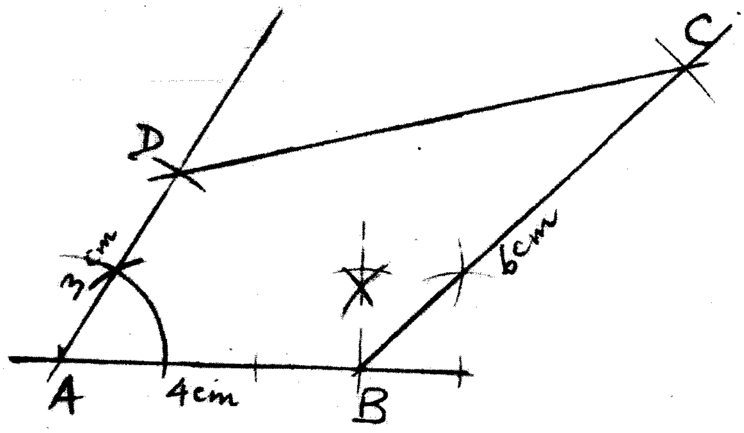
5.0 THE YEAR 2012 KCSE EXAMINATION MARKING SCHEMES

5.1 MATHEMATICS (121 AND 122)

5.1.1 Mathematics Alternative A Paper 1 (121/1)

1.	$\dfrac{\frac{6}{5}-\frac{4}{3}}{\frac{1}{8}-\frac{1}{4}}-\dfrac{14}{15}$		
	$=\dfrac{-\frac{2}{15}}{-\frac{1}{8}}-\dfrac{14}{15}$	M1 M1	numerator denominator
	$=\dfrac{16}{15}-\dfrac{14}{15}$	M1	
	$=\dfrac{2}{15}$	A1	
		4	
2.	$\dfrac{1}{0.216}=4.630$	B1	
	$\dfrac{\sqrt[3]{0.512}}{0.216}=0.8\times 4.630$	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.	$\dfrac{24}{2}=\dfrac{1}{2}\times 8\times x\sin 30^\circ$	M1	or equivalent
	$x=\dfrac{12}{4\sin 30}=6cm$		
	$perimeter=2(6+8)=28$	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
	$y=\dfrac{1}{2}$ 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 $\begin{array}{r} 11{:}00 \\ \underline{5{:}15}- \\ 5{:}45 \text{ p.m.} \end{array}$	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.	$\binom{3}{-2} - \binom{2}{3}$ $= \binom{1}{-5}$ 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.

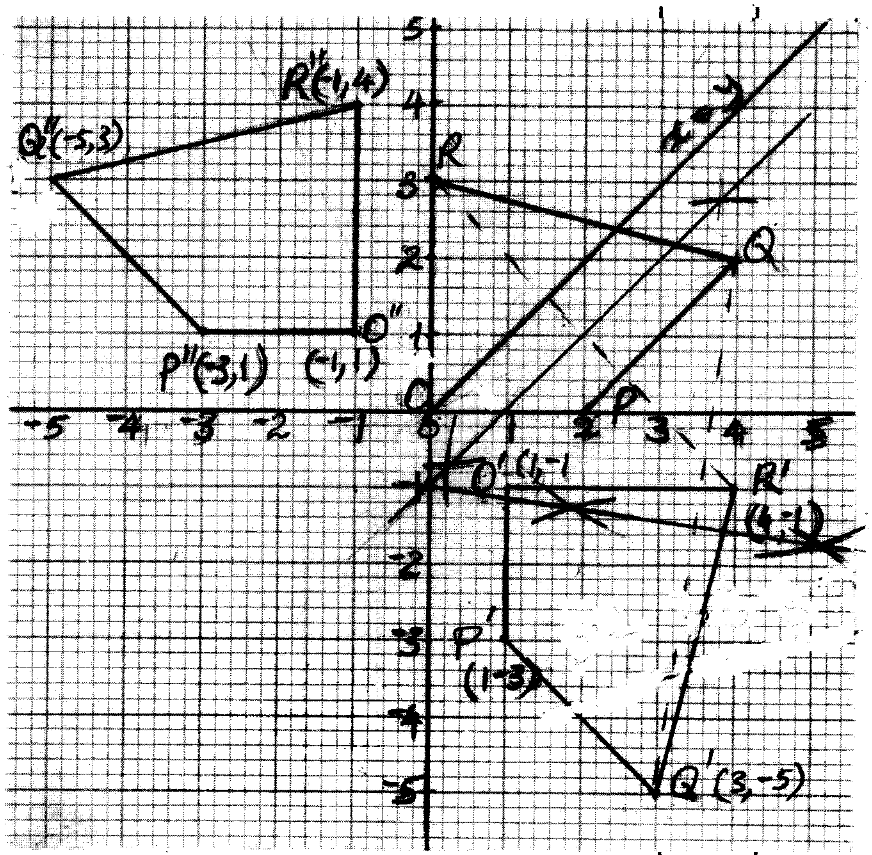
13.	$2y = 4x + 5 \Rightarrow y = 2x + \frac{5}{2}$ gradient, M_1 of line = 2 gradient, M_2, of perpendicular is given by $2M_2 = -1 \Longrightarrow M_2 = -\frac{1}{2}$ equation of line L $\frac{y-1}{x-3} = -\frac{1}{2}$ $y = -\frac{1}{2}x + \frac{5}{2}$	 B1 M1 A1 3	
14. (a)	195250 Chinese Yuan into Kenya 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.	$\left.\begin{array}{l}4(A-2) = B+2 \\ 2(A+10) = B+10\end{array}\right\}$ $4A - B = 10....(i)$ $\mp 2A \pm B = \pm 10...(ii)$ $2A = 20$ $\Longrightarrow A = 10$ 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) (b)	modal class 40 - 44 (i) mid points: $22, 27, 32, 37, 42, 47, 52, 57$ $\frac{22 \times 2 + 27 \times 15 + 32 \times 18 + 37 \times 25 +}{101}$ $\frac{42 \times 30 + 47 \times 6 + 52 \times 3 + 57 \times 2}{101}$ $= 37.25$	B1 B1 M1 M1 A1	 fx for $\frac{\Sigma fx}{\Sigma f}$

