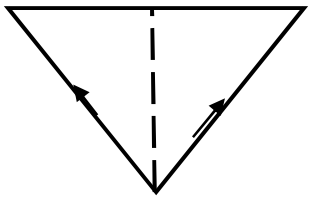
LAIKIPIA EAST TERM 2 2022 FORM 4 EVALUATION EXAM

Kenya Certificate of Secondary Education – K.C.S.E

Maths pp2

MARKING SCHEME

1.	No. / Log 45.3 — $\bar{1}.6651$ 0.00697 — $\bar{3}.8432$ + $\bar{1}.5083$ 8.450 x 10^{-1} — $\bar{1}.7275$ $\bar{1}.7808$ 3 $\frac{-1-2}{3} + \frac{2.7808}{3}$ **0.8450** — $\Leftarrow$ T.9269	M1 ✓ All logs M1 +, - M1 division by 3 A1	
2.	$2\text{Sin}^2 x - 1 = 1 - \text{Sin}^2 x + \text{Sin}x$ $3\text{Sin}^2 x - \text{Sin}x - 2 = 0$ $(3\text{Sin}x + 2)(\text{Sin}\, x - 1) = 0$ Either $\text{Sin}x = 0.6667$ or $\text{Sin}\, x = 1$ $x = 90^0, 221.81, 318.19$	M1 Evaluation M1 Factorisation A1	
3.	(a) $1 + 5 \text{ x } \frac{3}{x} + 10 \text{ x } \frac{3}{x}^2 + 10\text{x } \frac{3}{x}^3$ $+ 5 \text{ x } \frac{3}{x}^4 \ldots$ $1 + \frac{15}{x} + \frac{90}{x^2} + \frac{270}{x^3} + \frac{402}{x^4} + \ldots.$ (b) $(2.5)^2 = (1 + \frac{3}{x})^5$ $1.5 = \frac{3}{x}$ $x = 2$ $1 + \frac{15}{2} + \frac{90}{4} + \frac{270}{8} + \frac{405}{16}$ $1 + 7.5 + 22.5 + 33.75 + 25.3125 + \ldots.$ 90.063	M1 Factorisation A1 M1 Substitution A1	
4	$\frac{T^2}{P^2} = \frac{Q^2}{Q^2 - 1}$ $T^2Q^2 - T^2 = P^2Q^2$ $T^2Q^2 - P^2Q^2 = T^2$ $Q^2(T^2 - P^2) = T^2$ $Q = \pm\sqrt{\frac{T^2}{T^2 - P^2}}$	M1 M1 A1	√removal of $\sqrt{}$ Terms of Q on one side. $\sqrt{} \pm \sqrt{\frac{T^2}{T^2 - P^2}}$

5	A 2 D 1 B  O $\begin{pmatrix} 4 \\ 4 \\ -6 \end{pmatrix}\begin{pmatrix} 10 \\ 4 \\ 12 \end{pmatrix}$ OD = OA + AD $\begin{pmatrix} 4 \\ 6 \\ -6 \end{pmatrix} + \frac{2}{3}\begin{pmatrix} 10 & -4 \\ 4 & -4 \\ 12 & --6 \end{pmatrix}$ $\begin{pmatrix} 4 \\ 4 \\ -6 \end{pmatrix} + \frac{2}{3}\begin{pmatrix} 6 \\ 0 \\ 18 \end{pmatrix}$ $\begin{pmatrix} 4 \\ 4 \\ -6 \end{pmatrix} + \begin{pmatrix} 4 \\ 0 \\ 12 \end{pmatrix}$ 8i + 4j + 6k Co-ordinates of D are(8, 4, 6)	M1 Expression for OD M1 Simplification A1	
6.	Cost price = $\frac{3\ x\ 140+5\ x\ 160}{8}$ = 152.50 Profit = 180 – 152.50	M1 Cost price B1 Profit	

