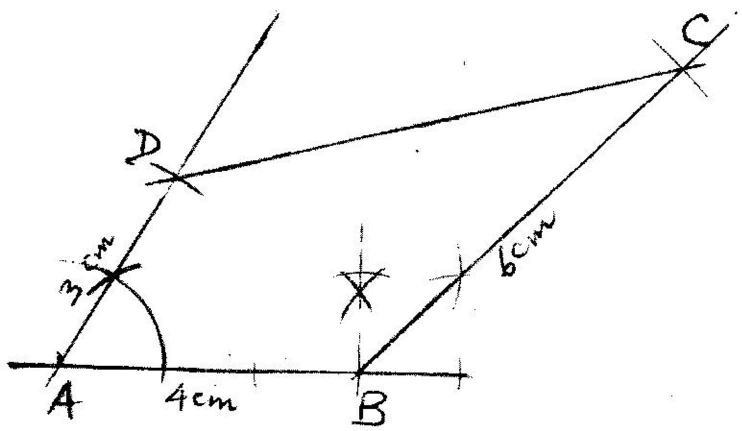
5.0 THE YEAR 2012 KCSE EXAMINATION MARKING SCHEMES

5.1 MATHEMATICS (121 AND 122)

5.1.1 Mathematics Alternative A Paper 1 (121/1)

1.	$\dfrac{\frac{6}{5}-\frac{4}{3}}{\frac{1}{8}-\frac{1}{4}}-\frac{14}{15}$		
	$=\dfrac{-\frac{2}{15}}{-\frac{1}{8}}-\frac{14}{15}$	M1 M1	numerator denominator
	$=\frac{16}{15}-\frac{14}{15}$	M1	
	$=\frac{2}{15}$	A1	
		4	
2.	$\frac{1}{0.216}=4.630$	B1	
	$\frac{\sqrt[3]{0.512}}{0.216}=0.8\times 4.630$	M1	
	$=3.704$	A1	
		3	
3.	$(2x^2-3y^3)^2+12x^2y^3$		
	$=4x^4-12x^2y^3+9y^6+12x^2y^3$	M1	
	$=4x^4+9y^6$	A1	
		2	
4.	$\frac{24}{2}=\frac{1}{2}\times 8\times x\sin 30^\circ$	M1	or equivalent
	$x=\frac{12}{4\sin 30}=6cm$		
	$perimeter=2(6+8)=28$	M1 A1	
		3	
5.	$9^{2y}\times 2^x=9\times 8$		
	$(3^2)^{2y}\times 2^x=3^2\times 2^3$	M1	
	$(3^2)^{2y}=3$ and $2^x=2^3$		
	$4y=2$ and $x=3$	M1	equating indices
	$y=\frac{1}{2}$ and $x=3$	A1	
		3	

6.	LCM of 9, 15 and 21 $3^2 \times 5 \times 7 = 315$ minutes Last time of ringing together 11:00 5:15 − 5:45 p.m.	 B1 M1 A1 3	 For 315 minutes For subtraction
7.	$\frac{x}{8} = \frac{x}{20} + \frac{1}{4}$ $\frac{x}{8} - \frac{x}{20} = \frac{1}{4}$ $\Rightarrow \frac{3x}{40} = \frac{1}{4}$ $x = 3\frac{1}{3}$ Distance to shopping centre $12 - 3\frac{1}{3} = 8\frac{2}{3}$ km	M1 A1 B1 3	
8.	 Construction of 135^0 angle between lines AB = 4 cm and BC = 6 cm Construction of 60^0 angle between lines AB = 4 cm and AD = 3 cm Completion of quadrilateral ABCD $\angle BCD = 31^\circ \pm 1^\circ$	 B1 B1 B1 B1 4	

9.	$\begin{pmatrix} 3 \\ -2 \end{pmatrix} - \begin{pmatrix} 2 \\ 3 \end{pmatrix}$	M1	
	$= \begin{pmatrix} 1 \\ -5 \end{pmatrix}$		
	magnitude $= \sqrt{1^2 + (-5)^2}$	M1	
	$= \sqrt{26} \simeq 5.1$	A1	
		3	
10.	$x = \tan^{-1}\frac{3}{7} = 23.20°$	B1	
	$Cos(90 - 23.2)° = 0.3939$	B1	
		2	
11.	$A^2 = \begin{pmatrix} 1 & 0 \\ -2 & 3 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ -2 & 3 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ -8 & 9 \end{pmatrix}$	B1	
	$2AB = 2\begin{pmatrix} 1 & 0 \\ -2 & 3 \end{pmatrix}\begin{pmatrix} 3 & 0 \\ 2 & 1 \end{pmatrix} = 2\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix} = \begin{pmatrix} 6 & 0 \\ 0 & 6 \end{pmatrix}$	B1	
	$C = 2AB - A^2 = \begin{pmatrix} 6 & 0 \\ 0 & 6 \end{pmatrix} - \begin{pmatrix} 1 & 0 \\ -8 & 9 \end{pmatrix}$	M1	
	$= \begin{pmatrix} 5 & 0 \\ 8 & -3 \end{pmatrix}$	A1	
		4	
12.	$\log_{10}\left(\frac{x^2}{2^3} \times 32\right) = 2$	M1	
	$\frac{x^2}{2^3} \times 2^5 = 100$	M1	dropping logs.
	$4x^2 = 100$		
	$x = \sqrt{25} = \pm 5$	A1	
	$x = 5$		
		3	