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

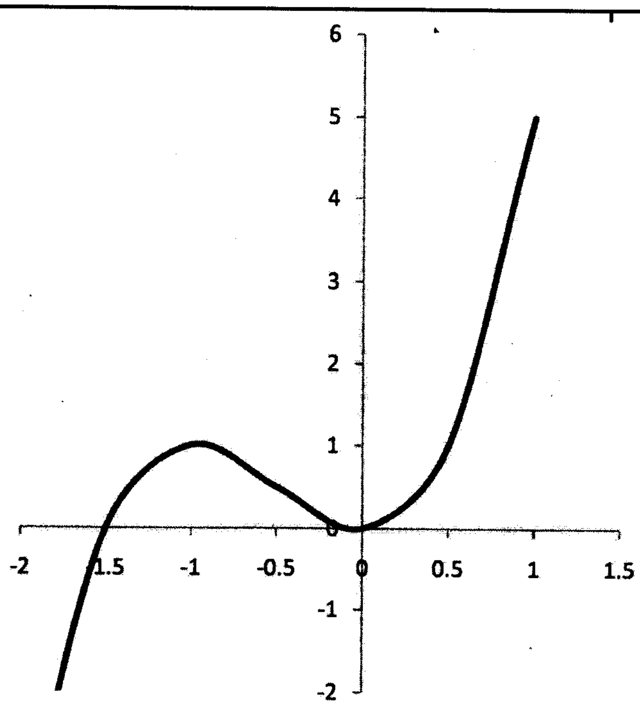
19. (a)	*Ratio: copper: zinc: tin* copper zinc tin 3 $\frac{2}{3}$ 5 9 6 10	M1	
	Copper : zinc : tin = 9 : 6 : 10	A1	
(b) (i)	mass of tin $= 250 \times \frac{10}{25}$ $= 100kg$	M1 A1	
(ii)	mass of zinc and tin in alloy B: mass of copper $= \frac{70}{100} \times 90$ $= 63$	M1	
	$\therefore$ mass of zinc 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	
	$x = 3$ *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
	$y = 5$ *or* -16 No. of tests: 5 + 2 = 7	A1	
		10	

