FORM FOUR CLUSTER KCSE MODEL 7

MATHEMATICS PAPER 2 ANSWERS

SECTION 1 (50 Marks)

Answer ALL questions in this section in the spaces provided.

1.

$$\frac{6.373xLog4.948}{\sqrt{(0.004636)}} = \frac{6.373x0.694430}{\sqrt{(0.004636)}}$$

NUMBER	STD FORM	LOG		
6.373	$6.373\text{x}10^0$	0.804344		
0.694430	$6.9443 \text{ x } 10^{-1}$	$\bar{1}.841628$ +	M1	√ all logs
		0.645972		
$(0.004636)^{½}$	$(4.636\text{x}10^{-3})^{½}$	½x $\bar{3}.666143$ $\frac{[-4+1.666143]}{2}$		
		$\bar{2}.833072$ -	M1	√div by 2
		0.645972 $\bar{2}.833072$ −	M1 A1	√add & subt √to 4 dpl
64.9981	$6.499807\text{x}10^1$	1.812900	04	

2.

No of loaves(x)	4000(x_1)	6 000 x_2
Cost sh (y)	22,000(y_1)	30, 000(y_2)

Equation : $\frac{y-y_1}{x-x_1} = \frac{y_2-y_1}{x_2-x_1}$

$$\frac{y-22000}{x-4000} = \frac{30000-22000}{6000-4000}$$

$$= \frac{8000}{2000}$$

$$= 4$$

y- 22000 = 4(x-4000)

y -22000 = 4x -1600

y = 4x -16000+22000

y = 4x +6000

$\log_4 x + \log_x 16 = 3$

$\log_4 x + \log_x 4^2 = 3$

$\log_4 x + 2\log_x 4 = 3$

$\log_4 x + 2x\frac{1}{\log_4 x} = 3$

$let m = \log_4 x$

$m + 2\frac{1}{m} = 3$

$m^2 + 2 = 3m$

$m^2 - 3m + 2 = 0$

$m^2 - m - 2m + 2 = 0$

$m(m-1) - 2(m-1) = 0$

$(m-2)(m-1) = 0$

$m - 2 = 0$

$m = 2$

$when m = 2$

$\log_4 x = 2$

$4^2 = x$

$x = 16$

$\therefore x = 4, or 16$

$m - 1 = 0$

$m = 1$

$when m = 1$

$\log_4 x = 1$

$4^1 = x$

3. $x = 4$

4.

$Ratio\ of\ \cos t\ x\ and\ y = 2:3$

$x:y = 2:3$

$Ratio\ of\ \cos ts\ of\ y\ and\ z = 6:1$

$x:y = 2:3$

$y:z = 6:1 \qquad l.cm\ of\ 3\ and\ 6\ is\ 6$

$\therefore x:y:z = 4:6:1$

$\cos t\ of\ x = (\frac{4}{4+6+1})x1100 = \frac{4}{11}x1100 = 400$

$= sh400$

$$\frac{\cos t\ of\ z}{\cos t\ of\ y} = (\frac{\frac{1}{11}}{\frac{6}{11}x1100}x1100)x\ 100\% = \frac{100}{600}x100$$

$$= 16\frac{2}{3}\%\ or 16.67\%$$

5.

$$Accumulated\ amount\ A = p\left(1 + \frac{r}{100}\right)n$$

$$where A = 10356.4$$

$$n = 2x4 = 8$$

$$R = \frac{1}{2}r$$

$$p = 8500$$

$$10.356.4 = 8500(1 + \frac{\frac{1}{2}r}{100})8$$

$$\frac{10356.4}{8500} = \left(1 + \frac{\frac{1}{2}r}{100}\right)8$$

$$1.21840 = \left(1 + \frac{\frac{1}{2}r}{100}\right)8$$

$$8\sqrt{1.2184} = \left(1 + \frac{\frac{1}{2}r}{100}\right)$$

$$1.025 = 1 + \frac{\frac{1}{2}r}{100}$$

$$102.5 = 100 + \frac{1}{2}r$$

$$2.5 = \frac{1}{2}r$$

$$r = 2x2.5 = 5\%$$

$$R = 5\% P.A$$

6.

