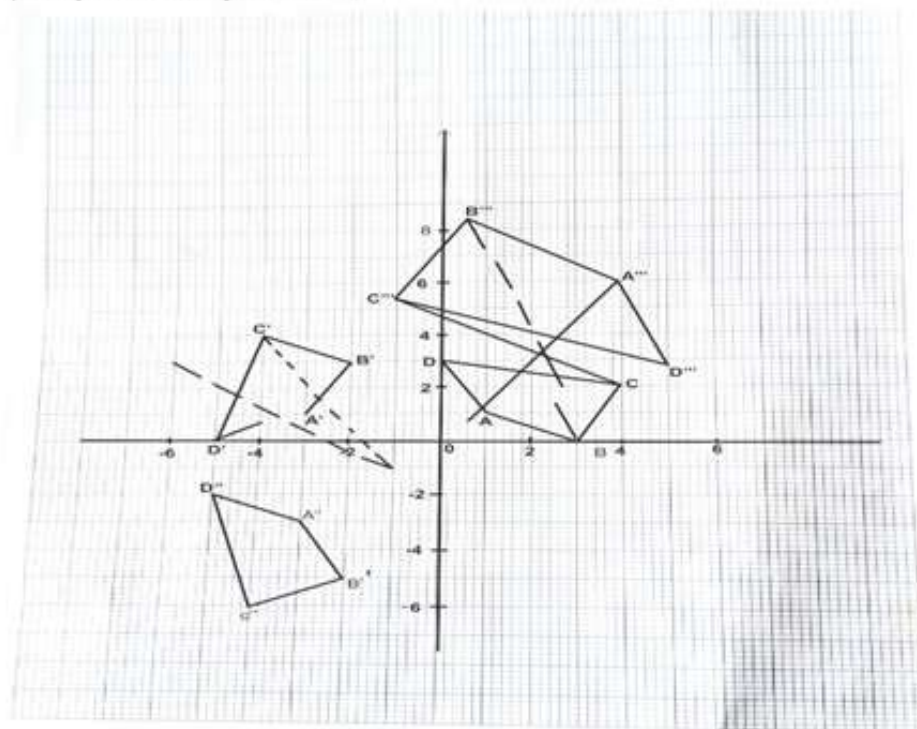
$$1.03.48$$

$$12.18:48 \text{ pm}$$

22.

a) $\pm 90^\circ$ Rotation about $(-1, 1)$

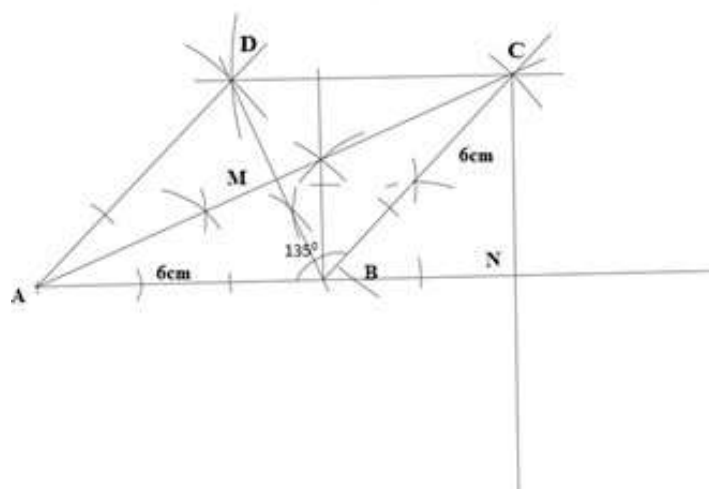
b) Reflection in $y = -x - 2$



For $A''B''C''D''$

$$A''(3, 5) \quad B''(4, 6) \quad C''(3, 7) \quad D''(2, 6)$$

23.



b) $BN = 4.1 \text{ cm}$

$CN = 4.3 \text{ cm}$

c) $AM = 5.9 \text{ cm}$

d) $\text{Area} = \frac{1}{2} \times 2.3 \times 5.9$
 $= 6.785 \text{ cm}^2$

24.

Original number of parents x

New number of parents $x - 60$

Original contribution per parent $\frac{3600000}{x}$

New contribution parent $\frac{3600000}{x - 60}$

$$\frac{3600000}{x - 60} - 2000 = \frac{3600000}{x}$$

$$x^2 - 60x - 108000 = 0$$

$$\frac{60 \pm \sqrt{3600 + 420000}}{2}$$

$$x = -300 \text{ or } 360$$

$$x = 360 \text{ parents}$$

b) Contribution per parent

$$\Rightarrow 360 - 60 = 300 \text{ parents}$$

$$= 3600000$$