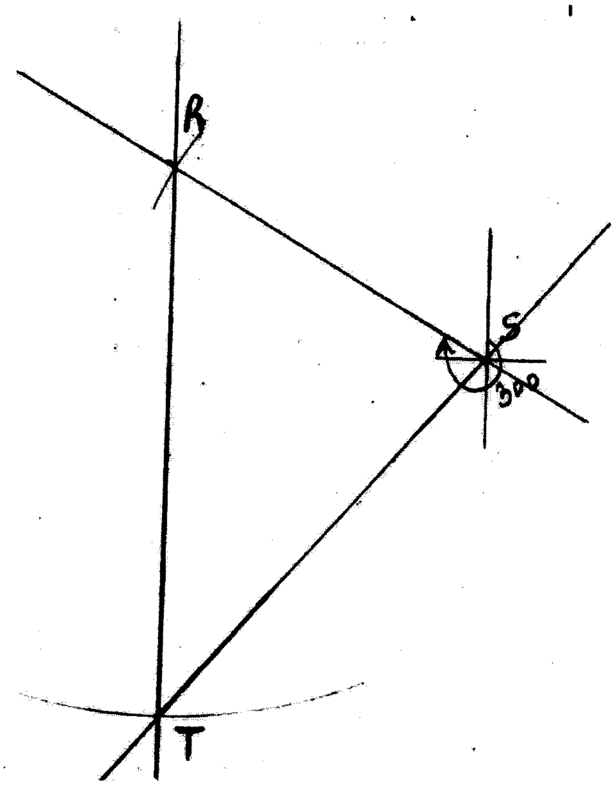
21.			
	a) (i) OPQR √drawn	B1	
	$O'P'Q'R'$ √drawn	B1	
	(ii) Perpendicular bisectors √drawn (at least 2)	B1	
	centre of rotation $(0, -1)$ shown	B1	
	angle of rotation -90°	B1	
	b) line of reflection x = y drawn	B1	can be implied
	quadrilateral $O''P''Q''R''$ drawn	B1	
	c) (i) directly congruent quads: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

23. (a)

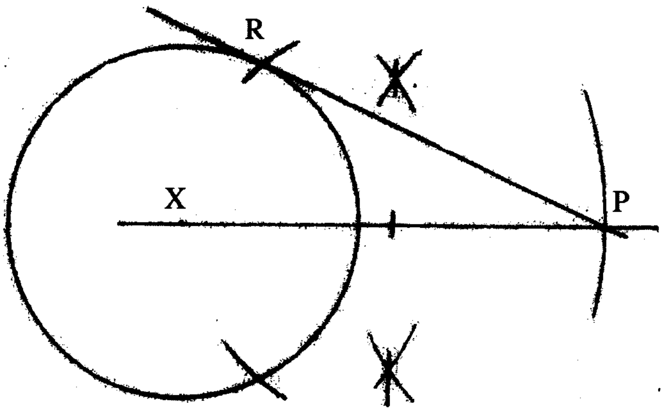


23. (a)	√ location of R	B1	length 5 cm and bearing 300°
	√ location of T	B1	length 7.5 cm; south of R
	*complete*Δ	B1	
(b) (i)	Distance TS: $6.6(\pm.1)cm$	B1	
	conversion $6.6 \times 60 = 396$ m	B1	
(ii)	Bearing of T from S $180 + 41°(\pm 1°) = 221°$	B1	
(c)	area of field $\angle TRS = 60°$	B1	
	$area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

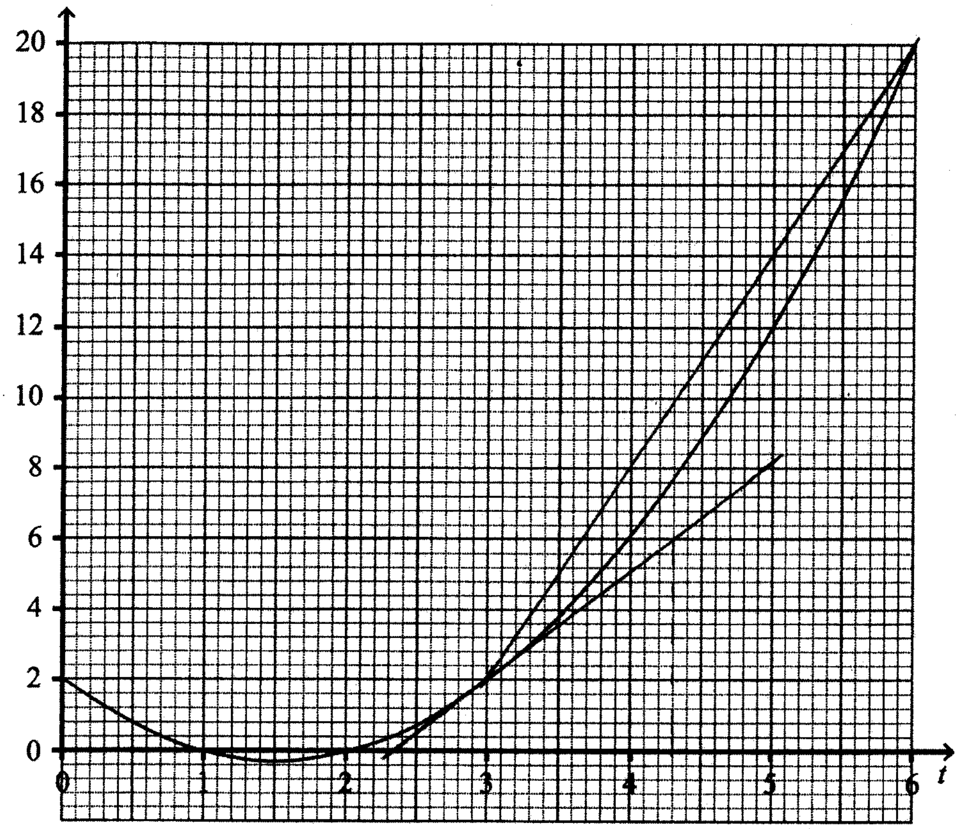
24. (a)	length of RT:		
	$= \frac{3}{5} \times 10$	M1	
	= 6 cm	A1	
(b) (i)	Perpendicular distance between PQ & RS		
	= 10 sin 40	M1	
	= 6.4 cm	A1	
(ii)	$\frac{TS}{\sin 40} = \frac{6}{\sin 60}$ $TS = \frac{6 \times \sin 40}{\sin 60}$	M1	
	= 4.5 cm	A1	
(c)	length RS using cosine rule		
	$RS^2 = 6^2 + 4.5^2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

