

FORM FOUR CLUSTER KCSE MODEL5

MATHEMATICS PAPER 1 ANSWERS

SECTION I (50 Marks)

Answer ALL questions

1.
$$\Rightarrow \frac{(2^9 \times 3^3)^{\frac{1}{3}} \times (5^3 \times 10^{-6})^{\frac{1}{3}}}{(2^4 \times 3^6)^{\frac{1}{2}}}$$

$$\Rightarrow \frac{2^3 \times 3 \times 5 \times 10^{-2}}{2^2 \times 3^3}$$

$$\Rightarrow \frac{2 \times 5}{3^2 \times 100} = \frac{10}{9 \times 100}$$

$$\Rightarrow \frac{1}{90}$$

2.
$$(a^2 - b^2) = (a+b)(a-b) \quad a = 5x - 4, b = (-3x - 1)$$

$$(a+b)(a-b) = (5x - 4 + -3x - 1)(5x - 4 - (3x - 1))$$

$$= (2x - 5)(8x - 3)$$

OR

$$\text{Expand } 25x^2 - 40x + 16 - (9x^2 + 6x + 1)$$

$$\Rightarrow 16x^2 - 46x + 15$$

$$\Rightarrow 16x^2 - 6x - 40x + 15 = (2x - 5)(8x - 3)$$

3.
$$\frac{1}{4}x - 1 < \frac{1}{2}x + 1$$

$$-2 < \frac{1}{4}x$$

$$-8 < x$$

$$\frac{1}{2}x + 1 \leq \frac{1}{3}x + 4 = \frac{1}{6}x \leq 3$$

$$x \leq 18 \quad -8 < x \leq 18$$

Sum of all possible integers prime no.

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

4.
$$13^x \cdot 13^1 = \frac{13^x}{13^2} = 4824612$$

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

$$12 \cancel{168} /_{129} a = 4824612$$

$$a = 371293 = 13^5$$

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

$$x=5$$

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. $\frac{x-10}{x} = \tan 20$

$$x-10 = x(\tan 20)$$

$$x - x(\tan 20) = 10$$

$$x = \frac{10}{1 - \tan 20}$$

$$= 15.723$$

$$\therefore \text{height cliff} = 15.72 - 10 = 5.723m$$

7. $\sin x = \cos (90-x)$

$$\therefore x + 0.6x = 90$$

$$x = \frac{90}{1.6} = 56.25^\circ$$

$$\frac{8}{15}x = \frac{8}{15} \times 56.25 = 8(3.75) = 30^\circ$$

$$\tan 30^\circ = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3} \text{ or } \frac{1}{3}\sqrt{3}$$

8. $96\% \Rightarrow 960$

$$100\% \rightarrow \frac{100}{96} \times 960 = 1000 / =$$

$$\text{New S.P} \Rightarrow 1 \times 1.5(100) \rightarrow 120 = 1030 / =$$

$$\% \text{ Profit} = \frac{1030 - 1000 \times 100}{1000}$$

$$= 3\%$$

- 9.

$$\frac{x(4-9x^2)}{3x^2-6x+2x-4} = \frac{x(2-3x)}{3x(x-2)+2(x-2)}$$

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

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

10.

$$y = \frac{3}{2}x + 3$$

$$m_1 = \frac{3}{2} \quad m_2 = -\frac{2}{3}$$

$$\therefore eq \rightarrow \frac{y-3}{x+1} = \frac{2}{3}$$

$$y = \frac{-2}{3}x + \frac{7}{3}$$

11. Area of parallelogram = $10(7) \sin 30^\circ$

$$= 35 \text{ cm}^2$$

$$\text{Area of Sector} = \frac{30}{360} \times \frac{22}{7} \times 7 \times 7$$

$$= 12\frac{5}{6} \text{ cm}^2$$

$$\therefore \text{shaded area } 35 - 12\frac{5}{6} = 22\frac{1}{6} \text{ cm}^2$$

12.

$$\text{Boys absent } \frac{1}{6} \times \frac{3}{10}x = \frac{1}{20}x$$

$$\text{Girls absent } \frac{2}{5} \times \frac{7}{10}(x) = \frac{7}{25}x$$

$$\therefore \frac{1}{20}x + \frac{7}{25}x = 165$$

$$\frac{33x}{100} = 160$$

$$x = 500 \text{ students}$$

13.