$$\left(\sqrt{\frac{2(c-3x\frac{1}{2}}{3k}}\right)^2 = 1^2$$

$$\frac{2(c-3x^{\frac{1}{2}}}{3k} = 1$$

$$2(c-3x^{\frac{1}{2}} = 3k$$

$$2c-6x^{\frac{1}{2}} = 3k$$

$$6x^{\frac{1}{2}} = 2c-3k$$

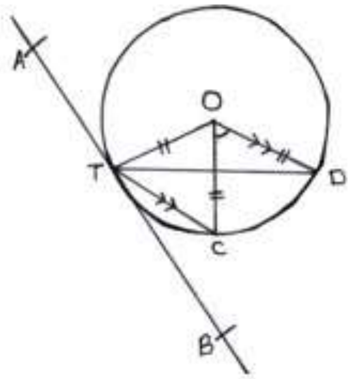
$$x^{\frac{1}{2}} = \frac{2c-3k}{6}$$

$$x = \left(\frac{2c-3k}{6}\right)^2 \ or$$

$$x = \left(\frac{4c^2-12ck+9k^2}{36}\right) or$$

$$= \frac{c^2}{9} - \frac{ck}{3} + \frac{k^2}{4}$$

7.



8.

Since OD // TC,

$$\hat{O}C = T\hat{O}C = 36^0$$

$OT = OC = radius \Rightarrow DOTC$ *is isosccles and*

$$T\hat{O}C = 180 - 2x36^0$$

$$= 180 - 72$$

$$= 108^0$$

$$T\hat{O}D(obtuse) = T\hat{O}C + C\hat{O}D = 108^0 + 36^0$$

$$= 144^0$$

P(Stops in green or white)=P(G or W)
=P(G)+P(W)

$$= \frac{1}{8} + \frac{1}{3} = \frac{3+8}{24}$$

$$= \frac{11}{24} \; or \; 0.45833 \; or \; 45.83\%$$

9.
$$L.S.F = \frac{AC}{BC} = \frac{4}{3}$$

$$A.S.F = (L.S.F)^2 = \left(\frac{4}{3}\right)^2 = \frac{16}{9}$$

$$\frac{Area\ of\ \Delta ACD}{Area\ of\ ABC} = \frac{16}{9}$$

Area ofΔ ACD= $\frac{16}{9}$ $x Area$ of Δ ABC

$$= \frac{16}{9} X 24$$

$$= \frac{384}{9} = \frac{128}{3}$$

$$42^{\frac{2}{3}} cm^2 \; or$$

$$42.67 cm^2$$

10.

$x^2 + y^2 - 4x - 2y + 4 = 0$

$centre \ A(2,1)$

$x^2 + y^2 - 8x - 10y = -16$

$centre \ B(4,5)$

$x^2 + y^2 - 10x - 14y + 25 = 0$

$centre \ C(5,7)$

Method 1 vector method

If A, B and C lie on a line (collinear)

$Let \ \vec{AB} = k\vec{B}C$

$$\begin{pmatrix}4\\5\end{pmatrix} - \begin{pmatrix}2\\1\end{pmatrix} = k\left\{\begin{pmatrix}5\\7\end{pmatrix} - \begin{pmatrix}4\\5\end{pmatrix}\right\}$$

$$\begin{pmatrix}2\\4\end{pmatrix} = k\begin{pmatrix}1\\2\end{pmatrix} \Rightarrow k = 2$$

$\therefore \ \vec{AB} = 2\vec{B}C$

$Since \ \vec{AB} = 2\vec{BC} \ and \ B \ in \ a \ common \ point \ A, B$
$and \ C \ are \ collinear.$

