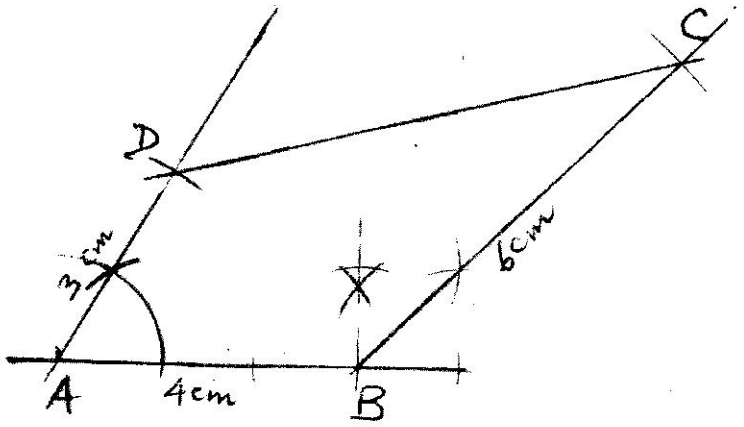
5.0 THE YEAR 2012 KCSE EXAMINATION MARKING SCHEMES

5.1 MATHEMATICS (121 AND 122)

5.1.1 Mathematics Alternative A Paper 1 (121/1)

1.	$\dfrac{\frac{6}{5}-\frac{4}{3}}{\frac{1}{8}-\frac{1}{4}}-\dfrac{14}{15}$ $= \dfrac{-\frac{2}{15}}{-\frac{1}{8}}-\dfrac{14}{15}$ $= \dfrac{16}{15}-\dfrac{14}{15}$ $= \dfrac{2}{15}$	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.	$\dfrac{24}{2} = \dfrac{1}{2} \times 8 \times x \sin 30^\circ$ $x = \dfrac{12}{4 \sin 30} = 6cm$ $perimeter = 2(6+8) = 28$	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 135^0 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.	$\begin{pmatrix}3\\-2\end{pmatrix} - \begin{pmatrix}2\\3\end{pmatrix}$ $= \begin{pmatrix}1\\-5\end{pmatrix}$ magnitude $= \sqrt{1^2+(-5)^2}$ $= \sqrt{26} \simeq 5.1$	M1 M1 A1 3	
10.	$x = \tan^{-1}\frac{3}{7} = 23.20^\circ$ $Cos(90-23.2)^\circ = 0.3939$	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.	$\log_m\left(\frac{x^2}{2^3}\times 32\right) = 2$ $\frac{x^2}{2^3}\times 2^5 = 100$ $4x^2 = 100$ $x = \sqrt{25} = \pm 5$ $x = 5$	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	

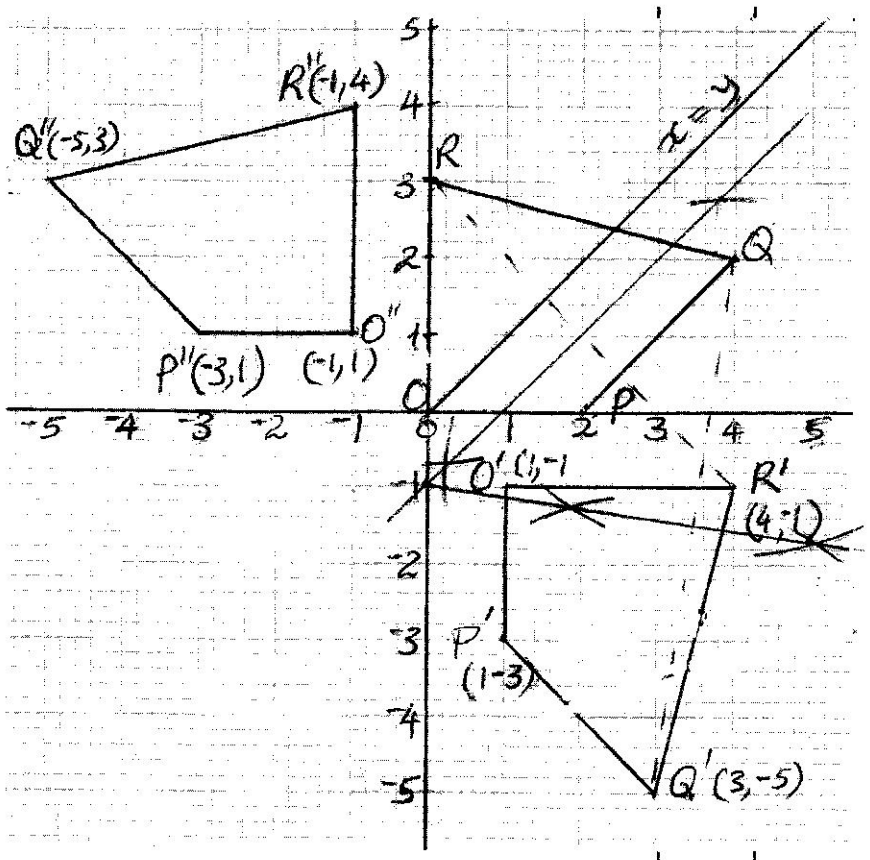
15.	Volume of solid $= \frac{1}{3} \times \frac{22}{7} \times 10.5^2 \times 15 - \frac{22}{7} \times 3.5^2 \times 8$ $= 1732.5 - 308$ $= 1424.5\ cm^3$	M1 M1 A1 3	
16.	$4(A-2) = B+2$ $2(A+10) = B+10$ $4A - B = 10....(i)$ $\mp 2A \pm B = \pm 10...(ii)$ $2A = 20$ $\Longrightarrow A = 10$ Substitute A = 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	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	3 pairs of congruent faces
		M1	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 Copper : zinc : tin = 9 : 6 : 10	M1 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 $= \frac{70}{100} \times 90$ $= 63$ $\therefore$ mass of zinc and tin: $= 250 - 63$ $= 187$	M1 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	

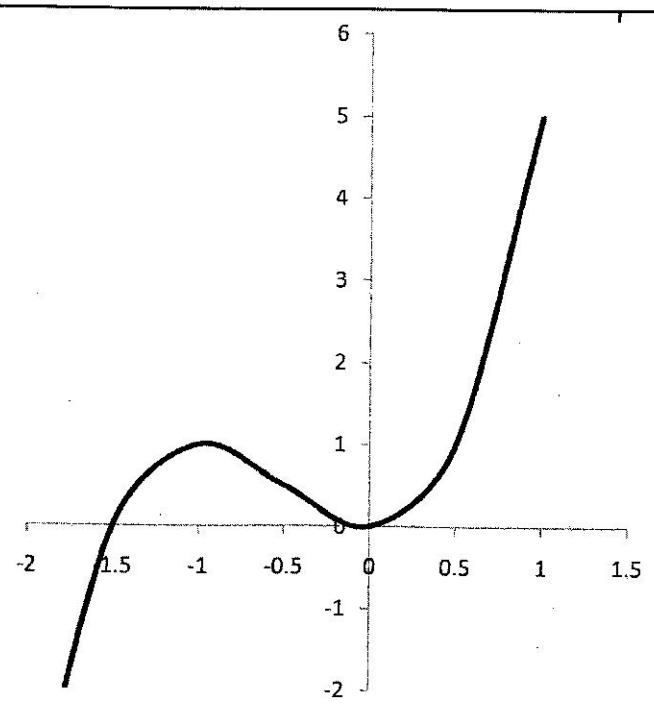
20. (a)	$\frac{1}{x-2} - \frac{2}{x+5} = \frac{3}{x+1}$		
	$\frac{x+5-2(x-2)}{(x-2)(x+5)} = \frac{3}{x+1}$		
	$\frac{-x+9}{x^2+3x-10} = \frac{3}{x+1}$	M1	
	$4x^2 + x - 39 = 0$	A1	
	$(4x+13)(x-3) = 0$	M1	
	$x = 3 \text{ or } x = -3\frac{1}{4}$	A1	
(b)	mean for second set of tests $= \frac{147}{y+2}$	B1	
	$\frac{120}{y} - \frac{147}{y+2} = 3$	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	