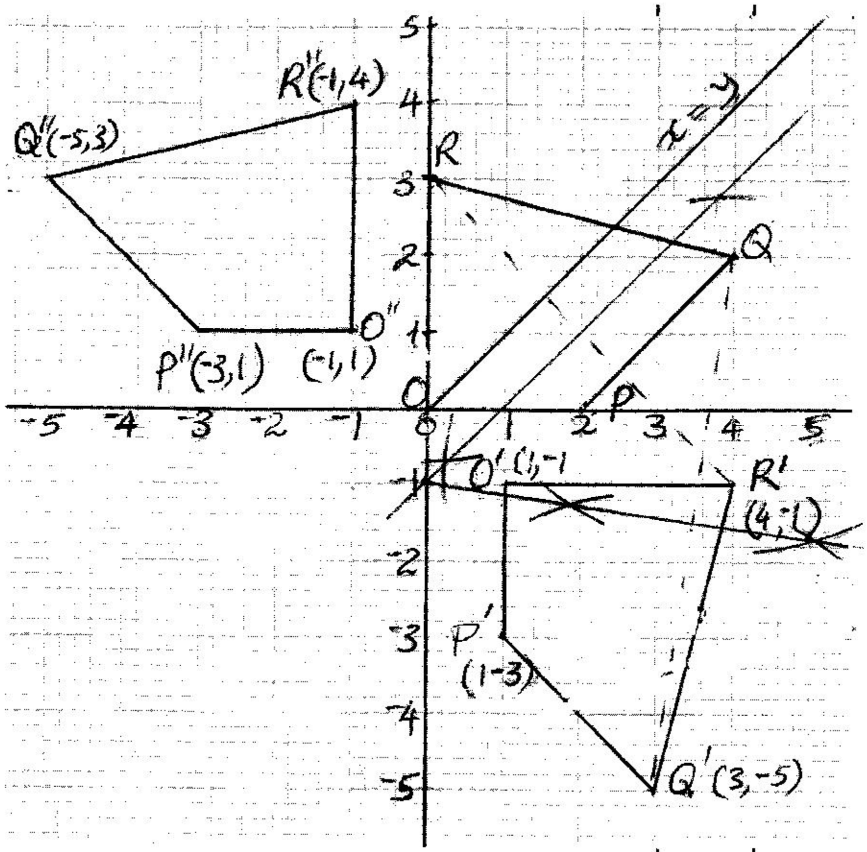
13.	$2y = 4x + 5 \Rightarrow y = 2x + \frac{5}{2}$ gradient, M_1 of line = 2 gradient, M_2, of perpendicular is given by $2M_2 = -1 \Longrightarrow M_2 = -\frac{1}{2}$ equation of line L $\frac{y-1}{x-3} = -\frac{1}{2}$ $y = -\frac{1}{2}x + \frac{5}{2}$	B1 M1 A1 3	
14. (a)	195250 Chinese Yuan into Kenya Shillings $= 195250 \times 12.34 = 2409385$	B1	
(b)	Balance: $= 2409385 - 1258000$ $= 1151385$ Balance in S.A. Rand $= \frac{1151385}{11.37}$ = 101265	M1 M1 A1 4	

15.	Volume of solid $= \frac{1}{3} \times \frac{22}{7} \times 10.5^2 \times 15 - \frac{22}{7} \times 3.5^2 \times 8$ $= 1732.5 - 308$ $= 1424.5\ cm^3$	M1 M1 A1 3	
16.	$\left.\begin{array}{l} 4(A-2) = B+2 \\ 2(A+10) = B+10 \end{array}\right\}$ $4A - B = 10 \ldots (i)$ $\mp 2A \pm B = \pm 10 \ldots (ii)$ $2A = 20$ $\Longrightarrow A = 10$ Substitute A = 10 in (i) $4 \times 10 - B = 10$ $\Longrightarrow B = 30$	M1 M1 A1 3	for both values of A and B
17. (a)	modal class 40 - 44	B1	
(b)	(i) mid points: $22, 27, 32, 37, 42, 47, 52, 57$	B1	
	$\frac{22 \times 2 + 27 \times 15 + 32 \times 18 + 37 \times 25 +}{101}$	M1	fx
	$\frac{42 \times 30 + 47 \times 6 + 52 \times 3 + 57 \times 2}{101}$	M1	for $\frac{\Sigma fx}{\Sigma f}$
	$= 37.25$	A1	