$\underline{Method \ 2}$

$\underline{Eqtn \ of \ AB}$

$\quad x_1 \ y_1 \quad x_2 \ y_2$

$A(2, \ 1), B(4, \ 5) \ C(5,7)$

$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\frac{y - 1}{x - 2} = \frac{5 - 1}{4 - 2} = \frac{4}{2} = 2$$

$y = 2x - 3$

If C(5,7) lies on y=2x -3 it must satisfy the equation

$y = 2x - 3 \rightarrow C(5,7)$

$7 = 2(5) - 3$

$7 = 7$

$\therefore A, B \ and \ C \ are \ collinear.$

Method 3: If A,B,C lie on a line, the triangle ABC formed has area zero.

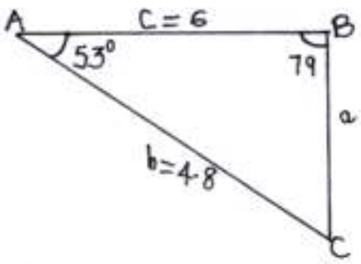
Area of Δ ABC$= \frac{1}{2}\left\{x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3\right.$

$$= \frac{1}{2}\left\{2(5-7) + 4(7-1) + 5(1-5)\right\}$$

11.

$$=\frac{1}{2}\{-4+24-20\}=\frac{1}{2}x0$$
$$=0$$

$\therefore$ *A,B and C are collinear*



12.

$$\hat{ACB}=180^0-(53^0+79^0)=180^0-132^0=48^0$$

$$\frac{a}{Sin\ A}=\frac{b}{Sin\ B}\Rightarrow\frac{a}{Sin53^0}=\frac{4.8}{Sin79^0}$$

$$a=\frac{4.8x\sin 53^0}{Sin\ 79^0}$$

$$a=3.91$$
$$=3.9cm$$

$a)\ \left(3x+\frac{1}{3x}\right)^4$

Terms without coefficents

$(3x)^4, (3x)^3\left(\frac{1}{3x}\right), (3x)^2 . \left(\frac{1}{3x}\right)^2, (3x)\left(\frac{1}{3x}\right)^3 . \left(\frac{1}{3x}\right)^4$

$81x^4, 27x^3 . \frac{1}{3x}, 9x^2 . \frac{1}{9x^2}, 3x . \frac{1}{27x^3}, \frac{1}{81x^4}$

$81x^4, 9x^2,\ \ 1\ \ \frac{1}{9x^2}, \frac{1}{81x^4}$

1 4 6 4 1

$$\therefore \left(3x+\frac{1}{3x}\right)^4 = 81x^4 + 4x9x^2 + 6x1 + 4x\frac{1}{9x^2} + \frac{1}{81x^4}$$

$$= 81x^4 + 36x^2 + 6 + \frac{4}{9x^2} + \frac{1}{81x^4}$$

$$b)\left(3x+\frac{1}{3x}\right)^4 = \left(3\frac{1}{3}\right)^4 = \left(3+\frac{1}{3}\right)^4 \Rightarrow 3x = 3$$

$$x = 1$$

$$\therefore \left(3+\frac{1}{3}\right)^4 = 81x + 36x^2 + 6$$

$$= 81(1) + 36(1)^2 + 6$$

$$= 123$$

13.

$$\frac{1+\sqrt{2}}{2+3\sqrt{3}} - \frac{1-\sqrt{2}}{2-3\sqrt{3}}$$

$$= \frac{(1+\sqrt{2})(2-3\sqrt{3}) - (1-\sqrt{2})(2+3\sqrt{3})}{(2+3\sqrt{3})(2-3\sqrt{3})}$$

$$= \frac{2-3\sqrt{3}+2\sqrt{2}-3\sqrt{6}-[2+3\sqrt{3}-2\sqrt{2}-3\sqrt{6}]}{4-27}$$

$$= \frac{2-3\sqrt{3}+2\sqrt{2}-3\sqrt{6}-2-3\sqrt{3}+2\sqrt{2}+3\sqrt{6}}{-23}$$

$$= \frac{-6\sqrt{3}+4\sqrt{2}}{-23}$$

$$= \frac{6\sqrt{3}-4\sqrt{2}}{23}$$

14.

