MATHEMATICS PAPER 1

KCSE 2012

ANSWERS

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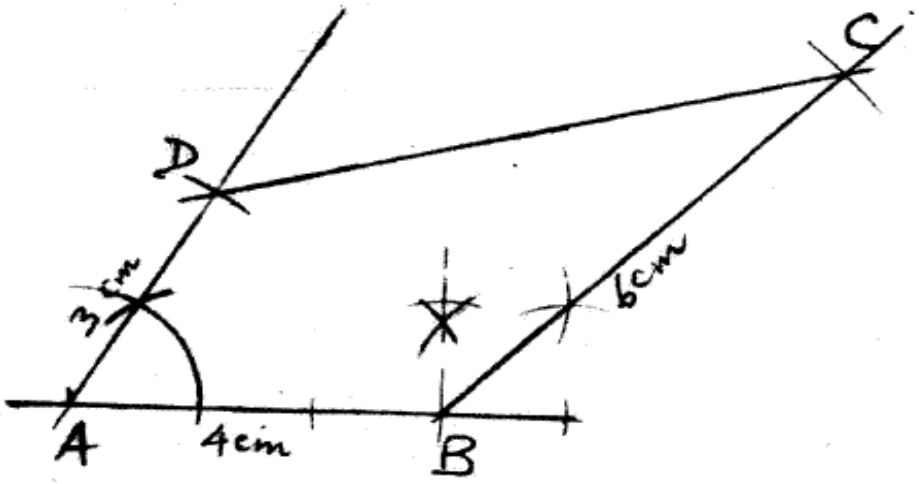
1.	$\dfrac{\frac{6}{5}-\frac{4}{3}}{\frac{1}{8}-\frac{1}{4}}-\dfrac{14}{15}$ $= \dfrac{-\frac{2}{15}}{-\frac{1}{8}}-\dfrac{14}{15}$ $= \dfrac{16}{15}-\dfrac{14}{15}$ $= \dfrac{2}{15}$	M1 M1 M1 A1 4	numerator denominator
2.	$\dfrac{1}{0.216} = 4.630$ $\dfrac{\sqrt[3]{0.512}}{0.216} = 0.8 \times 4.630$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

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° angle between lines AB = 4 cm and BC = 6 cm Construction of 60° angle between lines AB = 4 cm and AD = 3 cm Completion of quadrilateral ABCD $\angle BCD = 31° \pm 1°$	 B1 B1 B1 B1 4	