5.1.2 Mathematics Alternative A Paper 2 (121/2)

1.	$\dfrac{5\log 4 - 4\log 5}{\frac{1}{5}\log 4 + \frac{1}{4}\log 5}$ $= \dfrac{3.010299957 - 2.795880017}{0.120411998 + 0.174742501}$ $= 0.726466785$ $\simeq 07265$ (4 s.f.)	M1 A1 2	
2.	$\left(\dfrac{r}{p}\right)^2 = \dfrac{m^2}{n-1}$ $n - 1 = \left(\dfrac{mp}{r}\right)^2$ $n = \left(\dfrac{mp}{r}\right)^2 + 1$	M1 M1 A1 3	squaring
3.	Fraction filled by inlet tap in $1h = \dfrac{1}{6}$ Fraction filled when two taps open in $1h = \dfrac{1}{10}$ $\therefore$ fraction emptied by outlet tap in $1h = \dfrac{1}{6} - \dfrac{1}{10}$ $= \dfrac{1}{15}$ Time for outlet tap to empty tank = 15h	B1 M1 A1 3	for $\dfrac{1}{6}$ or $\dfrac{1}{10}$
4.	$\underset{\sim}{R} = 6\underset{\sim}{i} - 9\underset{\sim}{j} + 3\underset{\sim}{k} + 6\underset{\sim}{i} - 8\underset{\sim}{j} - 6\underset{\sim}{k}$ $= 12\underset{\sim}{i} - 17\underset{\sim}{j} - 3\underset{\sim}{k}$ $\lvert R \rvert = \sqrt{12^2 + 17^2 + 3^2}$ $= \sqrt{442}$ $= 21.02 \simeq 21$ (2 s.f.)	B1 M1 A1 3	
5.	Sin (2t + 10)° = 0.5 2t + 10 = 30°, 150° t = 10°, 70°	B1 B1 2	

6.			
	Drawing circle	B1	
	Fixing point P	B1	
	Bisecting XP and drawing tangent	B1	
	RP = $5.4 \pm 0.1cm$	B1	
		4	
7.	Amount for Kago		
	$= 30000 + \frac{12}{100} \times 30000 \times 5$		
	$= 48000$	B1	
	Compound interest rate for Nekesa		
	$30000\left(1 + \frac{r}{100}\right)^5 = 48000$	M1	
	$\left(1 + \frac{r}{100}\right)^5 = \frac{48000}{30000} = 1.6$		
	$1 + \frac{r}{100} = \sqrt[5]{1.6}$	M1	
	$r = 100(1.098560543 - 1)$		
	$= 9.9\%$	A1	
		4	
8.	Differences from assumed mean		
	$-6 - 2 + 0 + 2 + 3 + 6 + 9 - 5 + 6 + 3 + 9$ $-2 + 3 - 6 - 2 + 3 + 2 + 0 + 6 + 9 = 38$	M1	differences from the assumed mean
	$\therefore mean = 96 + \frac{38}{20}$	M1	
	$= 97.9$	A1	
		3	