$$A \,\&\, x \rightarrow A = kx$$

$$B \,\&\, \frac{1}{x} \rightarrow B = \frac{m}{x}$$

$$when \;\; x = 2 \quad A + B = 7$$

$$kx + \frac{m}{x} = 7$$

$$2k + \frac{m}{2} = 7 \Rightarrow 4k + m = 14 \ldots\ldots\ldots\ldots(1)$$

$$when \;\; x = 3, \;\; A + B = 8$$

$$3k + \frac{m}{3} = 8 \Rightarrow 9k + m = 24 \ldots\ldots\ldots\ldots(2)$$

Solving (1) and (2) simultaneously:

$$4k + m = 14$$

$$4k + 3m = 14$$

$$9k + m = 24$$

$$5k = 10$$

$$k = 2$$

$$4k + m = 14$$

$$4x^2 + m = 14 \Rightarrow m = 6$$

$$k = 2, \; m = 6$$

$$\therefore \; A = 2x \quad and \quad B = \frac{6}{x}$$

$$when \quad x = 4$$

$$A + B = 2X + \frac{6}{X}$$

$$= 2(4) + \frac{6}{4}$$

$$= 8 + 1\frac{1}{2}$$

$$= 9\frac{1}{2} \quad or \quad 9.5$$

15.

MOI

$let\ \ M = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$

$$\begin{array}{ccccc} & A\quad B & & A^1\quad B^1 \\ \begin{pmatrix} a & b \\ c & d \end{pmatrix} & \begin{pmatrix} 2 & 4 \\ 2 & 3 \end{pmatrix} & = & \begin{pmatrix} 2 & 4 \\ 8 & 15 \end{pmatrix} \end{array}$$

$2a + 2b = 2$ $\qquad$ $2c + 2d = 8$

$4a + 3b = 4$ $\qquad$ $4c + 3d = 15$

$4a + 4b = 4$ $\qquad$ $4c + 4d = 16$

$4a + 3b = 4$ $\qquad$ $4c + 3d = 1$

$b = 0$ $\qquad$ $-$ $\qquad$ $d = 1$

$2a + 2b = 2$ $\qquad$ $2c + 2d = 8$

$2a = 2$ $\qquad$ $2c + 2x1 = 8$

$a = 1$ $\qquad$ $2c = 6$

C=3

$\therefore M = \begin{pmatrix} 1 & 0 \\ 3 & 1 \end{pmatrix}$

16. D=7cm, r=3.5cm=0.035cm

$$Rate\ of\ flow\ per\ \sec = \frac{22}{7}x(0.035)^2 x5$$

$$v_1 = 0.01925\,cm^3$$

$$Vol.\ of\ water\ to\ the\ filled\ v_2 = \frac{1}{2}xlwh$$

$$v_2 = \frac{1}{2}x5.5x3x4.2$$

$$= 34.65\,cm^3$$

$$Time\ taken\ to\ fill\ \tan k = \frac{34.65}{0.01925}$$

$$= 1800\ \sec$$

$$= 30\min\ s$$

$$Time\ when\ full = 6.00 + 30\min\ s$$

$$= 6:30 a.m$$

SECTION II (50 Marks)

Answer ONLY FIVE questions in this section in the spaces provided.