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

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	

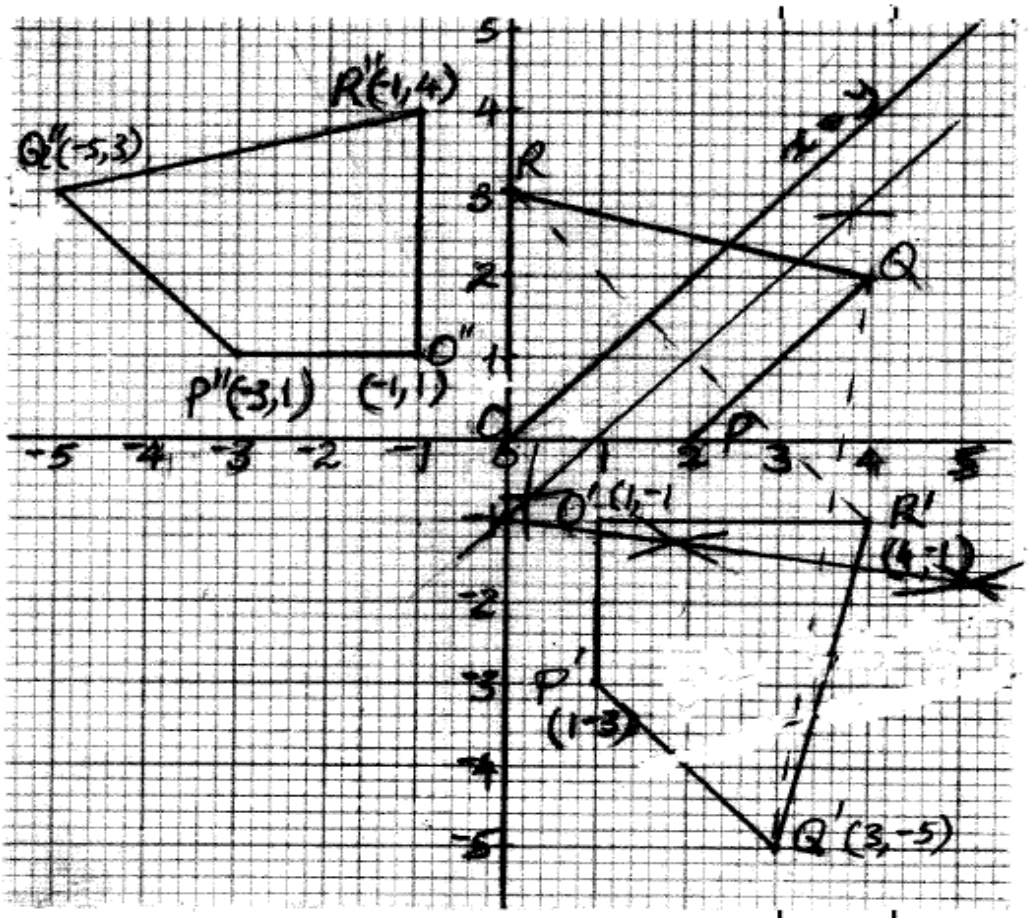
15.	Volume of solid $= \frac{1}{3} \times \frac{22}{7} \times 10.5^2 \times 15 - \frac{22}{7} \times 3.5^2 \times 8$ $= 1732.5 - 308$ $= 1424.5\ cm^3$	M1 M1 A1 3	
16.	$4(A-2) = B+2$ $2(A+10) = B+10$ $4A - B = 10 \ldots (i)$ $\mp 2A \pm B = \pm 10 \ldots (ii)$ $2A = 20$ $\Longrightarrow A = 10$ Substitute 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 $\frac{22 \times 2 + 27 \times 15 + 32 \times 18 + 37 \times 25 + 42 \times 30 + 47 \times 6 + 52 \times 3 + 57 \times 2}{101}$ $= 37.25$	B1 M1 M1 A1	fx for $\frac{\Sigma fx}{\Sigma f}$

	(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
	$= 630 cm^2$	A1	
(c)	volume $= 5 \times 12 \times 15 cm^3$	M1	
	mass $= 7.6 \times 5 \times 12 \times 15$	M1	
	$= 6840 gm$		
	$= \frac{6840}{1000}$	M1	division by 1000
	$= 6.84 kg$	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 $= 250 \times \frac{10}{25}$	M1	
	$= 100kg$	A1	
(ii)	mass of zinc and tin in alloy B: mass of copper $= \frac{70}{100} \times 90$	M1	
	$= 63$		
	$\therefore$ mass of zinc and tin: $= 250 - 63$	M1	
	$= 187$	A1	
(c)	amount of tin in alloy A than B: mass of tin in alloy B		
	$= \frac{8}{11} \times 187$	M1	
	$= 136$		
	difference: $136 - 100$	M1	
	$= 36$	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

$x^2(2x+3)=0$ — M1

$x=0$ *and* $x=-\frac{3}{2}$ — 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. $6x^2+6x=0$ — M1

$6x(x+1)=0$

$x=0$ *or* $x=-1$ — A1

$\therefore$ stationary points are:

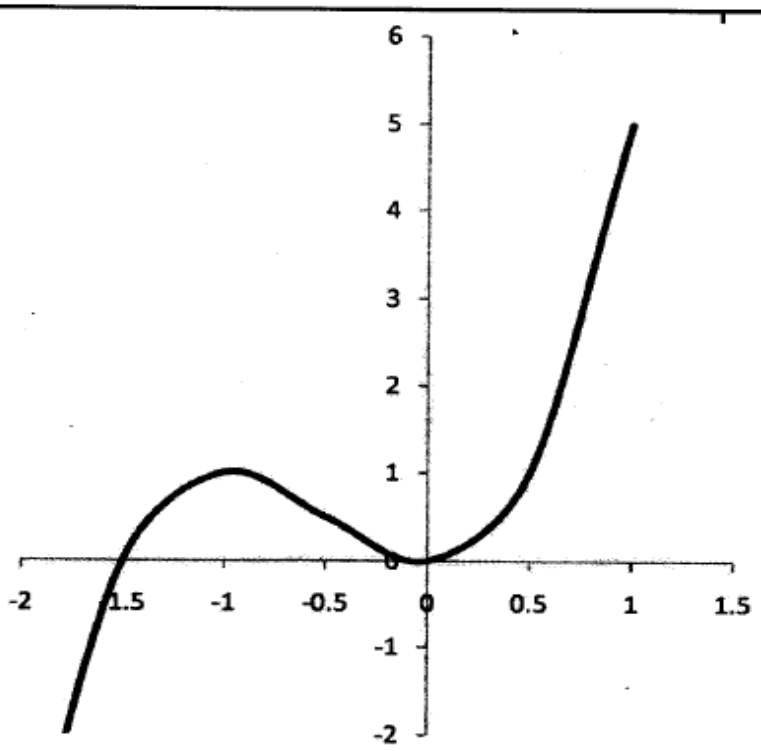
$(0,0)$ and $(-1,1)$ — B1

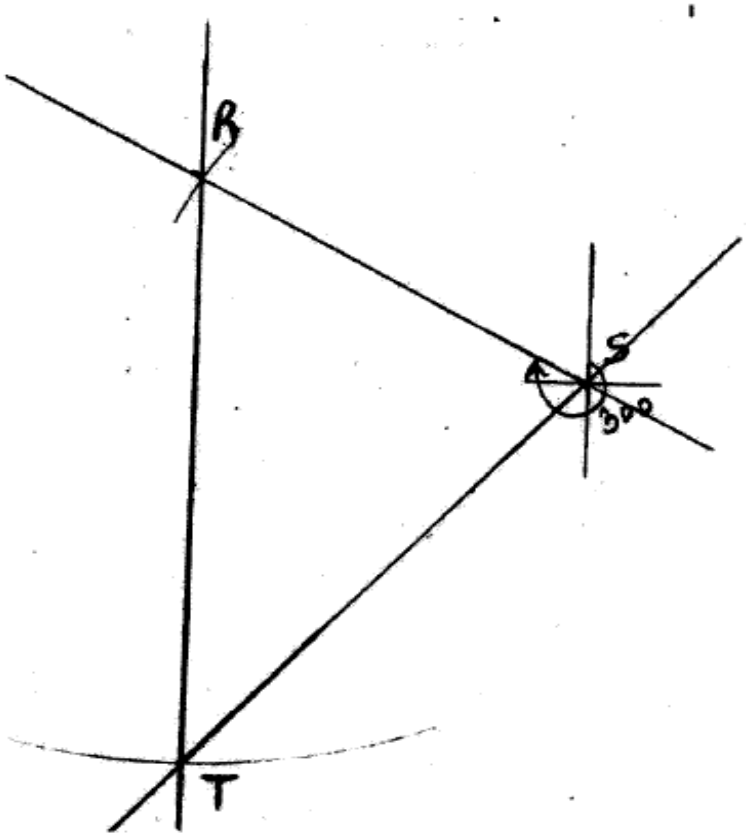
(ii)

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

B1 checking points

minimum point (0,0)
maximum point (-1,1) — B1 for both

(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 $180 + 41°(\pm 1°) = 221°$	B1	
(c)	area of field $\angle TRS = 60°$	B1	
	$area = \frac{1}{2} \times 300 \times 450 \sin 60°$	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	