9.	$x + y = 17$..........(*i*) $xy - 5x = 32$......(*ii*) from (i) $y = 17 - x$ substituting $y = 17 - x$ in (ii) $x(17 - x) - 5x = 32$ $17x - x^2 - 5x = 32$ $x^2 - 12x + 32 = 0$ $(x - 4)(x - 8) = 0$ $x = 4$ *or* $x = 8$ substituting x = 4 in (i) $4 + y = 17 \Rightarrow y = 13$ substituting x = 8 in (ii) $8 + y = 17 \Rightarrow y = 9$	M1 M1 A1 B1 4	for substitution or elimination for both 4 and 8 for both 13 and 9
10	$\frac{\sqrt{5}}{\sqrt{5} - 2} = \frac{\sqrt{5}}{\sqrt{5} - 2} \times \frac{\sqrt{5} + 2}{\sqrt{5} + 2}$ $= \frac{5 + 2\sqrt{5}}{5 - 4}$ $= 5 + 2\sqrt{5}$	M1 A1 2	
11.	minimum possible area $= \frac{1}{2}(6.35 \times 3.45)$ $= 10.95375$ cm² maximum possible area $= \frac{1}{2} \times 6.45 \times 3.55$ $= 11.44875$ cm² maximum absolute error in area $= \frac{11.44875 - 10.95375}{2}$ $= 0.2475$ cm²	M1 M1 A1 3	for both expressions - min. and max. areas
12.	(a) $(1 + x)^7 = 1^7 + 7 \times 1^6 \times x + 21 \times 1^5 \times x^2 + 35 \times 1^4 \times x^3 + \ldots$ $= 1 + 7x + 21x^2 + 35x^3$ (b) $(0.94)^7 = [1 + (-0.06)]^7$ $= 1 + 7 \times (-0.06) + 21 \times (-0.06)^2 + 35 \times (-0.06)^3$ $= 1 - 0.42 + 0.0756 - 0.00756$ $= 0.64804$	B1 M1 A1 3	