	= 27.50 % Profit = $\frac{27.50}{152.50}$ x 100 = 18.03%	 A1
7	$Z\alpha\frac{X^2}{\sqrt{Y}} \Rightarrow Z = \frac{kx^2}{\sqrt{y}}$ $Z_1 = \frac{(1.2)^2 kx^2}{\sqrt{\frac{81}{100}}.\sqrt{y}}$ $\frac{1.44\ kx^2}{0.9\sqrt{y}}$ 1.6z % Change = $\frac{1.6Z-Z}{Z}$ x 100% $\frac{z(1.6-1)}{z}$ x 100 = 60%	 M1 M1 A1
8.	$x^2 - 4x + y^2 + 6y - 1 = 0$ $x^2 - 4x + 4 + y^2 + 6y + 9 = 14$ $(x - 2)^2 + (y + 3)^2 = 14$ Centre (2, -3) Radius = 3.742	B1 Completing square on RHS B1 Completing square LHS B1 for radius and centre
9.	(a) $\frac{1}{2} - \frac{1}{5} = \frac{3}{10}$ Required time $\frac{10}{3}$ $3\frac{1}{3}$ or 3 hrs 20 min (b) $\frac{1}{2} - \frac{1}{5} - \frac{1}{6} = \frac{4}{30}$ Required time $\frac{30}{4}$ $7\frac{1}{2}$ hrs	 M1 Expression A1 M1 Expression A1
10	$\frac{\sqrt{8}}{1 + Cos\ 45^0}$ $\frac{2\sqrt{2}}{1 + \frac{1}{\sqrt{2}}}$ $\frac{2\sqrt{2}\ (1 - \frac{1}{\sqrt{2}})}{\left(1 + \frac{1}{\sqrt{2}}\right)(1 - \frac{1}{\sqrt{2}})}$ $\frac{2\sqrt{2} - 2}{\frac{1}{2}}$	 M1 M1 Conjugate

	$\frac{2(\sqrt{2}-1)}{\frac{1}{2}} = 4(\sqrt{2} - 1)$	A1	
11	L_1 y = x y > x $L_2 \frac{x}{4} + \frac{y}{4} = 1$ x + y = 4 x + y ≤ 4 $L_3 \frac{x}{-1} + \frac{y}{3} = 1$ -3x + y = 3 y – 3x = 3 y – 3x ≤ 3	B1 Inequality obtained B1Inequality B1 Inequality obtained	
12	$2x^2 - 5x = -3$ $x^2 - \frac{5}{2}x + \frac{25}{4} = \frac{-3}{2} + \frac{25}{4}$ $\left(x - \frac{5}{2}\right)^2 = 4.75$ $x - \frac{5}{2} = \pm 2.179$ $x = 4.679$ or $x = 0.321$	M1 M1 A1	

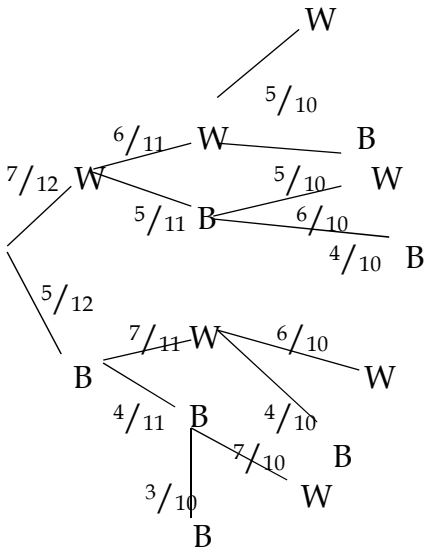
13.	General Eq. $y = \frac{x^3}{3} - 2x^2 + 3x + c$ $O = \frac{1}{3} - 2 + 3 + C$ $C = 1^1/_3$ Particular eq. $y = \frac{x^3}{3} - 2x^2 + 3x - {}^4/_3$	M1 M1 A1	
14.	Max. Area: ½ x 6.45 x 3.55 = 11.44875 Min. Area: ½ x 6.35 x 3.45 = 10.95375 $A.E = \frac{1}{2}(11.44875 - 10.95375)$ $= 0.2475$	M1 M1 A1	
		03	
15	$\frac{5x - 15}{2x - 3} = 10$ $-15x - 15 = 20x - 30$ $-15x = -15$ $x = 1$	M1 A1	
16	$A = P\left(1 + \frac{r}{100}\right)^n$ $= 20\,000\left(1 + \frac{6}{100}\right)^3$ $= 20\,000(1.06)^3$ $= Sh.\,23\,820.32$ $interest = sh.\,23\,820.32 - 20\,000$ $= sh.\,3\,820.32$	M 1 M 1 A 1	