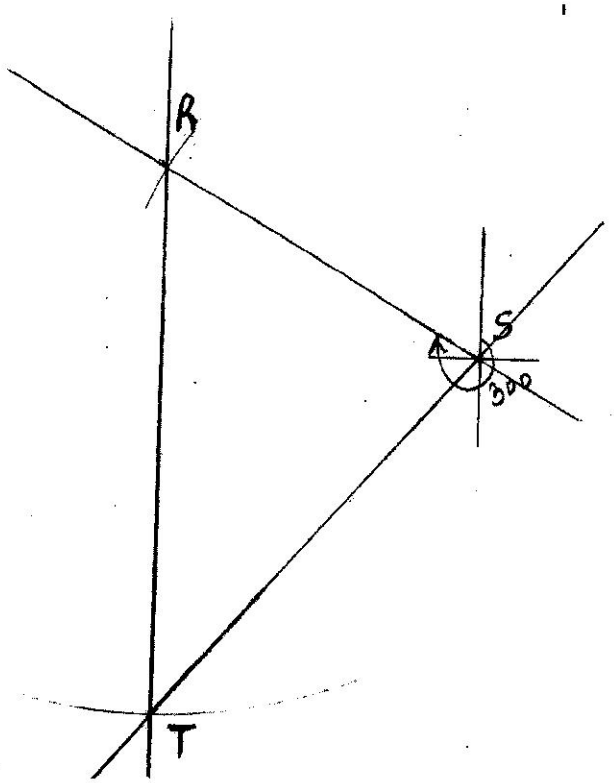
21.



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)	<table><tr><td>x</td><td>-2</td><td>$-1\frac{1}{2}$</td><td>-1</td><td>$-\frac{1}{2}$</td><td>0</td><td>$\frac{1}{2}$</td><td>1</td></tr><tr><td>$\frac{dy}{dx}$</td><td>12</td><td>$4\frac{1}{2}$</td><td>0</td><td>$-1\frac{1}{2}$</td><td>0</td><td>$4\frac{1}{2}$</td><td>12</td></tr></table> minimum point (0,0) maximum point (-1,1)	B1 B1	checking points for both

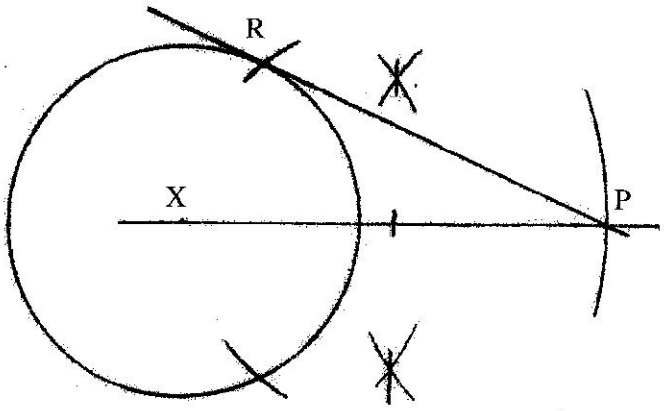
(c)			
	points plotted at $\left(-1\frac{1}{2},0\right),(-1,1)$ *and* $(0,0)$	B1	
	smooth curve	B1	
		10	

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		
	$RS^2 = 6^2 + 4.5^2 - 2 \times 4.5 \times 6Cos\, 80$	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	

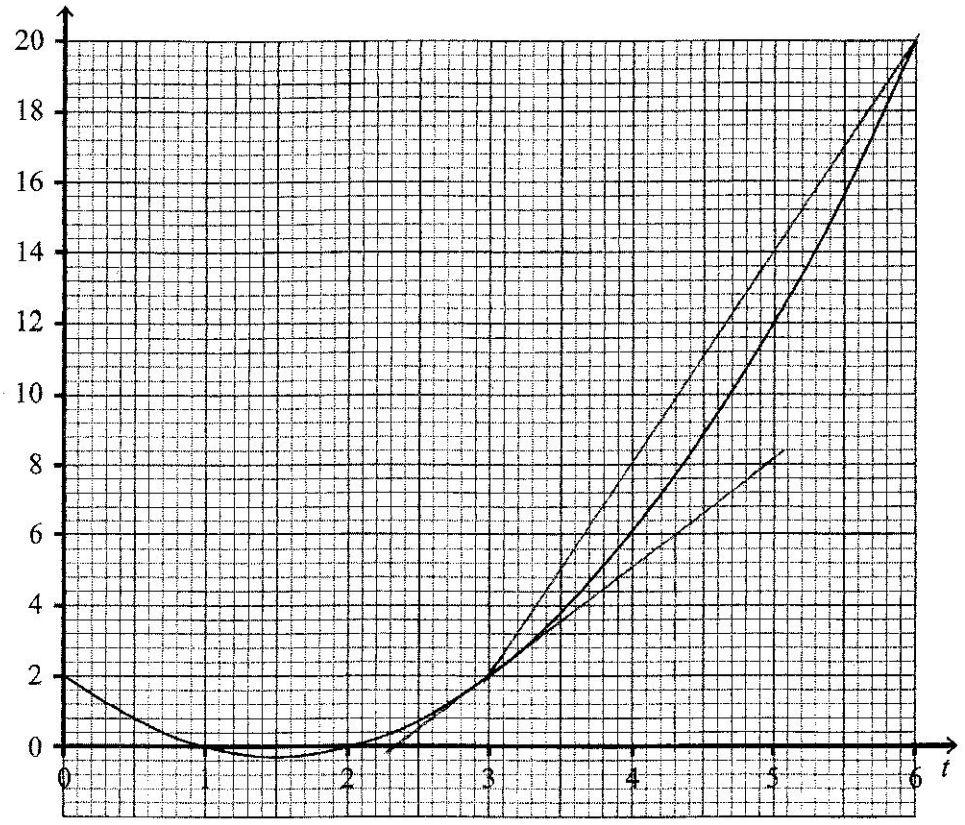
5.1.2 Mathematics Alternative A Paper 2 (121/2)

1.	$\frac{5\log 4 - 4\log 5}{\frac{1}{5}\log 4 + \frac{1}{4}\log 5}$ $= \frac{3.010299957 - 2.795880017}{0.120411998 + 0.174742501}$ $= 0.726466785$ $\simeq 07265$ (4 s.f.)	M1 A1 2	
2.	$\left(\frac{r}{p}\right)^2 = \frac{m^2}{n-1}$ $n - 1 = \left(\frac{mp}{r}\right)^2$ $n = \left(\frac{mp}{r}\right)^2 + 1$	M1 M1 A1 3	squaring
3.	Fraction filled by inlet tap in $1h = \frac{1}{6}$ Fraction filled when two taps open in $1h = \frac{1}{10}$ $\therefore$ fraction emptied by outlet tap in $1h = \frac{1}{6} - \frac{1}{10}$ $= \frac{1}{15}$ Time for outlet tap to empty tank = 15h	B1 M1 A1 3	for $\frac{1}{6}$ or $\frac{1}{10}$
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 Fixing point P Bisecting XP and drawing tangent RP = $5.4 \pm 0.1cm$	B1 B1 B1 B1 4	
7.	Amount for Kago $= 30000 + \frac{12}{100} \times 30000 \times 5$ $= 48000$	 B1	
	Compound interest rate for Nekesa $30000\left(1 + \frac{r}{100}\right)^5 = 48000$ $\left(1 + \frac{r}{100}\right)^5 = \frac{48000}{30000} = 1.6$ $1 + \frac{r}{100} = \sqrt[5]{1.6}$ $r = 100(1.098560543 - 1)$ $= 9.9\%$	M1 M1 A1 4	
8.	Differences from assumed mean $-6 - 2 + 0 + 2 + 3 + 6 + 9 - 5 + 6 + 3 + 9$ $-2 + 3 - 6 - 2 + 3 + 2 + 0 + 6 + 9 = 38$ $\therefore mean = 96 + \frac{38}{20}$ $= 97.9$	 M1 M1 A1 3	differences from the assumed mean

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 $= \frac{1}{2}(6.35 \times 3.45)$ $= 10.95375$ cm^2 maximum possible area $= \frac{1}{2} \times 6.45 \times 3.55$ $= 11.44875$ cm^2 maximum absolute error in area $= \frac{11.44875 - 10.95375}{2}$ $= 0.2475$ cm^2	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