	(ii) Cumulative frequencies		
	$2, 17, 35, 60, 90, 96, 99, 101$	B1	
	$\frac{16}{25} \times 5$	M1	
	$= 3.2$		
	$34.5 + 3.2$	M1	
	$= 37.7$	A1	
	difference $37.7 - 37.25$		
	$= 0.45$	B1	
		10	
18. (a)	$\lvert AB \rvert = \sqrt{169 - 25} = 12$	B1	
(b)	$2 \times 5 \times 12 + 2 \times 5 \times 15 + 2 \times 12 \times 15$	M1 M1	3 pairs of congruent faces summing up.
	$= 630cm^2$	A1	
(c)	volume $= 5 \times 12 \times 15cm^3$	M1	
	mass $= 7.6 \times 5 \times 12 \times 15$	M1	
	$= 6840gm$		
	$= \frac{6840}{1000}$	M1	division by 1000
	$= 6.84kg$	A1	
(d)	$\frac{150 \times 120 \times 100\ cm^3}{15 \times 12 \times 5\ cm^3}$	M1	
	$= 2000$	A1	
		10	

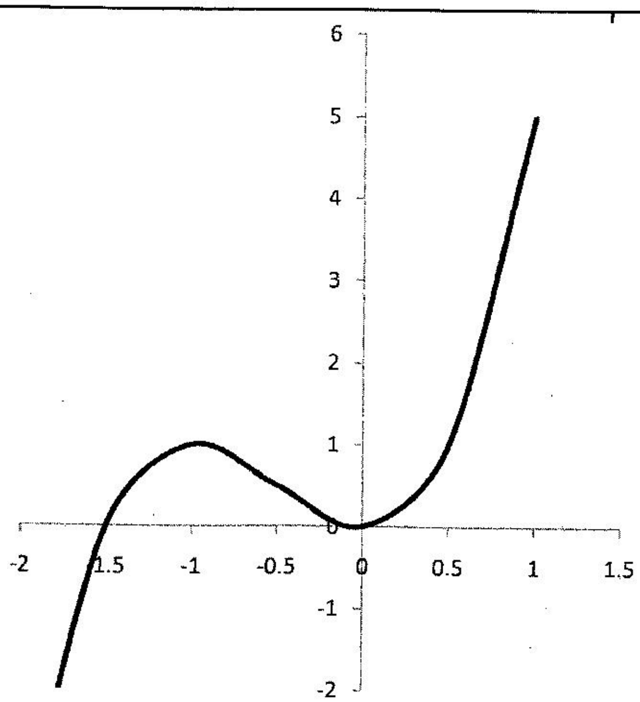
19. (a)	*Ratio: copper: zinc: tin* copper zinc tin 3 $\frac{2}{3}$ 5 9 6 10	M1	
	Copper : zinc : tin = 9 : 6 : 10	A1	
(b) (i)	mass of tin $= 250 \times \frac{10}{25}$ $= 100kg$	M1 A1	
(ii)	mass of zinc and tin in alloy B: mass of copper $= \frac{70}{100} \times 90$ $= 63$	M1	
	$\therefore$ mass of zinc and tin: $= 250 - 63$ $= 187$	M1 A1	
(c)	amount of tin in alloy A than B: mass of tin in alloy B $= \frac{8}{11} \times 187$ $= 136$ difference: $136 - 100$ $= 36$	M1 M1 A1	
		10	