17	(a)			

	Sum of arithmetic progression $S_n = \frac{n}{2}(2a + (n-1)d)$ $n = 5$ $560 = \frac{5}{2}(2a + 4d)$ $\frac{2}{5} \times 560 = 2a + 4d$ $224 = 2a + 4d$ $112 = a + 2d$.....(i) Last five terms: 41^{st} term is a + 40d; 40^{th} term is a + 39d; 39^{th} term is a + 38d; 38^{th} term is a + 37d; 37^{th} term is a + 36d total $5a + 190d = -250$.....(ii). Solving (i) and (ii) simultenously; $a + 2d = 112$ $a + 38d = -50$ (−) $-36d = 162$ $d = \frac{162}{-36} = -4.5$ $d = -4.5$ $a + 2(-4.5) = 112$ $a - 9 = 112$ $a - 121$ (b) Last term is a + 40d $= 121 + 40(-4.5)$ $= 121 - 180$ $= -59$ (c)	M_1 M_1 M_1 A_1 A_1 M_1 A_1	Formation of each equation Solving two equations simultaneously For common difference For the first term	

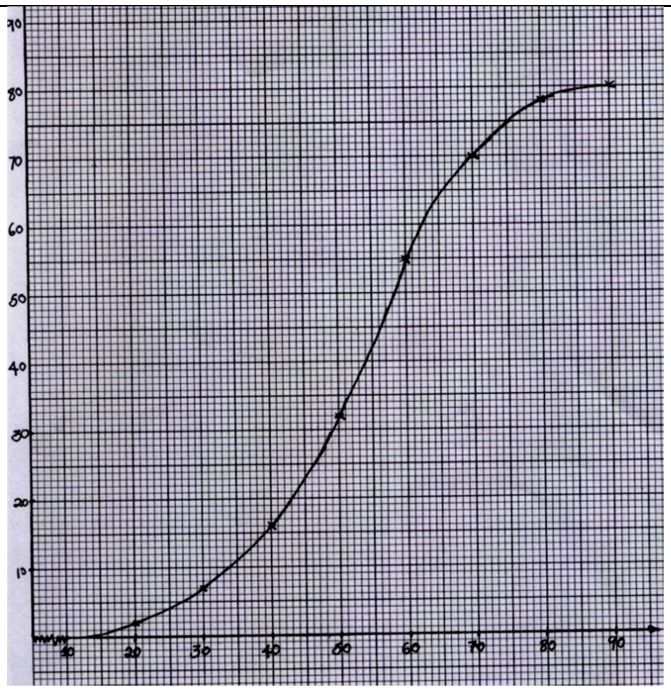
	$S_n = \frac{n}{2}(2a + (n-1)d)$ $S_n = \frac{41}{2}(2 \times 121 + (41-1)(-4.5))$ $S_n = \frac{41}{2}(242 - 180)$ $S_n = \frac{41}{2}(62)$ $S_n = 41 \times 31 = 1271$	M_1 M_1 A_1		
18	a. <MLN = 400 (angles subtended by the same arc NL are equal b. <OLN = 250 (650 – 400) c. <LNP = 650 (40+25 angles subtended in alternate segment) d. <MPQ = 100 (1800-(130+40)) e. <KNQ = 500 (Supplementary angles)	B1 B1 B1 B1 B1B1 B1B1 B1B1		

19	a) Latitude difference = 60 – 30 = 30 Distance = 30 x 60 = 1800nm b) Distance = 8 x 300 = 2400nm (x + 17)60 cos 60 = 2400nm x + 17 = −2400030=80 x = 63o Position of R (60oN, 63oW) c) Time difference = 80 x −415=5 *hrs* 20 *mins* Local time 15 hrs 12 mins – 5hrs 20 mins = 9.52 am d) Distance = 1800 + 2400 + 4200 4200 x 1.853 = 7782.6km	M1 A1 M1 M1 M1 A1 M1 A1 M1 A1		