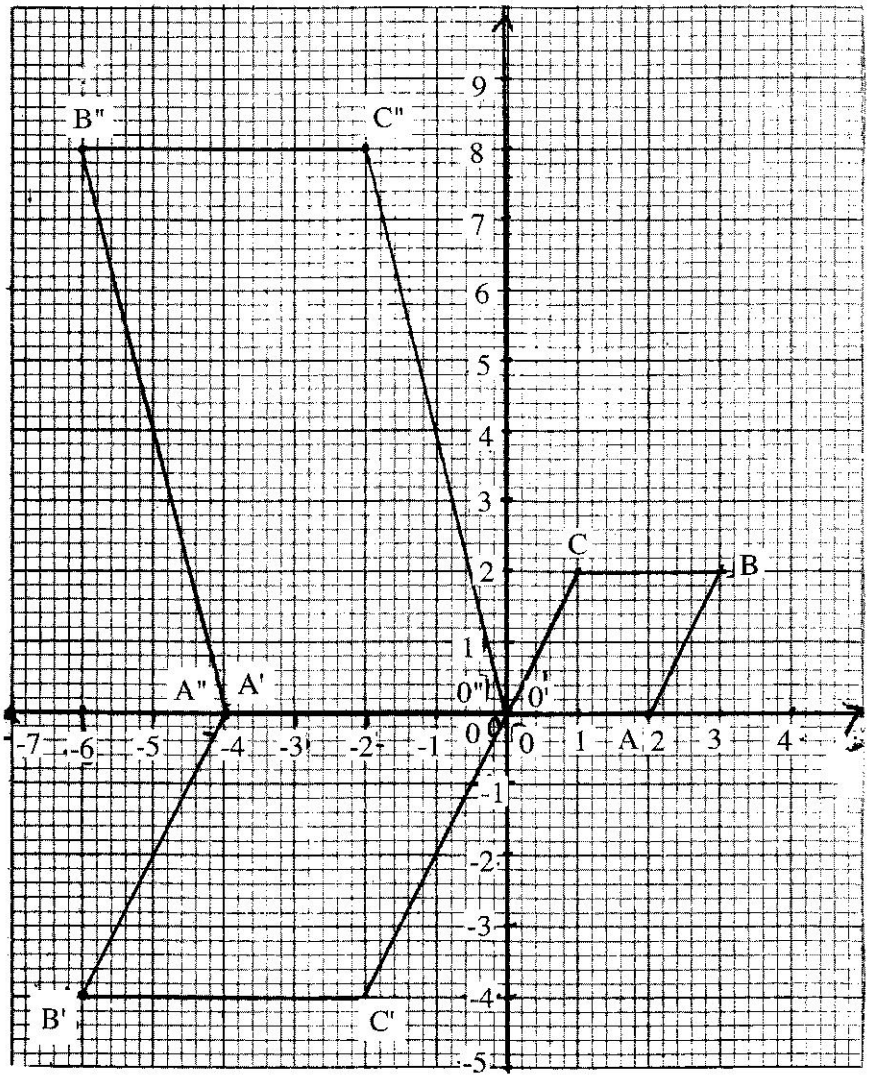


(a)	Average rate of change between t = 3 and t = 6	M1	
	$\frac{20-2}{6-3}$	A1	
	$= \frac{18}{3} = 6$		
(b)	Gradient at t = 3 seconds	M1	or equivalent
	$\frac{6-0}{4.3-2.3} = \frac{6}{2}$	A1	
	$= 3 \pm 0.1$	4	

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) $\begin{matrix} & O & A & B & C \end{matrix}$ $\begin{matrix} & O' & A' & B' & C' \end{matrix}$ $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}\begin{pmatrix} 0 & 2 & 3 & 1 \\ 0 & 0 & 2 & 2 \end{pmatrix} = \begin{pmatrix} 0 & -4 & -6 & -2 \\ 0 & 0 & -4 & -4 \end{pmatrix}$ 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)

$$\begin{matrix} & O'' & A'' & B'' & C'' \end{matrix}$$

$$\begin{pmatrix} 1 & 0 \\ 0 & -2 \end{pmatrix}\begin{pmatrix} 0 & -4 & -6 & -2 \\ 0 & 0 & -4 & -4 \end{pmatrix} = \begin{pmatrix} 0 & -4 & -6 & -2 \\ 0 & 0 & 8 & 8 \end{pmatrix}$$

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

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

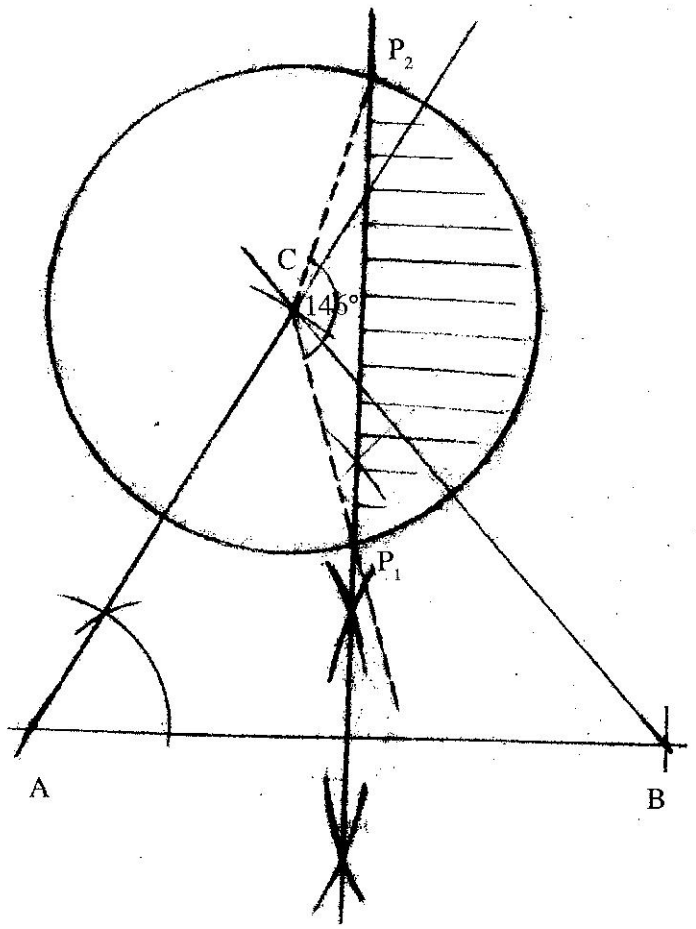
A1

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

21.