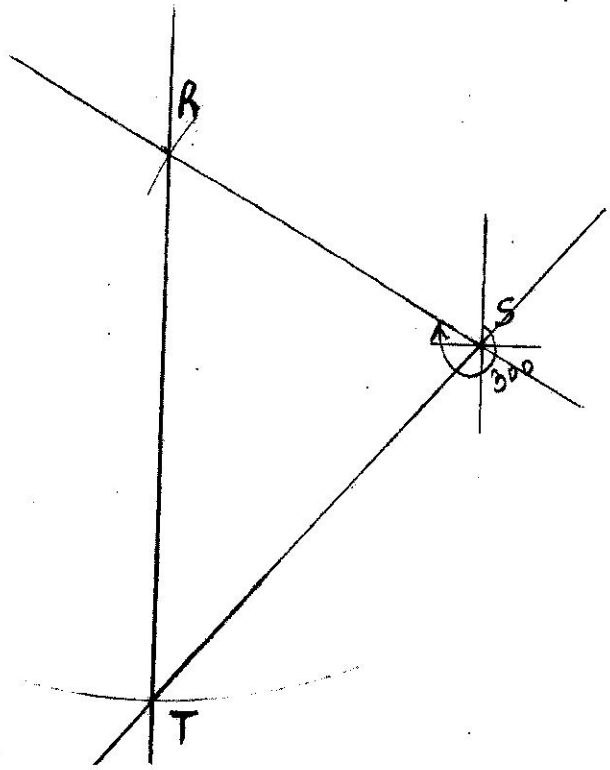
20. (a)	$\frac{1}{x-2} - \frac{2}{x+5} = \frac{3}{x+1}$		
	$\frac{x+5-2(x-2)}{(x-2)(x+5)} = \frac{3}{x+1}$		
	$\frac{-x+9}{x^2+3x-10} = \frac{3}{x+1}$	M1	
	$4x^2 + x - 39 = 0$	A1	
	$(4x+13)(x-3) = 0$	M1	
	$x = 3 \text{ or } x = -3\frac{1}{4}$	A1	
(b)	mean for second set of tests $= \frac{147}{y+2}$	B1	
	$\frac{120}{y} - \frac{147}{y+2} = 3$	M1	
	$\frac{120y + 240 - 147y}{y(y+2)} = 3$		
	$-27y + 240 = 3y^2 + 6y$	M1	elimination of denominator
	$-9y + 80 = y^2 + 2y$		
	$y^2 + 11y - 80 = 0$	A1	
	$(y-5)(y+16) = 0$	M1	factorization
	$y = 5 \text{ or } -16$ No. of tests: 5 + 2 = 7	A1	
		10	

21.			
	a) (i) OPQR √drawn	B1	
	$O'P'Q'R'$ √drawn	B1	
	(ii) Perpendicular bisectors √drawn (at least 2)	B1	
	centre of rotation $(0, -1)$ shown	B1	
	angle of rotation -90°	B1	
	b) line of reflection x = y drawn	B1	can be implied
	quadrilateral $O''P''Q''R''$ drawn	B1	
	c) (i) directly congruent quads: OPQR and O'P'Q'R'	B1	
	(ii) Oppositely congruent quads.:		
	OPQR and O"P"Q"R"	B1	
	O'P'Q'R' and O"P"Q"R"	B1	
		10	

22. (a) (i)	x - intercepts when y= 0 $x^2(2x+3)=0$ $x=0$ *and* $x=-\frac{3}{2}$	 M1 A1	
(ii)	y - intercept when x = 0, y = 0	 B1	
(b) (i)	stationary points of curve $\frac{dy}{dx}=6x^2+6x$ stationery points when $\frac{dy}{dx}=0$ i.e. $6x^2+6x=0$ $6x(x+1)=0$ $x=0$ *or* $x=-1$ $\therefore$ stationary points are: $(0,0)$ and $(-1,1)$	 M1 A1 B1	
(ii)	see table below	B1	checking points
	minimum point (0,0) maximum point (-1,1)	B1	for both

x	-2	$-1\frac{1}{2}$	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1
$\frac{dy}{dx}$	12	$4\frac{1}{2}$	0	$-1\frac{1}{2}$	0	$4\frac{1}{2}$	12

(c)			
	points plotted at $\left(-1\frac{1}{2},0\right),(-1,1)$ *and* $(0,0)$	B1	
	smooth curve	B1	
		10	

23. (a)			
	√ location of R	B1	length 5 cm and bearing 300°
	√ location of T	B1	length 7.5 cm; south of R
	*complete*Δ	B1	
(b) (i)	Distance TS: $6.6(\pm.1)cm$	B1	
	conversion $6.6 \times 60 = 396$ m	B1	
(ii)	Bearing of T from S $180 + 41^{\circ}(\pm 1^{\circ}) = 221^{\circ}$	B1	
(c)	area of field $\angle TRS = 60^{\circ}$	B1	
	$area = \frac{1}{2} \times 300 \times 450 \sin 60^{\circ}$	M1	
	$= \frac{58456.71476}{10000}$	M1	
	=5.8 ha	A1	
		10	

24. (a)	length of RT:		
	$= \frac{3}{5} \times 10$	M1	
	= 6 cm	A1	
(b) (i)	Perpendicular distance between PQ & RS		
	= 10 sin 40	M1	
	= 6.4 cm	A1	
(ii)	$\frac{TS}{\sin 40} = \frac{6}{\sin 60}$ $TS = \frac{6 \times \sin 40}{\sin 60}$	M1	
	= 4.5 cm	A1	
(c)	length RS using cosine rule		
	$RS^2 = 6^2 + 4.5^2 - 2 \times 4.5 \times 6 Cos\, 80$	M1	
	= 46.87299841		
	RS = 6.8	A1	
(d)	area of ΔRST $= \frac{1}{2} \times 6 \times 4.5 \sin 80$	M1	
	=13.3	A1	
		10	