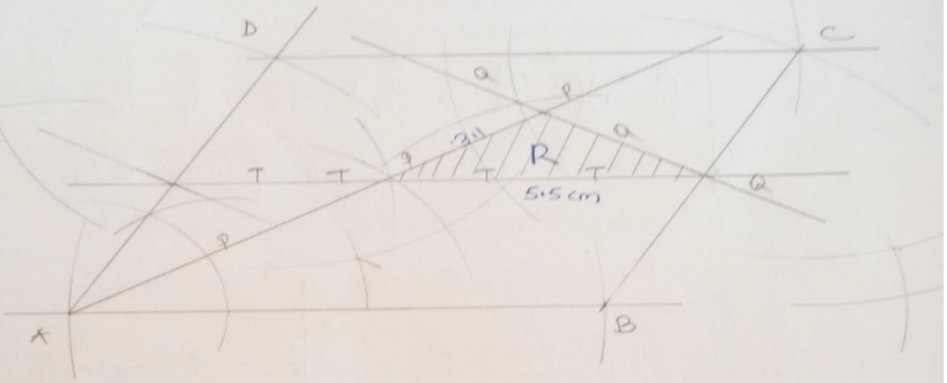
20		B1 B1 M1
	b) i) $(\frac{7}{12} \times \frac{6}{11} \times \frac{5}{10}) + (\frac{7}{12} \times \frac{5}{11} \times \frac{6}{10}) + (\frac{5}{12} \times \frac{7}{11} \times \frac{6}{10})$	A1
	$= \frac{21}{44}$	M1
	ii) $(\frac{7}{12} \times \frac{5}{11} \times \frac{4}{10}) + (\frac{5}{12} \times \frac{7}{11} \times \frac{4}{10}) + (\frac{5}{12} \times \frac{4}{11} \times \frac{7}{10})$	A1
	$= \frac{7}{22}$	M1
	iii) $(\frac{5}{12} \times \frac{4}{11} \times \frac{7}{10}) + (\frac{5}{12} \times \frac{7}{11} \times \frac{4}{10}) + (\frac{7}{12} \times \frac{5}{11} \times \frac{4}{10}) + (\frac{5}{12} \times \frac{7}{11} \times \frac{6}{10}) + (\frac{7}{12} \times \frac{5}{10} \times \frac{6}{10}) + (\frac{7}{12} \times \frac{6}{11} \times \frac{5}{10}) + (\frac{7}{12} \times \frac{6}{11} \times \frac{5}{10})$	A1
	$= \frac{427}{440}$	

22	a) $AC = \sqrt{18^2 + 24^2}$ $= 30\ cm$ VA = $0.5 \times 30 = 15\ cm$ b) $\cos\theta = \frac{15}{26}$ $\theta = 54.77°$ c) $\vartheta = \tan^{-1}\left(\frac{21.24}{12}\right) = 60.54°$ d) $\sqrt{26^2 - 15^2}$ $= 21.24\ cm$ e) $v = \frac{1}{3}Ah = \frac{1}{3} \times 24 \times 18 \times 21.24$ $= 3058.56\ cm^3$	M1 A1 M1 A1 M1A1 M1 A1 M1 A1	
		10	

24	x f c.f d t ft 15 2 2 -40 -4 -8 25 5 7 -30 -3 -15 35 9 16 -20 -2 -18 45 17 33 -10 -1 -17 55 22 55 0 0 0 65 15 70 10 1 15 75 8 78 20 2 16 85 2 80 30 3 06 $\sum ft=-21$ i) $Mean = 55 + \frac{-21}{80} x10$ $= 55 - 2.625 = 52.375$ *ii*) $40 + \frac{20-16}{17} x10$ $40 + \frac{4}{17} x10 = 42.35$ b) *c*) *i*) $\frac{4}{10} = 0.4$ $0.4x80 = 32$ $4^{th}\ decile = 50$ *ii*) 15^{th} 85^{th} $\frac{15}{100} x80 = 12 \Rightarrow 36$ $\frac{85}{100} x50 = 68$ *from* 36 *to* 68	M1 M1 A1 M1 A1 S1 P1 C1 B1 B1	If fx, fd Follow through √ft or equivalent Accept 52.38

23 (a) Using a ruler and a pair of compasses only, construct a parallelogram ABCD such that AB=9 cm, AD=7 cm and angle BAD=60°. (3 marks)



(a) On the same diagram, construct:

(i) the locus of a point P such that P is equidistant from AB and AD; (1 mark)

(ii) the locus of a point Q such that Q is equidistant from B and C; (1 mark)

(iii) the locus of a point T such that T is equidistant from AB and DC; (1 mark)