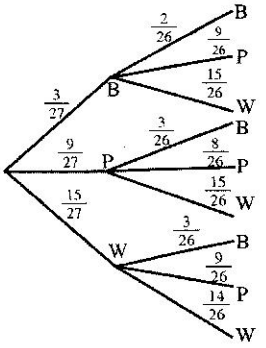
B1 construction of 60°

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 $=12.2\ cm^2$	M1 A1	
	10	

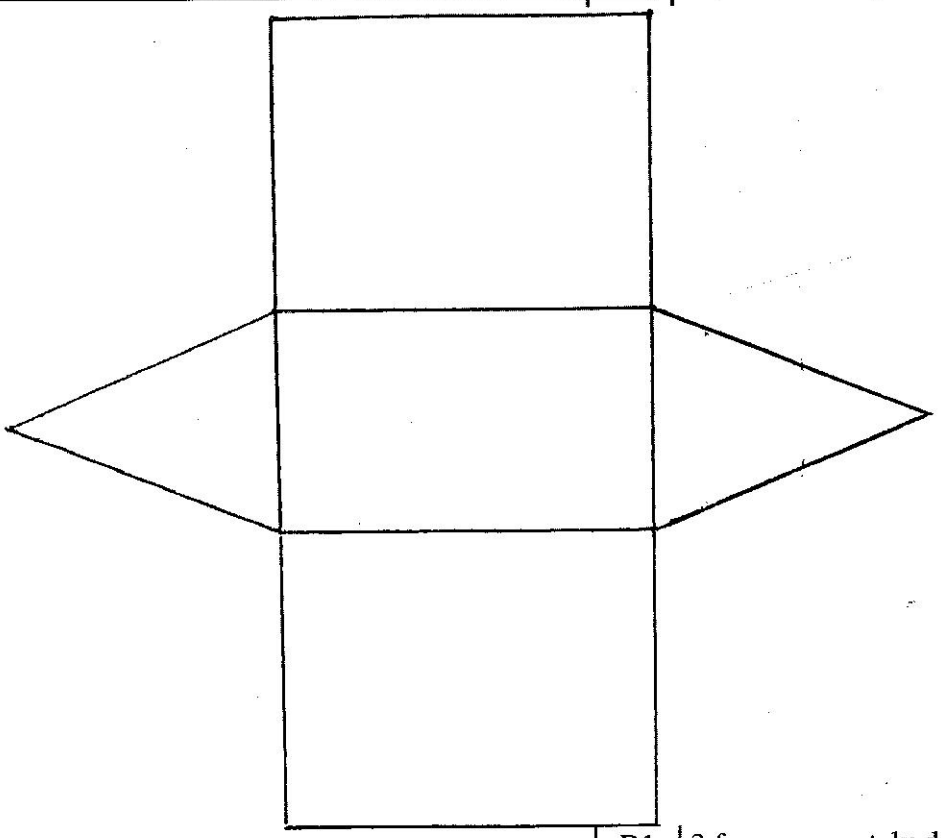
22.	(a) distance from T to U $= 2 \times 6370 \times \frac{22}{7} \times \frac{12}{360}$	M1	
	speed $= \frac{2 \times 6370 \times \frac{22}{7} \times \frac{12}{360}}{1\frac{1}{3}}$	M1	
	$= 1001$ km/h	A1	
	(b) time $= \frac{2 \times 6370 \times \frac{22}{7} \times \frac{30}{360} \cos 9°}{1001 \times \frac{90}{100}}$	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 $\frac{35-5}{360} \times 24$	M1	or equivalent
	= 2h		
	Arrival time at V (local time) 0850h + 3h 39min - 2h = 1029h	M1 A1	
		10	

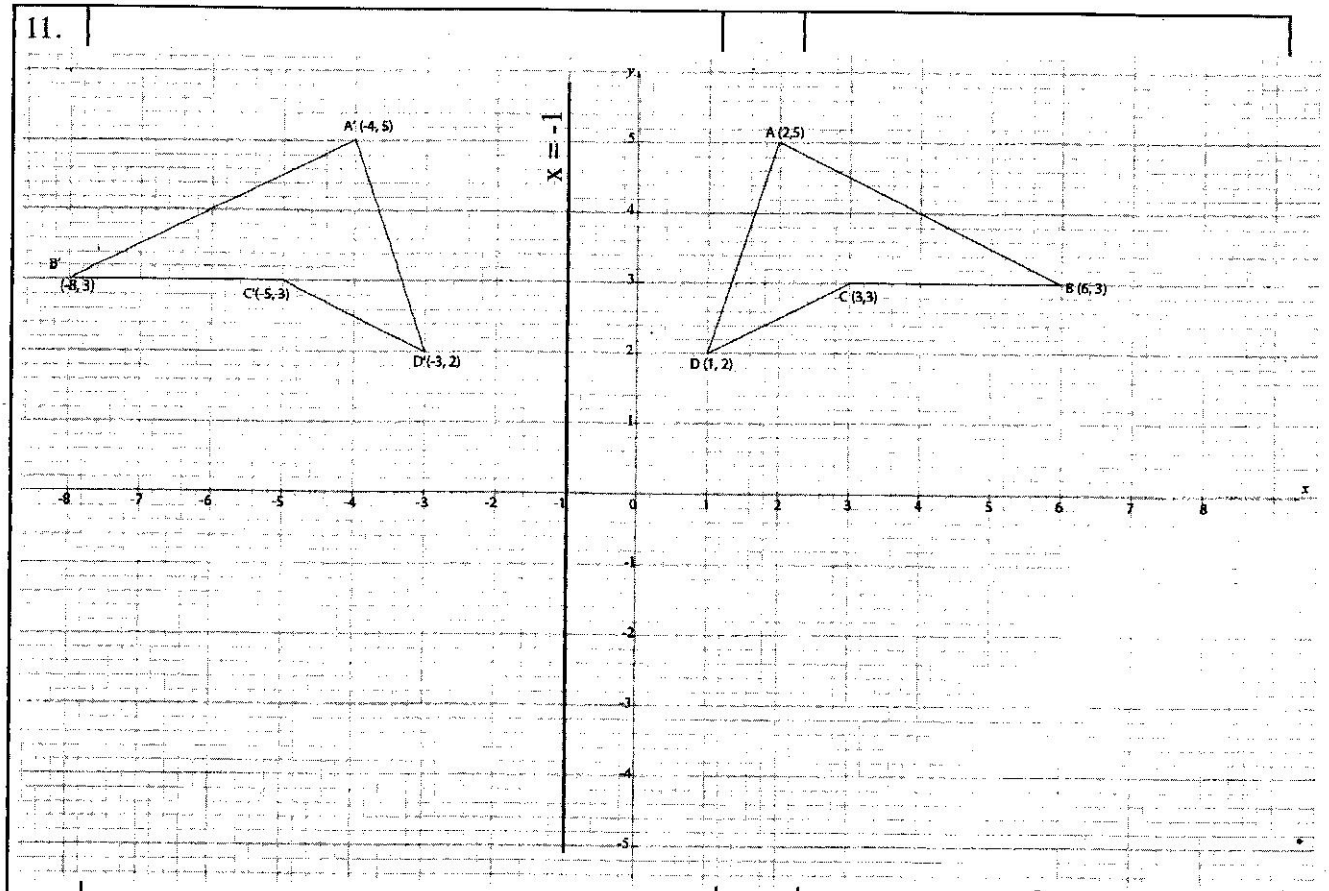
23.	(a) (i) P (brown) $= \frac{3}{27}$	B1	
	(ii) P(pink or white) $= \frac{9}{27} + \frac{15}{27}$	M1	
	$= \frac{8}{9}$	A1	
	(b) (i) P(white and brown) $= \frac{15}{27} \times \frac{3}{26} + \frac{3}{27} \times \frac{15}{26}$	M1	
	$= \frac{5}{78} + \frac{5}{78} = \frac{5}{39}$	M1 A1	
	(ii) white, white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

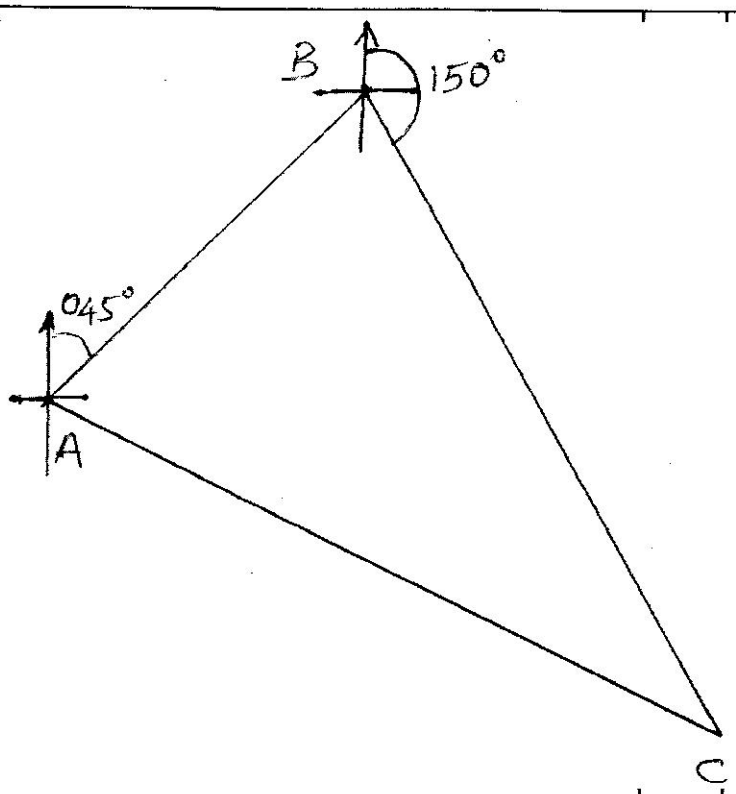
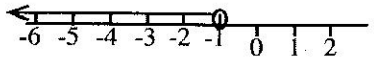