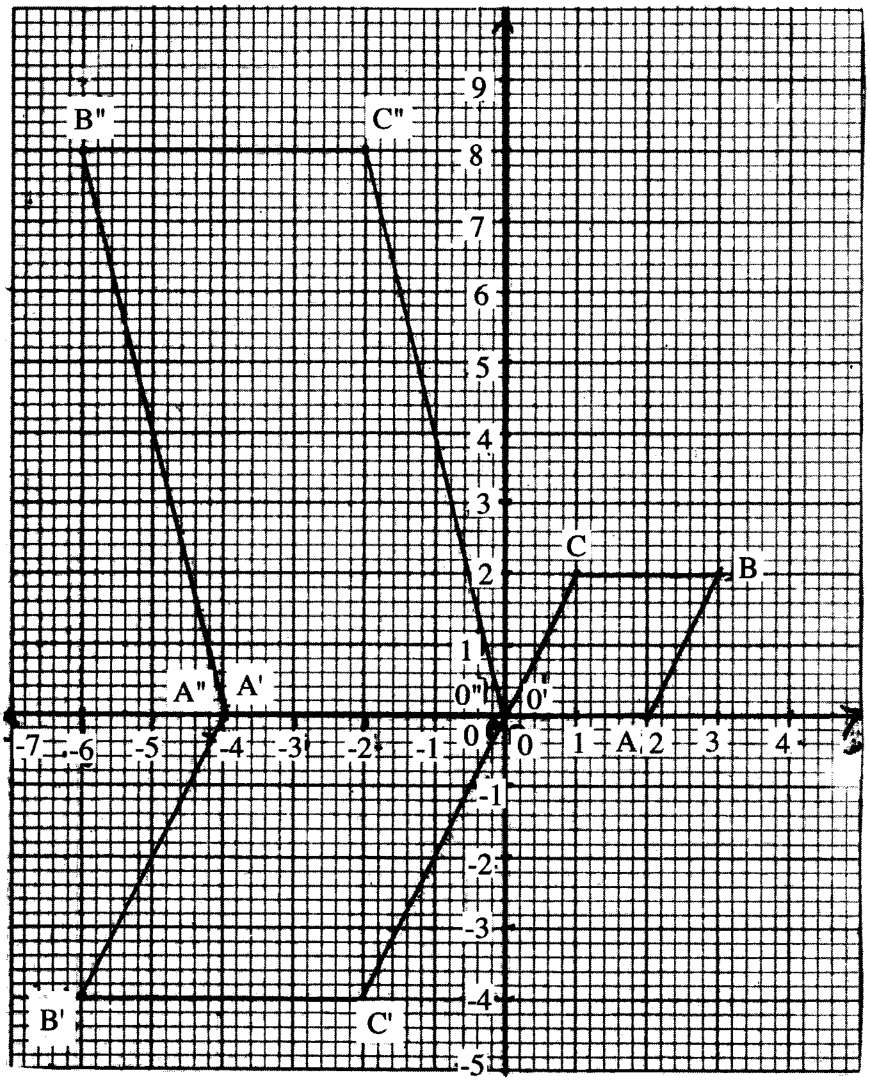
13	
	

(a)	Average rate of change between t = 3 and t = 6 $\frac{20-2}{6-3}$	M1	
	$= \frac{18}{3} = 6$	A1	
(b)	Gradient at t = 3 seconds $\frac{6-0}{4.3-2.3} = \frac{6}{2}$	M1	or equivalent
	$= 3 \pm 0.1$	A1	
		4	

14.	(a) Let UV be x cm: $VT \times UT = ST^2$ $(x + 8)8 = 12^2$ $8x = 144 - 64$ $= 80$ $x = 10$ cm (b) $VX = \frac{2}{5} \times 10 = 4$ cm $XU = 10 - 4 = 6$ cm $SX \times XW = VX \times XU$ $SX \times 3 = 4 \times 6$ $SX = 8$ cm	M1 A1 M1 A1 4	
15.	$P \propto \frac{Q}{\sqrt{R}} \Rightarrow P = \frac{kQ}{\sqrt{R}}$ $8 = \frac{k \times 10}{\sqrt{16}}$ $k = 3.2$ $P = \frac{3.2Q}{\sqrt{R}}$	M1 A1 B1 3	
16.	$OC = \frac{\sqrt{24^2 + 10^2}}{2}$ $= 13$ $\angle VCO = \cos^{-1}\frac{13}{26}$ $= 60°$	M1 M1 A1 3	

17.	(a) (i) $180000 + (11-1)x = 288000$ $10x = 108000$ $x = 10800$	M1 A1	
	(a) (ii) $S_{11} = \frac{11}{2}(180000 + 288000)$ $= 2574000$	M1 A1	
	(b) $\frac{150000 \times 1.1^{10}}{12}$ $= 32422$	M1 A1	
	(c) (i) $\frac{[150000 \times (1.1^{11} - 1)]}{(1.1-1)}$ $= 2779675$	M1 A1	
	(c) (ii) Difference between monthly averages for the 11 years $\frac{2779675 - 2574000}{11 \times 12}$ $= 1558$	M1 A1 10	
18.	(a) $\begin{matrix} & & O\ A\ B\ C & & O'\ A'\ B'\ C' \end{matrix}$ $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}\begin{pmatrix} 0 & 2 & 3 & 1 \\ 0 & 0 & 2 & 2 \end{pmatrix} = \begin{pmatrix} 0 & -4 & -6 & -2 \\ 0 & 0 & -4 & -4 \end{pmatrix}$ co-ordinates of O'A'B'C' O' (0, 0), A' (-4, 0), B' (-6, -4), C' (-2, -4)	M1 A1	

18. continued



B1 OABC √ drawn
B1 O'A'B'C' √ drawn
B1 O"A"B"C" √ drawn

(b)

$$\begin{pmatrix}1 & 0\\0 & -2\end{pmatrix}\begin{pmatrix}0 & -4 & -6 & -2\\0 & 0 & -4 & -4\end{pmatrix} = \begin{matrix} O'' & A'' & B'' & C'' \end{matrix}\begin{pmatrix}0 & -4 & -6 & -2\\0 & 0 & 8 & 8\end{pmatrix}$$

M1

A1

(c)

$$\begin{pmatrix}1 & 0\\0 & -2\end{pmatrix}\begin{pmatrix}-2 & 0\\0 & -2\end{pmatrix} = \begin{pmatrix}-2 & 0\\0 & 4\end{pmatrix}$$