a) Cost price of the separate types

Cp=(400x30)+(350x50)=12000+17500

=29,500

$$sp = \frac{120}{100} x29500 = 35400$$

$$1 \ bag \ of \ mixture = \frac{35400}{80} = sh.442.50$$

b) Cost price cp=400x+350y

$$\text{Price per bag of mixture} = \frac{4000x + 350y}{x + y}$$

$$383.50 = \frac{400x + 350y}{x + y}$$

$$400x + 350y = 383.5(x + y)$$

$$400x + 350y = 383.5x + 383.5y$$

$$(400 - 383.5)x = (383.5 - 350)y$$

$$16.5x = 33.5y$$

$$\frac{x}{y} = \frac{33.5}{16.5} = \frac{335}{165}$$

$$= \frac{67}{33}$$

$$\therefore x : y = 67 : 33$$

c) Cost price of mixture=(150x2)+(120x3)+(82.5x4)
=sh 990

$$sp = \frac{150}{100} x \ Sh \ 990 = 1485$$

$$sp \ per \ kg \ of \ mixture = sh\left(\frac{1485}{2+3+4}\right)$$

$$Sh\left(\frac{1485}{9}\right)$$

$$Sh \ 165$$

AP	1st a	5th a+4d	7th a+6d
GP	a	ar	Ar^2

$AP \Rightarrow 64, \quad 64+4d, \quad 64+6d$

$GP \quad a \quad ar \quad ar^2$

$a = 64, \quad ar = 64+4d \quad ar^2 = 64+6d$

$\frac{64+4d}{64} = \frac{64+6d}{64+4d} = r$

$b)\ \frac{64+4d}{64} = \frac{64+6d}{64+4d}$

AP $(64+4d)(64+4d) = 64(64+6d)$

$(64+4d)^2 = 4096+384d$

$4096+512d+16d^2 = 4096+384d$

$16d^2 = -128d$

$16d = -128$

$d = -8$

$\frac{64+4d}{64} = r$

$\frac{64-4x8}{64} = r$

$\frac{32}{64} = r \Rightarrow r = \frac{1}{2}$

$\therefore d = -8 \quad r = \frac{1}{2}$

i) and ii)

Marks	x	f	fx	Cf
21-30	25.5	4	102	4
31-40	35.5	6	213	10
41-50	45.5	12	540	22
51-60	55.5	3	166.5	25
61-70	65.5	10	655	35
71-80	75.5	5	377.5	40
		∑f	∑fx	
		40	2054	

Marks	CF	Frequency
21-30	4	4
31-40	10	6
41-50	22	12
51-60	25	3
61-70	35	10
71-80	40	5