5.1.3 Mathematics Alternative B (122/1)

1.	$\frac{a^2-b^2}{a^2+ab-a-b}=\frac{(a+b)(a-b)}{a(a+b)-1(a+b)}$ $=\frac{(a+b)(a-b)}{(a-1)(a+b)}$ $=\frac{a-b}{a-1}$	M1 M1 A1 3	
2.	Auma: Barua: Chiku = 2:3:5 Total profit $=\frac{105000}{7}\times 10$ $= 150000$	B1 M1 A1 3	
3.	$6561 = 3^8$ $3^{2y} = 3^8$ $2y = 8$ $y = 4$	B1 M1 A1 3	
4.	Hypotenuse $=\sqrt{7^2+5^2}$ $=\sqrt{74}$ $\text{Sin}\,\theta=\frac{5}{\sqrt{74}}$ or $= 0.5812$	M1 A1 2	or Alternative
5.	Density in g/cm^3 $=\frac{30}{64}$ Density in km/m^3 $=\frac{\frac{30}{1000}}{\frac{64}{100}}$ $= 468.75$ kg/m^3	M1 M1 A1 3	
6.	(a) $40 = 2^3\times 5$; $56 = 2^3\times 7$; $64 = 2^6$ Greatest length of pieces $= 2^3 = 8$ (b) $(40\div 8)+(56\div 8)+(64\div 8)$ $= 20$	M1 A1 M1 A1 4	
7.	Length of minor arc $=\frac{81}{360}\times 31.24$ $= 7.029$ Length of major arc $= 31.24 - 7.029$ $= 24.211$	M1 M1 A1 3	ALTERNATIVE Angle of major sector $= 360° - 81°$ $= 279°$ Length of major arc $=\frac{279°}{360°}\times 31.24$ $= 24.211$

8.	(a) $\angle CAD = 40°$ alternate $\angle$s (b) $\angle DBC = 40°$ $\therefore \angle TBD = 180° - 40°$ $= 140°$	B1 M1 A1 3	$\angle$s subtended by same chord are equal
9.		B1 B1 B1 3	3 faces accurately drawn
10.	$100x = 13.333...$ $10x = 1.333...$ $90x = 12$ $x = \frac{12}{90} = \frac{2}{15}$	M1 M1 A1 3	

11.			
	$x = -1$ √ drawn image A′ B′ C′ D′ √ drawn A′ B′ C′ D′ is oppositely congruent to ABCD	B1 B1 B1 3	
12.	Total surface area $= \frac{22}{7} \times 3.5^2 + \frac{22}{7} \times 3.5 \times 9$ $= \frac{22}{7} \times 3.5(3.5 + 9)$ $= 137.5$ cm	M1 M1 A1 3	

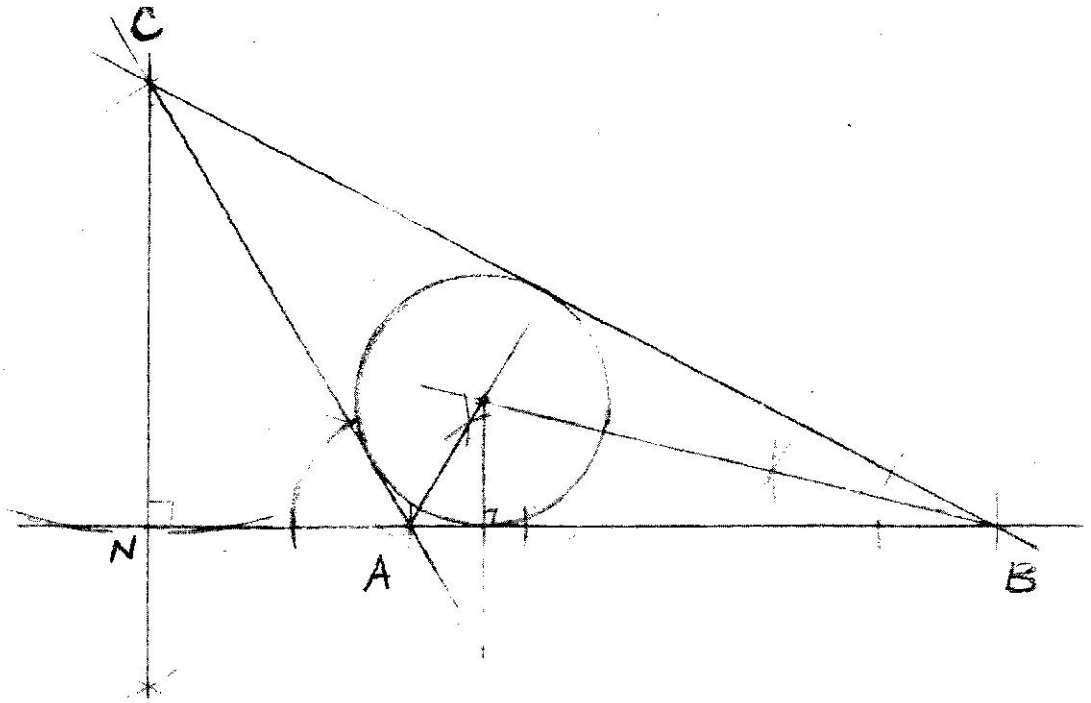
13.	 (a) AB accurately drawn BC accurately drawn (b) distance from A to C = 10.2 x 10 = 102 km	B1 B1 M1 A1 4	AC = 10.2 ± 0.1 cm
14.	(a) height $= \sqrt{13^2 - 5^2}$ $= 12$ cm (b) volume $= \frac{1}{3} \times 8 \times 6 \times 12$ $= 192$ cm^3	M1 A1 M1 A1 4	
15.	$-5x - 3 > 2x + 4$ $-5x - 2x - 3 > 4$ $-7x > 7$ $x < -1$ 	 B1 B1 2	

16.	Time at stop B $8.00 + \frac{12}{4}h = 11.00$ Time taken to C from B 11.45 - 11.30 = 15 minutes Distance $= 12 + \frac{15}{60} \times 72$ $= 30$ km	B1 B1 M1 A1 4	
17.	a) Area to be painted $2(15 \times 3 + 9 \times 3) - (2 \times 2.2 \times 3 + 1.5 \times 1.5 \times 6)$ $= 117.3\ m^2$ b) No. of tins required $= \frac{117.3}{4 \times 2.5}$ $= 11.73$ $\simeq 12$ tins c) Total cost: $12 \times 1700 + (2000 + 30 \times 117.3)$ = Sh 25919	M1 M1 M1 A1 M1 A1 B1 M1 M1 A1 10	area of walls area of doors and windows difference cost of paint sum of cost of paint, standing charge and labour

18.	a) $2 \times \frac{1}{2} \times 5 \times 5 \sin 150^\circ$ $= 12.5 \text{ cm}^2$ b) (i) $\frac{\frac{1}{2}BD}{5} = \sin 75^\circ$ $BD = 9.7$ (ii) Area of $\triangle BCD$ $S = \frac{1}{2}(9.7 + 16 + 16) = 20.85$ $A = \sqrt{20.85(20.85 - 9.7)(20.85 - 16)^2}$ $= \sqrt{20.85 \times 11.15 \times (4.85)^2}$ $= 73.95$ c) Area of kite ABCD $\frac{1}{2} \times 12.5 + 73.95$ $= 80.2 \text{ cm}^2$	M1 A1 M1 A1 B1 M1 A1 M1 M1 A1 10	
19.	a) odd numbers after x $x + 2, x + 4, x + 6$ $x + (x + 2) + (x + 4) + (x + 6) = 120$ $4x = 120 - 12$ $x = 27$ $\therefore$ odd numbers: 27, 29, 31, 33 b) (i) $3p + 2m = 1180$ $2p + m = 680$ $3p + 2m = 1180$ ..... (i) $2p + m = 680$ ..... (ii) $3p + 2m = 1180$ ..... (i) $4p + 2m = 1360$ ..... (iii) $p = 180$ substitute $p = 180$ in (ii) $2 \times 180 + m = 680$ $m = 320$ $p + m = 180 + 320 = 500$ (ii) $180 \times 1.1 + 320 \times 0.95$ $198 + 304 = 502$	B1 M1 A1 B1 B1 M1 A1 B1 M1 A1 10	for $3p + 2m = 1180$ or $2p + m = 680$ or equivalent for $p = 180$ and $m = 320$