No.	Log
415.2	2.6183
0.0761	$\bar{2}.8814$
	<u>1.4997</u>
135	<u>2.1303-</u>
	<u>1.3694</u> $\rightarrow \bar{3} + 2.3694$
	3 $\downarrow$

0.61631	$\bar{1.7898}$
---------	----------------

14. $x + y = 500$

$$x - y = 200$$

$$\hline 2x = 700$$

$$x = 350$$

$$y = 150$$

15. $\frac{3}{4} \left(\frac{2}{3} \times \pi \times 3.5^3 \right) = \pi \times 3.5 \times r$

$$r^2 = \frac{3}{4} \times \frac{2}{3} \times \frac{3.5^3}{3.5}$$

$$r^2 = 6.125$$

$$r = 2.475 \text{ cm}$$

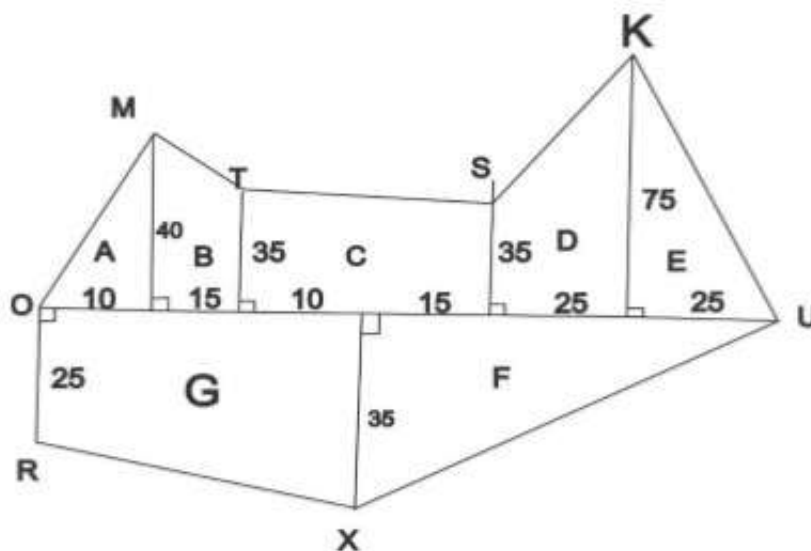
16. 15, 15, 16, 19, 19, 20, 20, 21, 22, 22, 23, 26, 27, 28

$$\text{median} \frac{20 + 21}{2} = 20.5$$

SECTION II (50 Marks)

Answer any FIVE questions.

17. a)