Median position= $\frac{40}{2} = 20^{th}$

$$md1 = 40.5 + \left(\frac{\frac{1}{2}x40 - 10}{12} \right) x10$$

$$= 40.5 + \frac{20 - 10}{12} x10 = 40.5 + \frac{100}{12}$$

$$= 40.5 + 8.333$$

$$= 48.333$$

$$md2 = 40.5 + \frac{21 - 10}{12} x10 = 40.5 + \frac{110}{12}$$

$$= 40.5 + 9.1667$$

$$49.6667$$

$$median = \frac{md1 + md2}{2} = \frac{48.833 + 49.6667}{2}$$

$$= \frac{98.49997}{2}$$

$$= 49.2499 \approx 49.25$$

$$ii)\ Mean\ \bar{x} = \frac{\sum fx}{\sum f} = \frac{2054}{40}$$

$$= 51.35$$

$$a)\ Deposit = \frac{60}{100} x2,800,000$$

$$= 1,680,000$$

$$Wekesa's\ contribution = \left(\frac{2}{3 + 2 + 5} \right) x1680000$$

$$= \frac{2}{10} x1,680,000$$

$$= 336,000$$

$$b)\ Balance\ after\ deposition$$

$$= 2,800,000 - 1,680,000$$

$= 1{,}120{,}000$

contribution by Cheptai

$= \frac{5}{10} x 1{,}120{,}000$

$= 560{,}000$

c) Onyango contribution in this balance

$= \frac{3}{10} x 1{,}120{,}000$

$= 336{,}000$

Share from profit $= \frac{3}{10} x 2{,}080{,}000$

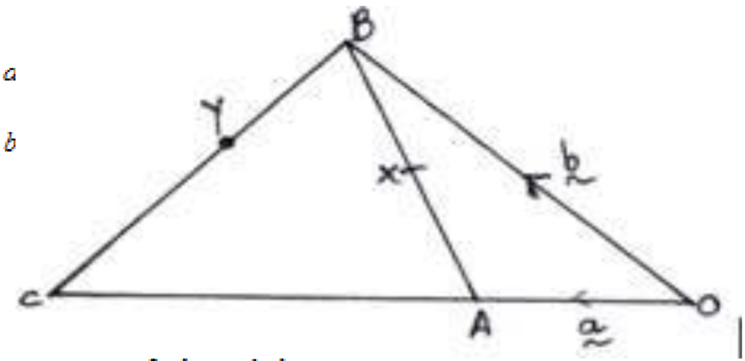
$= 624{,}000$

Amount left after paying $= 624{,}000 - 336{,}000$

$= 288{,}000$

a

b



$= \frac{1}{2}(\underset{\sim}{a} + \underset{\sim}{b})$

c) $\vec{BC} = \hat{BO} + \vec{OC} = -\underset{\sim}{b} + 3\underset{\sim}{a}$

$= 3\underset{\sim}{a} - \underset{\sim}{b}$

d) $\vec{OY} = \hat{OB} + \vec{BY}$

$= \underset{\sim}{b} + m\vec{BC}$

$= \underset{\sim}{b} + m(3\underset{\sim}{a} - \underset{\sim}{b}) = \underset{\sim}{b} + m\underset{\sim}{a} - m\underset{\sim}{b}$

$= 3m\underset{\sim}{a} + (1 - m)\underset{\sim}{b}$

e) $\vec{OY} = n\vec{OX} = n\left(\frac{1}{2}a + \frac{1}{2}\underset{\sim}{b}\right)$.......... ....(i)

22.

x	-4	-3	-2	-1	0	1	2	3
X^2	16	9	4	1	0	1	4	9
$2x^2$	32	18	8	2	0	2	8	18
6x	-24	-18	-12	-6	0	6	12	18
-5	-5	-5	-5	-5	-5	-5	-5	-5
y	3	-5	-9	-9	-5	3	15	31

b) i)

b) ii) y=7x+1

x	0	1	2	3
y	1	8	15	22

c) i) x=2, -1.5 or $\frac{-3}{2}$

ii) Let x=2 or x=$\frac{-3}{2}$

x-2=0 2x+3=0

Product: (x-2) (2x+3) =0

$$2x^2 + 3x - 4x - 6 = 0$$

$$2x^2 - x - 6 = 0$$

$a)\ y = a + bx^2$

$Let\ x = x^2$

$\therefore y = a + bx .... linear$

$b)\ Table$

X	0	2	4	6	8	10
$X=x^2$	0	4	16	36	64	100
y	7.76	11.8	24.4	43.6	71.2	107.0

d) In y=a+bx

a= y- intercept =7.76

b= gradient of the line

$=\frac{\Delta y}{\Delta x}=$ A(4,11.8) and B (100,107)

$$= \frac{107 - 11.8}{100 - 4} = \frac{95.2}{96} = \frac{119}{120}$$

$$= 0.9917 \approx 0.9920$$

$$\therefore a = 7.76$$

$$b = 0.992$$

$c)$

$e)\ When\ \ y = 12.8$

$$y = 7.76 + 0.992x^2$$

$$12.8 = 7.76 + 0.992x^2$$

$$x^2 = \frac{12.8 - 7.76}{0.992} = \frac{5.04}{0.992}$$

$$x^2 = 5.0806$$

$$x = \sqrt{5.0806}$$

$$= 2.254$$

$$= 2.25$$