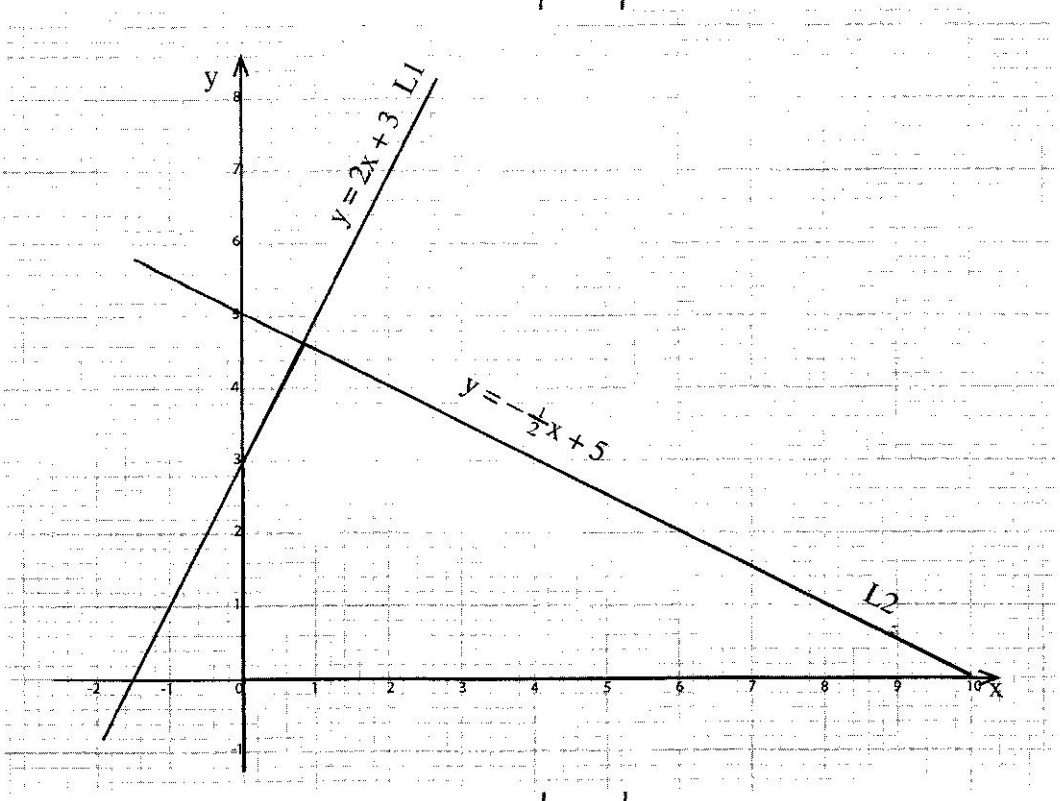
20.	a) (i) 10:800 1:80 height of door on photograph: $= \frac{240}{80}$ $= 3$ cm	 B1 M1 A1	
	(ii) L.S.F = 1:80 A.S.F = 1:6400 $\therefore$ Actual area of the window $= \frac{1.4 \times 6400}{10\,000}$ $= 0.896\ m^2$	 B1 M1 A1	 or equivalent
	b) (i) Volume scale factor $= (\sqrt{16})^3 : (\sqrt{49})^3$ $= 64 : 343$	 M1 A1	
	(ii) Volume of bigger cuboid $= \frac{128}{64} \times 343$ $= 686\ cm^3$	 M1 A1	
		10	

21



a) construction of 120°	B1	
completion of △	B1	
b) (i) identifying centre of circle	B1	at least 2 mediators drawn
⊥ from centre to at least one side	B1	at least 1 perpendicular drawn
completing circle radius 1.7 ± 0.1	B1	
(ii) ⊥ from C to N	B1	
$CN = 6.1 \pm 0.1$	B1	
c) area of $\triangle ABC = \frac{1}{2} \times 8 \times 6.1$	M1	
area of circle $= 3.142 \times 1.7^2$	M1	
area of △ outside the circle		
$= \frac{1}{2} \times 8 \times 6.1 - 3.142 \times 1.7^2$		
$= 24.4 - 9.079202769$		
$= 15.32079723$		
$= 15.32$	A1	
	10	

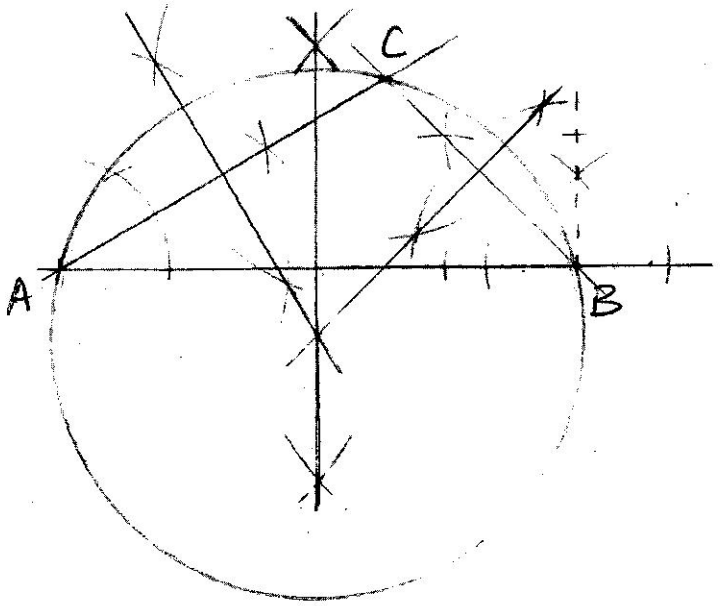
22.	a) $3600 \times 22.07 + 4500 \times 107.93$ $= 565137$	M1 M1 A1	√ conversions sum
	b) (i) $2000 \times 80.89 + 5000 \times 11.60$ $= 219780$	M1 M1 A1	√ conversions sum or equivalent e.g. 35% used correctly
	(ii) $219780 \times \frac{65}{100}$ $= 142857$	M1	
	Balance: $219780 - 142857$ $= 76923$	M1	
	Exchange: $= \frac{76923}{128.55}$ $\simeq 598$	M1 A1	
		10	

23.	a) (i) L_1: when $y = 0$, $x = \frac{-3}{2}$	B1	
	(ii) L_1: when $x = 0$, $y = 3$	B1	
	b) (i) L_2: when $y = 4$, $x = 2$	B1	
	L_2: when $x = -2$, $y = 6$	B1	
	c) (i) 		
	Line L_1 drawn	B1	
	Line L_2 drawn	B1	
	(ii) value of x and y when $L_1 = L_2$ $x = 0.8$, $y = 4.6$	B1	
	(iii) area of region bounded by L_1, L_2, and x - axis		
	Area $= \frac{1}{2} \times 11.5 \times 4.6$	M1	for 11.5 and 4.6
		M1	
	$= 26.45$	A1	
		10	

24.	a) $(3x + 1)2x = 6x^2 + 2x$	B1	
	b) (i) $(2x + 2)4x = 6x^2 + 2x + 36$	M1	
	$2x^2 + 6x - 36 = 0$	M1	
	$(2x + 12)(x - 3) = 0$	A1	
	$x = 3$		
	(ii) area of carpet		
	$= 3(3) + 1 + 2(3)$	M1	
	$= 10 \times 6 = 60m^2$	A1	
	c) Cost of carpet		
	$= 60 \times 1600$	M1	
	$= 96000$		
	Cost of labour		
	$= 96000 \times 0.025$	M1	
	$= 2400$		
	Total cost		
	$= 96000 + 2400$	M1	
	$= 98400$	A1	
		10	