M1 or equivalent

inverse $\frac{1}{-8}\begin{pmatrix}4 & 0\\0 & -2\end{pmatrix}$

M1

$= \begin{pmatrix}-\frac{1}{2} & 0\\0 & \frac{1}{4}\end{pmatrix}$

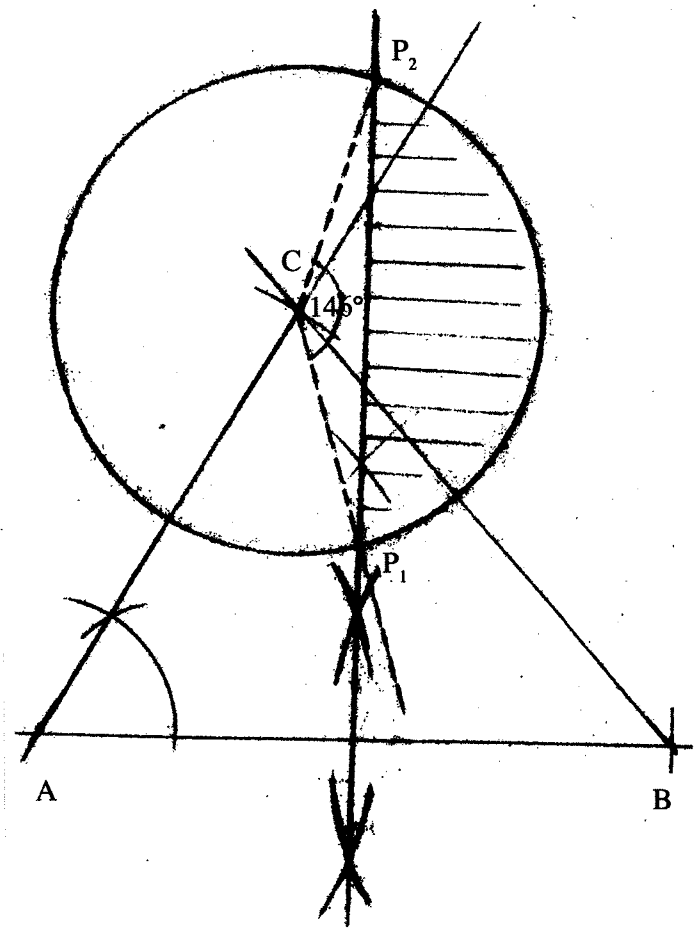
A1

10

19.	(a) (i) $\underset{\sim}{PN} = \frac{5}{6}\underset{\sim}{q} - \underset{\sim}{p}$	B1	
	(ii) $\underset{\sim}{QM} = \frac{2}{5}\underset{\sim}{p} - \underset{\sim}{q}$	B1	
	(b) (i) $\underset{\sim}{OX} = \underset{\sim}{p} + k\left(\frac{5}{6}\underset{\sim}{q} - \underset{\sim}{p}\right)$	B1	
	$\underset{\sim}{OX} = \underset{\sim}{q} + r\left(\frac{2}{5}\underset{\sim}{p} - \underset{\sim}{q}\right)$	B1	
	(ii) $\underset{\sim}{p} + k\left(\frac{5}{6}\underset{\sim}{q} - \underset{\sim}{p}\right) = \underset{\sim}{q} + r\left(\frac{2}{5}\underset{\sim}{p} - \underset{\sim}{q}\right)$	M1	
	$\underset{\sim}{p}(1-k) + \frac{5}{6}k\underset{\sim}{q} = \underset{\sim}{q}(1-r) + \frac{2}{5}r\underset{\sim}{p}$		
	$1 - k = \frac{2}{5}r$ and $1 - r = \frac{5}{6}k$	M1	
	$1 - r = \frac{5}{6}\left(1 - \frac{2}{5}r\right)$	M1	
	$1 - r = \frac{5}{6} - \frac{1}{3}r$		
	$\frac{1}{6} = \frac{2}{3}r \Rightarrow r = \frac{1}{4}$		
	$k = 1 - \frac{2}{5}r \Rightarrow k = 1 - \frac{2}{5} \times \frac{1}{4} = \frac{9}{10}$	A1	for both values of **r** and **k**
	(iii) $\underset{\sim}{QX} = \frac{1}{4}\underset{\sim}{QM}$	M1	
	$\underset{\sim}{MX} = \frac{3}{4}\underset{\sim}{QM}$		
	$\therefore \underset{\sim}{MX} : \underset{\sim}{XQ} = \frac{3}{4} : \frac{1}{4} = 3 : 1$	A1	
		10	

20.	(a) (i) July basic salary $= 17000 \times 1.02$ $= 17340$	 M1 A1	
	(ii) Total taxable income $= 17340 + 6000 + 2500 + 1800$ $= 27640$	 M1 A1	
	(b) Gross tax		
	1[st] bracket: $9680 \times 10\% = 968$	M1	
	2[nd] bracket: $(18800 - 9680) \times 15\% = 1368$	M1	
	3[rd] bracket: $(27640 - 18800) \times 20\% = 1768$	M1	[27649 - (9680 + 9120)]20%
	Gross tax: $968 + 1368 + 1768$ $= 4104$	M1 A1	
	Net tax: $4104 - 1056 = 3048$	B1	
		10	

21.