$$b) A = \frac{1}{2} \times 10 \times 40 = 200.0$$

$$B = \frac{1}{2} (40 + 35) 15 = 562.5$$

$$C = \frac{1}{2} (35 + 35) 25 = 875.0$$

$$D = \frac{1}{2} (35 + 75) = 937.5$$

$$E = \frac{1}{2} \times 25 \times 75 = 937.5$$

$$F = \frac{1}{2} \times 65 \times 35 = 1137.5$$

$$G = \frac{1}{2} (25 + 35) 35 = 1050.0$$

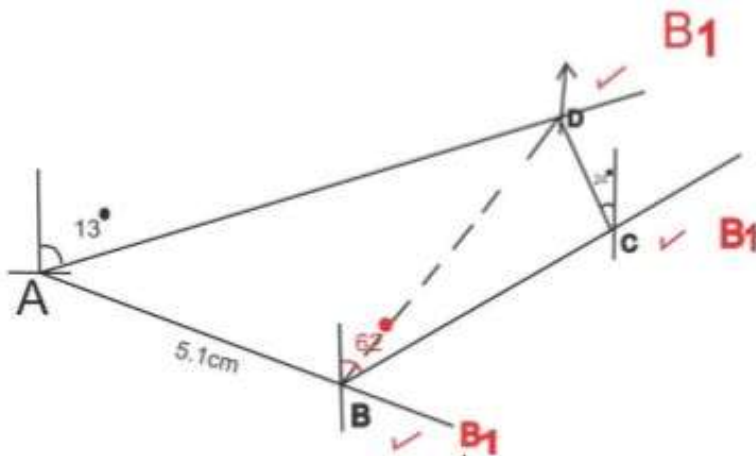
$$6137.5 \text{ km}^2$$

$$= 6137.5 \times 1,000,000 = 6,13,750,000 \text{ m}^2$$

$$= \frac{6,137,500,000}{10,000} = 613,750 \text{ Ha}$$

$$b) \text{ Cost} = 613,750 \times 12,500,000 \\ = 7,671,875,000,000$$

18.



ii) The bearing of B from D = $217^\circ \pm 1^\circ$

The bearing of A from C = $268 \pm 1^\circ$

iii) The distance

$$AC = (8.8 \pm 0.1) \times 20 = 176 \text{ km} \pm 2 \text{ km}$$

$$BD = (5.3 \pm 0.1) \times 20 = 106 \text{ km} \pm 2 \text{ km}$$

$$b) \vec{AB} \vec{BC} \vec{CD} \quad 102 + 94 + (2.4 \pm 0.1)20 \\ = 244 \pm 2$$

$$\text{Time} = \frac{500}{244 \pm 2} = 2.049 \text{ hrs} \pm 0.5$$

19.

$$a) \quad r = \frac{6}{9} \times 14 = 5.6 \text{ cm}$$

$$\text{Vol. water} = \frac{1}{3} \times \frac{22}{7} \times 14^2 (15) - \frac{1}{3} \times \frac{22}{7} \times 5.6^2 (6) \\ \Rightarrow 3080 - 197.12 = 2882.88 \text{ cm}^3$$

$$b) V.S.F = \frac{2882.88}{3080} = 0.936$$

$$L.S.F = \sqrt[3]{0.936} = 0.978$$

$$r = 0.978 \times 14 = 13.69 \text{ cm}$$

$$c) \text{ For big cone slant height } L = \sqrt{15^2 - 14^2} = 20.5183 \text{ cm}$$

$$\therefore \text{ Surface area of cone} = \pi RL$$

$$= \frac{22}{7} \times 14 \times 20.5183$$

$$= 902.805 \text{ cm}^2$$

$$\therefore \text{ Surface area in contact with water}$$

$$\Rightarrow A.S.F \times (\sqrt[3]{0.936})^2$$

$$S.A = (\sqrt[3]{0.936})^2 \times 902.805$$

$$= 863.86 \text{ cm}^2$$

20.