5.1.4 Mathematics Alternative B Paper 2 (122/2)

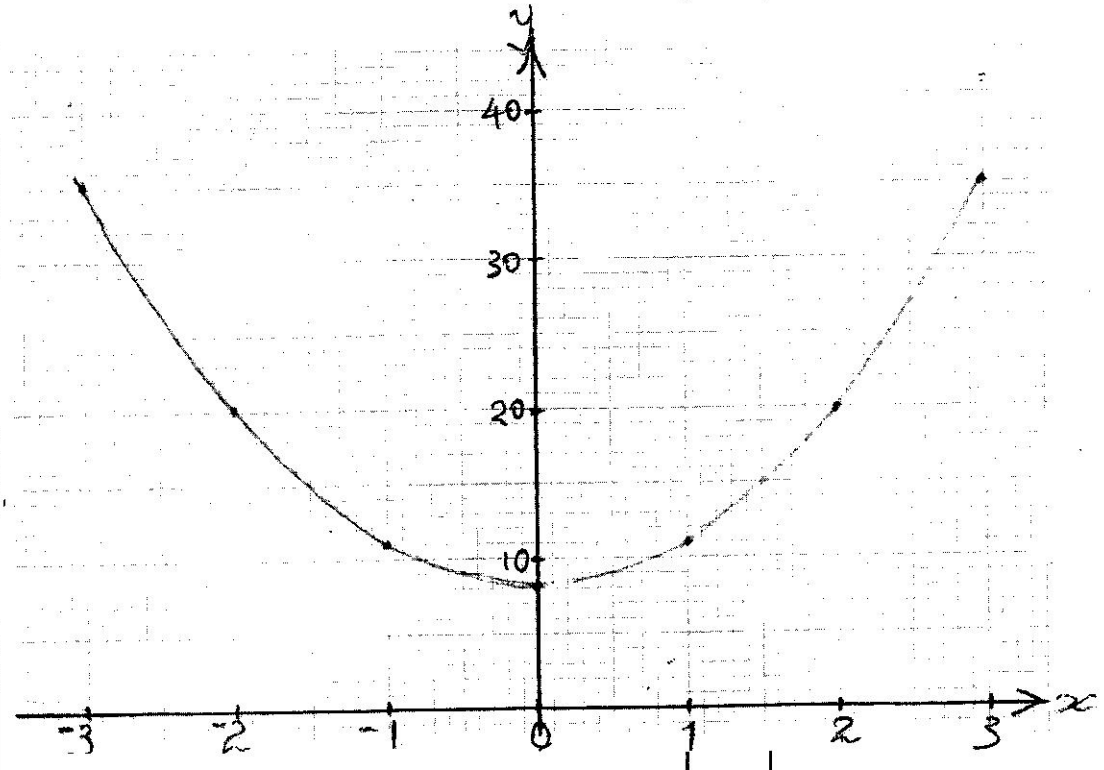
1.	$200 + \frac{90 \times 5}{10}$ $= 245$	B1 M1 A1 3	√ rounding off √ operations
2.	$mn = pm^2 - pn$ $mn + pn = pm^2$ $n(m + p) = pm^2$ $n = \frac{pm^2}{m + p}$	M1 M1 A1 3	
3.	$x(x - 3) = 108$ $x^2 - 3x - 108 = 0$ $(x - 12)(x + 9) = 0$ $x = 12$ *or* $x = -9$ $\therefore$ *length* $= 12m$	B1 M1 A1 3	or equivalent expression
4. (a)	CLASS | 1-10 | 11-20 | 21-30 | 31-40 | 41-50 FREQUENCY | 3 | 8 | 10 | 8 | 7	B1 B1	classes frequencies
(b)	modal class $= 21 - 30$	B1 3	
5.	Interest $= 195\,600 - 120\,000$ $= 75\,600$ Rate: $120\,000 \times R \times \frac{7}{2} = 75\,600$ $\Longrightarrow R = \frac{75\,600 \times 2}{120\,000 \times 7} \times 100$ $= 18\%$	B1 M1 A1 3	

6.		B1 B1 B1 B1 4	30° *and* 45° constructed completion of △. Perpendicular bisector at least 2 sides of △. Drawing circle.
7.	$2x + y = 5 \ldots (i)$ $11x + 4y = 17 \ldots (ii)$ $8x + 4y = 20$ $11x + 4y = 17$ $x = -1$ *Subst.* $x = -1$ *in* (i): $2(-1) + y = 5$ $y = 7$ $x = -1, y = 7$	M1 M1 A1 3	
8.	$\underset{\sim}{OB} = \begin{pmatrix} 2 \\ 5 \end{pmatrix} + \begin{pmatrix} 4 \\ 5 \end{pmatrix}$ $= \begin{pmatrix} 6 \\ 10 \end{pmatrix}$ $OM = \frac{1}{2}\begin{pmatrix} 6 \\ 10 \end{pmatrix}$ $= \begin{pmatrix} 3 \\ 5 \end{pmatrix}$ M is (3, 5)	M1 M1 A1 3	

9.	Function of work done in 4 hours. $= 4\left(\frac{1}{10}+\frac{1}{15}+\frac{1}{18}\right)$ $\frac{8}{9}$	M1 A1 2	
10.	$AC^2 = 8^2 + 6^2 - 2\times 8\times 6\cos 120^\circ$ $= 64 + 36 - 96\times -0.5$ $AC = \sqrt{148} = 12.17$	M1 M1 A1 3	
11. (a)		B1	

x	-3	-2	-1	0	1	2	3
$y = 3x^2 + 8$	**(35)**	20	**(11)**	8	11	**(20)**	35

(b)



P1
C1
3

12.	1^{st} *bracket*: $9680 \times \frac{10}{100}$ $= 968$ 2^{nd} *bracket*: $(16420 - 9680) \times \frac{15}{100}$ $= 1011$ *Net tax*: $(968 + 1011) - 1056$ $= 923$	M1 M1 M1 A1 4	
13.	$a = 50\,000; r = 1.1$ $s_n = 50\,000 \times \frac{(1.1)^3 - 1}{1.1 - 1}$ $= 165\,500$	B1 M1 A1 3	
14.	*Longitude difference* $= 15^\circ + 6 = 21^\circ$ *Time diference* $= 21 \times 4 = 84$ min *local time at* $R = 8.30 + 1h$ 24 min $= 9.54$ *pm*	B1 B1 B1 3	
15.	$\begin{matrix} & P & Q & R \end{matrix}$ $\begin{matrix} & P' & Q' & R' \end{matrix}$ $\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} -3 & 1 & 4 \\ 1 & 3 & -2 \end{pmatrix} = \begin{pmatrix} 6 & -2 & -8 \\ -2 & -6 & 4 \end{pmatrix}$ $-3a + b = 6 \qquad c + 3d = -6$ $a + 3b = -2 \qquad 4c - 2d = 4$ $a = -2 \qquad c = 0$ $b = 0 \qquad d = -2$ $Matrix = \begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$	M1 M1 A1 B1 4	

16.	<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td></td><td>2</td><td>3</td><td>6</td><td>11</td><td>18</td><td>27</td></tr></table> $y = x^2 + 2$ $Area = \frac{1}{2}\{(2+27)+2(3+6+11+18)\}cm^2$ $\frac{1}{2}\{29+2\times 38\}$ $= 52.5cm^2$	B1 M1 A1 3	√ ordinates (may be implied from working)
17.	(a) (i) *Mass of type x*: $\frac{7}{10}\times 20 = 14kg$ *Mass of type y*: $\frac{3}{10}\times 20 = 6kg$ (ii) $Cost\ \text{Price} = 14\times 150 + 6\times 240$ $= Sh\ 3\,540$ $Selling\ \text{Price} = Sh\ \frac{125}{100}\times 3540$ $= Sh\ 4\,425$ (b) (i) $\frac{150a+240b}{a+b} = 186$ $150a + 240b = 186a + 186b$ $36a = 54b$ $a:b = 3:2$ (ii) $\frac{3}{5}\times 500g$ $= 300g$	B1 B1 M1 M1 M1 A1 M1 A1 10	