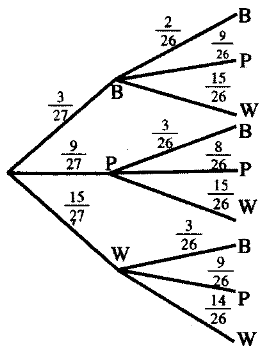


B1 construction of 60°

B1 completion of Δ

(a) locus of P locus of Q	B1 B1	
(b) (i) shading region R	B2	
(ii) area of shaded region area of minor sector P_1CP_2 $= \frac{146}{360} \times \pi \times 3.5^2$ $\simeq 15.6\ cm^2$	M1	($\angle P_1CP_2 = 146° \pm 1°$)
area of ΔP_1CP_2 $\frac{1}{2} \times 3.5^2 \sin 146°$ $\simeq 3.4\ cm^2$	M1	
$\therefore$ shaded area 15.6 - 3.4 =12.2 cm²	M1 A1	
	10	

22.	(a) distance from T to U $= 2 \times 6370 \times \frac{22}{7} \times \frac{12}{360}$	M1	
	speed $= \dfrac{2 \times 6370 \times \frac{22}{7} \times \frac{12}{360}}{1\frac{1}{3}}$	M1	
	$= 1001$ km/h	A1	
	(b) time $= \dfrac{2 \times 6370 \times \frac{22}{7} \times \frac{30}{360} \cos 9^\circ}{1001 \times \frac{90}{100}}$	M1 M1	
	$= 3.658104965$ h $\simeq 3$ h 39 min	A1	
	(c) Arrival time at U 0700 + 1h 20 min = 0820 h		
	Departure time at U 0820 + 30 min = 0850 h	M1	
	Time difference between U and V $\frac{35-5}{360} \times 24$ = 2h	M1	or equivalent
	Arrival time at V (local time) 0850h + 3h 39min - 2h = 1029h	M1 A1	
		10	

23.	(a) (i) P (brown) $= \frac{3}{27}$	B1	
	(ii) P(pink or white) $= \frac{9}{27} + \frac{15}{27}$	M1	
	$= \frac{8}{9}$	A1	
	(b) (i) P(white and brown) $= \frac{15}{27} \times \frac{3}{26} + \frac{3}{27} \times \frac{15}{26}$	M1 M1	
	$= \frac{5}{78} + \frac{5}{78} = \frac{5}{39}$	A1	
	(ii) white, white + pink, pink + brown, brown $= \frac{15}{27} \times \frac{14}{26} + \frac{9}{27} \times \frac{8}{26} + \frac{3}{27} \times \frac{2}{26}$	M1 M1 M1	
	$= \frac{35}{117} + \frac{4}{39} + \frac{1}{117} = \frac{16}{39}$	A1	
		10	
24.	(a) (i) $\frac{dv}{dt} = 4 - t$		
	$V = \int (4 - t)dt$		
	$= 4t - \frac{1}{2}t^2 + c$	B1	
	when t = 0, v = 3 m/s $\therefore 3 = 4 \times 0 - \frac{1}{2} \times 0^2 + c$	B1	
	$3 = c$		
	$\therefore V = 4t - \frac{1}{2}t^2 + 3$	B1	
	(ii) when t = 2 seconds $V = 4 \times 2 - \frac{1}{2} \times 2^2 + 3$	M1	
	$= 8 - 2 + 3$		
	$= 9\ m/s$	A1	
	(b) (i) At maximum velocity $\frac{dv}{dt} = 0$		
	i.e. 4 - t = 0	M1	
	t = 4 seconds	A1	
	(ii) $\int_0^4 4t - \frac{1}{2}t^2 + 3 = \frac{4}{2}t^2 - \frac{1}{2} \times \frac{1}{3}t^3 + 3t \Big]_0^4$	M1	
	$= 2t^2 - \frac{1}{6}t^3 + 3t \Big]_0^4$	M1	
	$= [2 \times 16 - \frac{1}{6} \times 64 + 12] - 0$		
	$= 32 - 10\frac{2}{3} + 12 = 33\frac{1}{3}$	A1	
		10	