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

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

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

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

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

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

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

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

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

$\Rightarrow AX : XM = 5 : 8$

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

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

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

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

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

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 $(3\frac{3}{4} - t)$ hr

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

$$1.25t = 150$$

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

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

Car left at 8:12am

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

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

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

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

$$\therefore AB = 265.625 + 318.75$$

$$= 584.375 \text{ km}$$

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

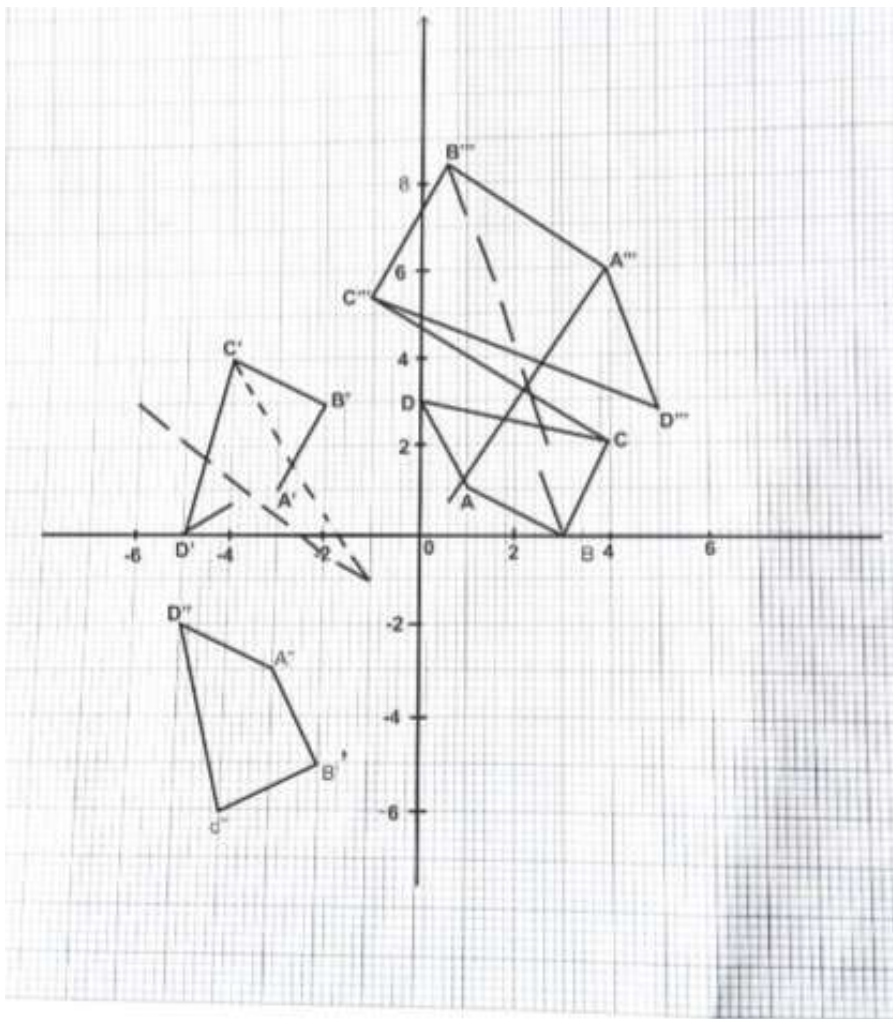
$$\Rightarrow 10.45$$

$$0.30$$

$$1.03.48$$

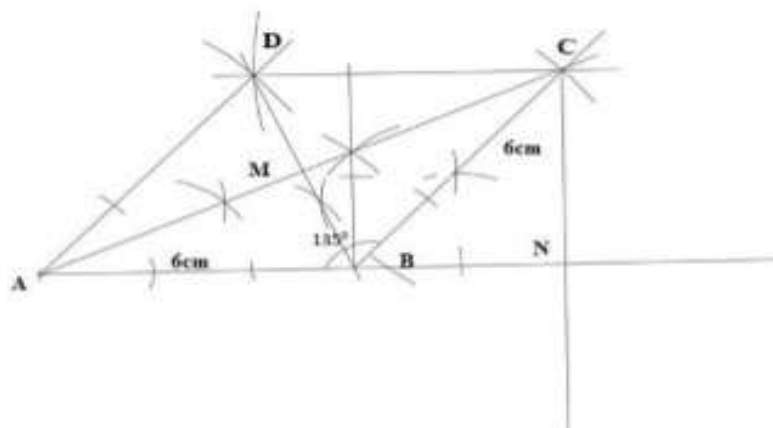
$$12.18 : 48 \text{ pm}$$

22. a) $\pm 90^\circ$ Rotation about $(-1, 1)$
 b) Reflection in $y = -x - 2$



For $A''' B''' C''' D'''$
 $A'''(3.5, 6) B'''(0.5, 7.5) C'''(-1, 4.5) D'''(5, 3)$

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 $x - 60$

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

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

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

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

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

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

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

$$b) \text{ Contribution per parent}$$

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

$$= 3600000$$