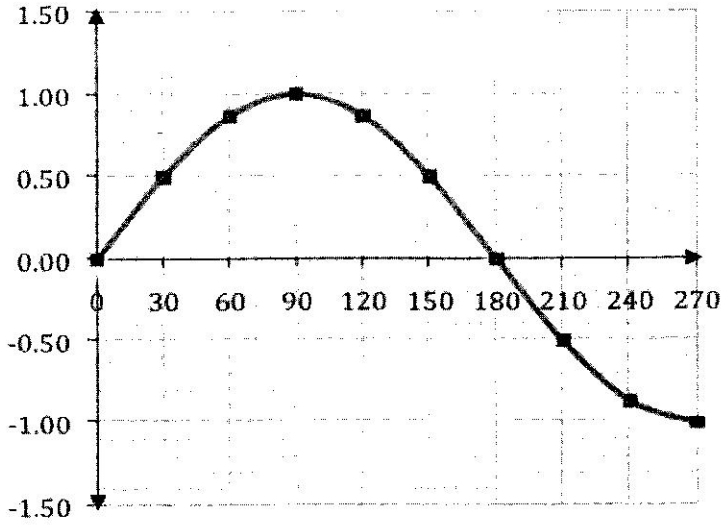
18.	(a) $R = \begin{pmatrix} x & 3 \\ 2x & 3x \end{pmatrix}$		
	$\therefore 3x^2 - 6x = 0$	M1	
	$3x(x-2) = 0$	M1	
	$x = 0$ *or* $x = 2$	A1	
	(b) (i) $BA = \begin{pmatrix} 2 & -1 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 3 & 1 \\ 2 & 4 \end{pmatrix}$	B1	
	$= \begin{pmatrix} 4 & -2 \\ 2 & 4 \end{pmatrix}$		
	(ii) $3B = 3\begin{pmatrix} 2 & -1 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} 6 & -3 \\ 0 & 3 \end{pmatrix}$	B1	
	(iii) $P = \begin{pmatrix} 4 & -2 \\ 2 & 4 \end{pmatrix} - \begin{pmatrix} 6 & -3 \\ 0 & 3 \end{pmatrix}$	M1	
	$= \begin{pmatrix} -2 & 1 \\ 2 & 1 \end{pmatrix}$	A1	
	(iv) $\lvert \mathbf{P} \rvert = -2 \times 1 - 2 \times 1$		
	$= -4$	B1	
	Inverse of $\mathbf{P} = -\frac{1}{4}\begin{pmatrix} 1 & -1 \\ -2 & -2 \end{pmatrix}$	M1	
	$= \begin{pmatrix} -\frac{1}{4} & \frac{1}{4} \\ \frac{1}{2} & \frac{1}{2} \end{pmatrix}$	A1	
		10	

19. (a)

x	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°
Sin x		0.5			0.87			-0.5	-0.87	-1

B2 Allow B1 for 3 or 4 values correct.

(b)



S1 √ use of scale
P2 P1 for at least 7 √
C1 curve

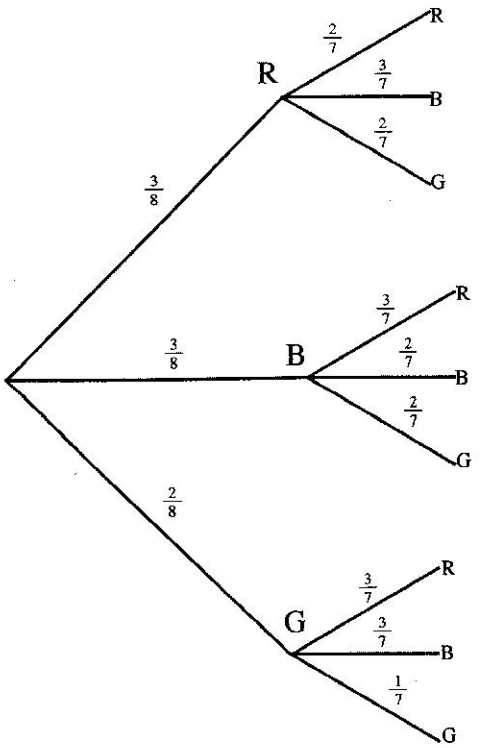
(c) x when y = 0.7

x = 45° B1
= 135° B1

(d) sin x = - 0.4 B1
x = 204° B1

10

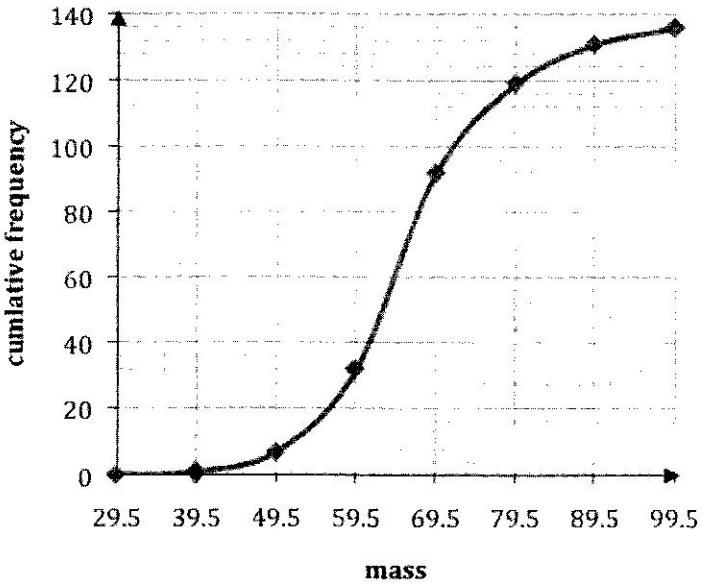
20.	(a) (i) $OP = \frac{2.5}{\sin 50^\circ}$	M1	
	$= 3.26$ cm	A1	
	(ii) $AP = \frac{2.5 \sin 40^\circ}{\sin 50}$	M1	
	$= 2.10$	A1	
	(iii) $AC = 2\,AE$		
	$= 2 \times 2.5 \sin 40^\circ$	M1	
	$= 3.21$	A1	
	(b) (i) $\angle PAC = 40^\circ$ (sum of $\angle$s in $\triangle$ AEP)	B1	
	$\angle ADC = 40^\circ$ (angle in alt. segment)	B1	
	(ii) $\angle ACD = \frac{1}{2}(180^\circ - 40^\circ)$	M1	
	$= 70^\circ$	A1	
		10	
21.	(a) Value of car after 3 years		
	$(100 - 10)\% = 90\%$	M1	
	500000×0.9^3	M1	
	$= 364\,500$	A1	
	(b) (i) 364500×1.15	M1	
	$= 419\,175$	A1	
	(ii) 419175×1.12^2	M1	
	$= 525\,813$	A1	
	(c) % gain from investment		
	$= \frac{(525813 - 364500)}{364500} \times 100$	M1 M1	
	$= 44.3\%$	A1	
		10	

22.	(a) 	B1	1st set branches
		B1	2nd set branches
	(b) (i) P (both balls red) $= \frac{3}{8} \times \frac{2}{7}$	M1	
	$= \frac{3}{28}$	A1	
	(ii) P (one ball red and one ball green) $= \frac{3}{8} \times \frac{2}{7} + \frac{2}{8} \times \frac{3}{7}$	M1 M1	
	$= \frac{6}{56} + \frac{6}{56} = \frac{3}{14}$	A1	
	(iii) P (different colours) $= 1 - \left[\left(\frac{3}{8} \times \frac{2}{7}\right) + \left(\frac{3}{8} \times \frac{2}{7}\right) + \left(\frac{2}{8} \times \frac{1}{7}\right)\right]$	M1 M1	P (same colours) 1 - P (same colours)
	$= 1 - \frac{14}{56} = \frac{3}{4}$	A1	
		10	

23.

Mass kg	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Frequency	2	5	25	60	27	12	5
Upper class unit	39.5	49.5	59.5	69.5	79.5	89.5	99.5
Cumulative frequency	1	7	32	92	119	131	136

B1	for upper class limit
B1	for c.f.



	S1	√ scale
	P2	√ plotting allow B1 for 4-6
	C1	points
(b) (i) identifying 68 patients	B1	
reading 65.5 ± 1 kg	B1	
(ii) identifying 50.5 kg	B1	
reading 8 patients	B1	
	10	

24.	(a) (i) $S = \frac{kT}{R}$	B1	
	$\Rightarrow 18 = \frac{k \times 9}{4}$		
	$k = \frac{18 \times 4}{9}$	M1	
	$= 8$	A1	
	(ii) $S = \frac{8T}{R}$	B1	
	(iii) value of T when S = 108 and R =6		
	$T = \frac{S \times R}{8}$	M1	making T the subject
	$= \frac{108 \times 6}{8}$	M1	√ substitution
	$= 81$	A1	
	(b) % change of S		
	New $S = \frac{8 \times T}{1.2R}$	M1	
	Old $S = \frac{8T}{R}$		
	change $= \frac{8T}{1.2R} - \frac{8T}{R}$	M1	
	$\% = \left(\frac{1}{1.2} - 1\right) \times 100$		
	$= -16\frac{2}{3}\%$	A1	
		10	