(b) (i) Shade the region R bounded by the locus of P, the locus of Q and the locus of T. (1 mark)

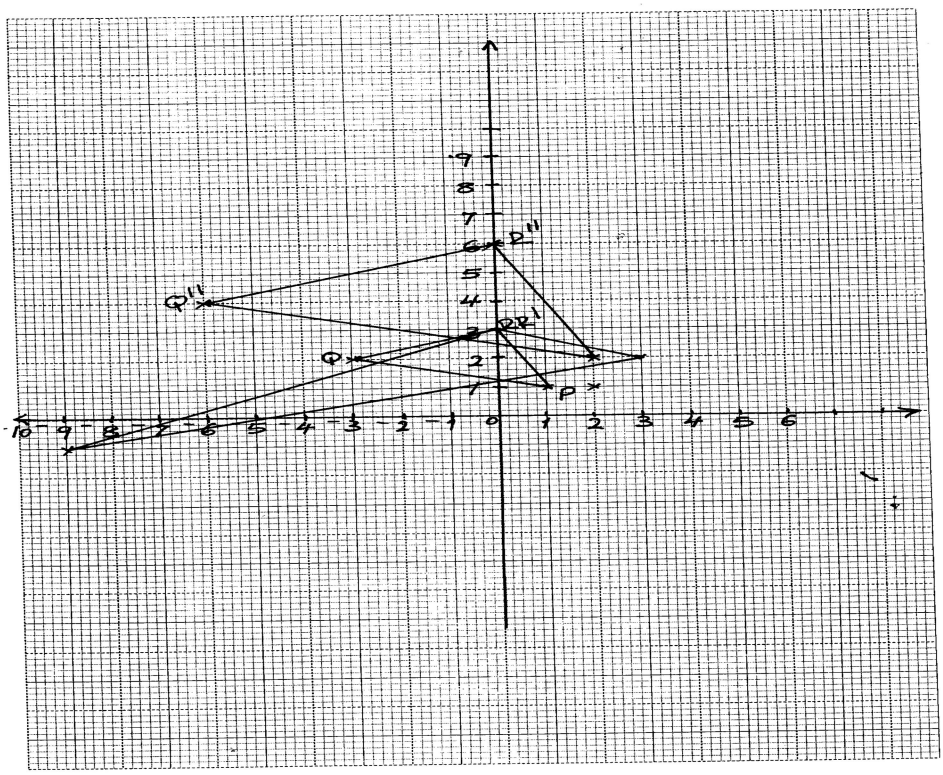
(ii) Find the area of the region shaded in (d)(i) above. (3 marks)

$= \frac{1}{2} \times 3.1 \times 5.5 \times \sin 30$

$= 4.2625 \text{ cm}^2$

21

(a)



B1

b)

$$\begin{pmatrix} 3 & 0 \\ 1 & 1 \end{pmatrix}\begin{pmatrix} P & Q & R \\ 1 & -3 & 0 \\ 1 & 2 & 3 \end{pmatrix} = \begin{pmatrix} P^1 & Q^1 & R^1 \\ 3 & -9 & 0 \\ 2 & -1 & 3 \end{pmatrix}$$

M1
A1
B1

c)

$$\begin{pmatrix} \frac{2}{3} & 0 \\ \frac{-2}{3} & 2 \end{pmatrix} \begin{pmatrix} 3 & -9 & 0 \\ 2 & -1 & 3 \end{pmatrix} = \begin{pmatrix} P^{11} & Q^{11} & R^{11} \\ 2 & -6 & 0 \\ 2 & 4 & 6 \end{pmatrix}$$

coordinates

M1
A1
B1

d)

$(-64)R$

It is an enlargement centre origin (0,0) scale factor 2

$$\begin{pmatrix} \frac{2}{3} & 0 \\ -\frac{2}{3} & 2 \end{pmatrix} \begin{pmatrix} 3 & 0 \\ 1 & 1 \end{pmatrix} = \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$$

M1

M1

A1

Note correct the 2nd matrix in (b) from $\begin{pmatrix} -1 & 0 \\ 1 & 3 \end{pmatrix}$ to $\begin{pmatrix} \frac{2}{3} & 0 \\ \frac{-2}{3} & 2 \end{pmatrix}$
