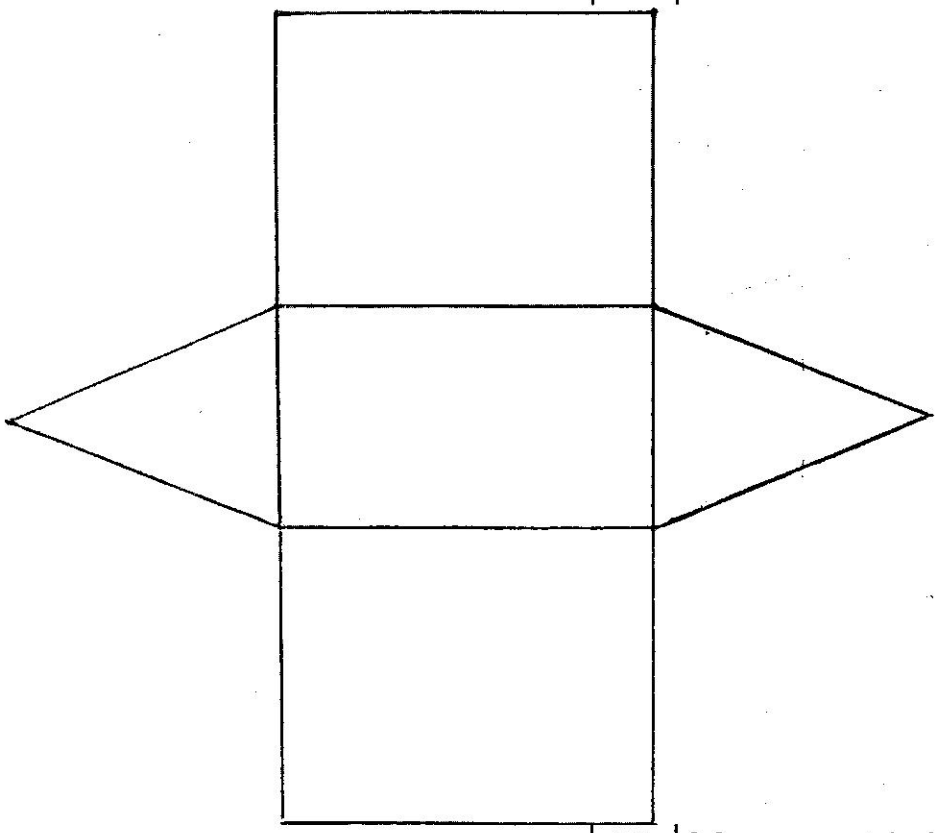
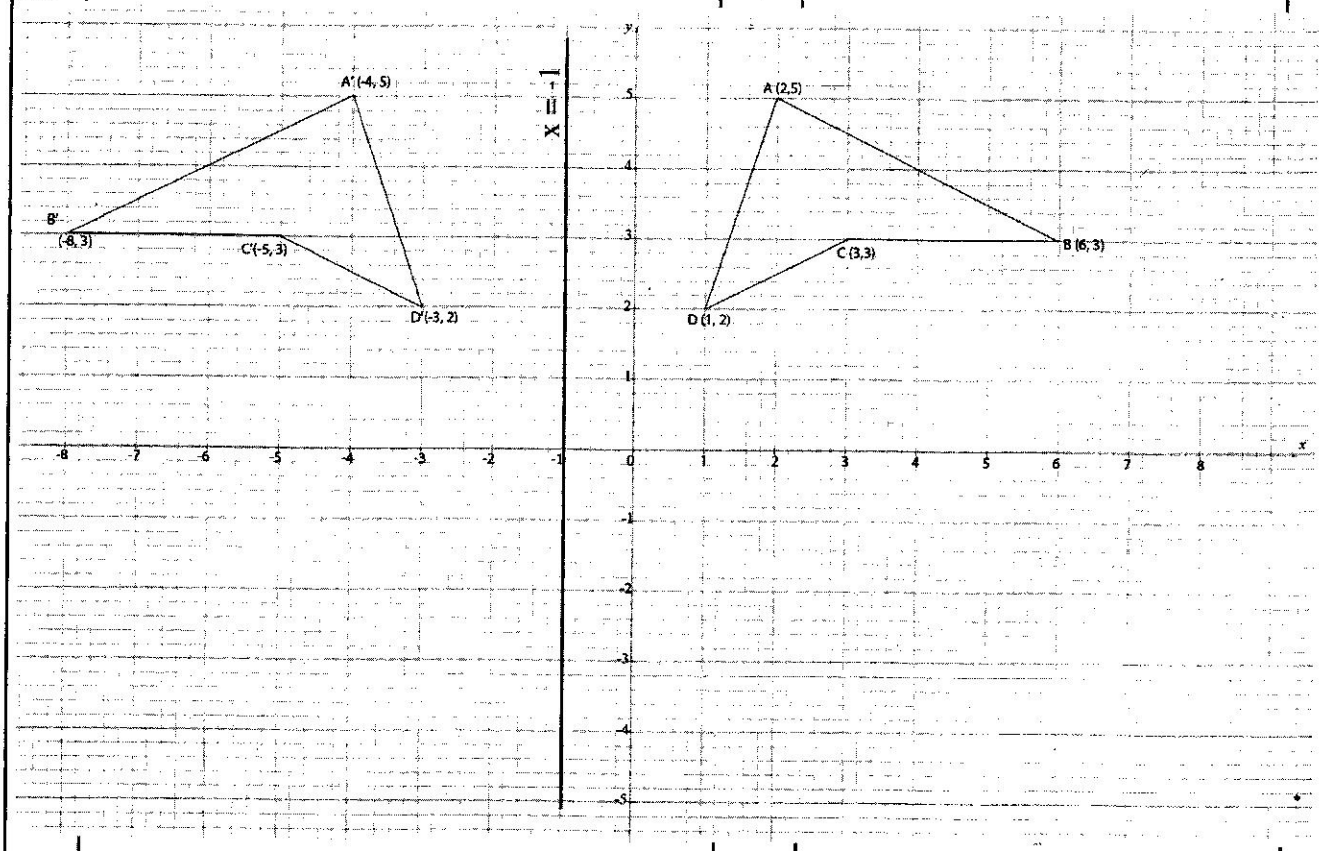
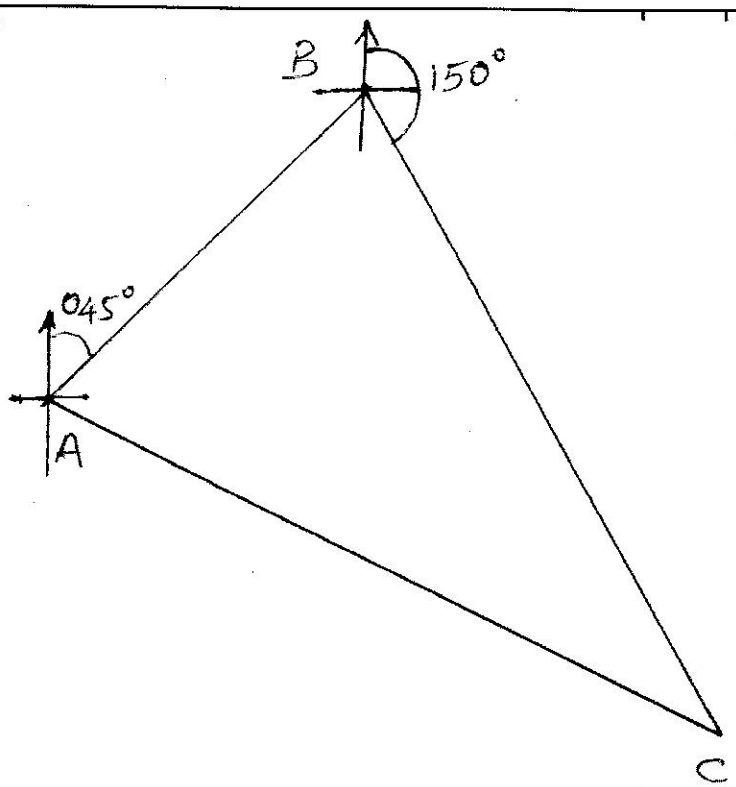
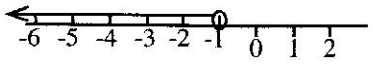
5.1.3 Mathematics Alternative B (122/1)

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 $= 360^\circ - 81^\circ$ $= 279^\circ$ Length of major arc $=\frac{279^\circ}{360^\circ}\times 31.24$ $= 24.211$

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	

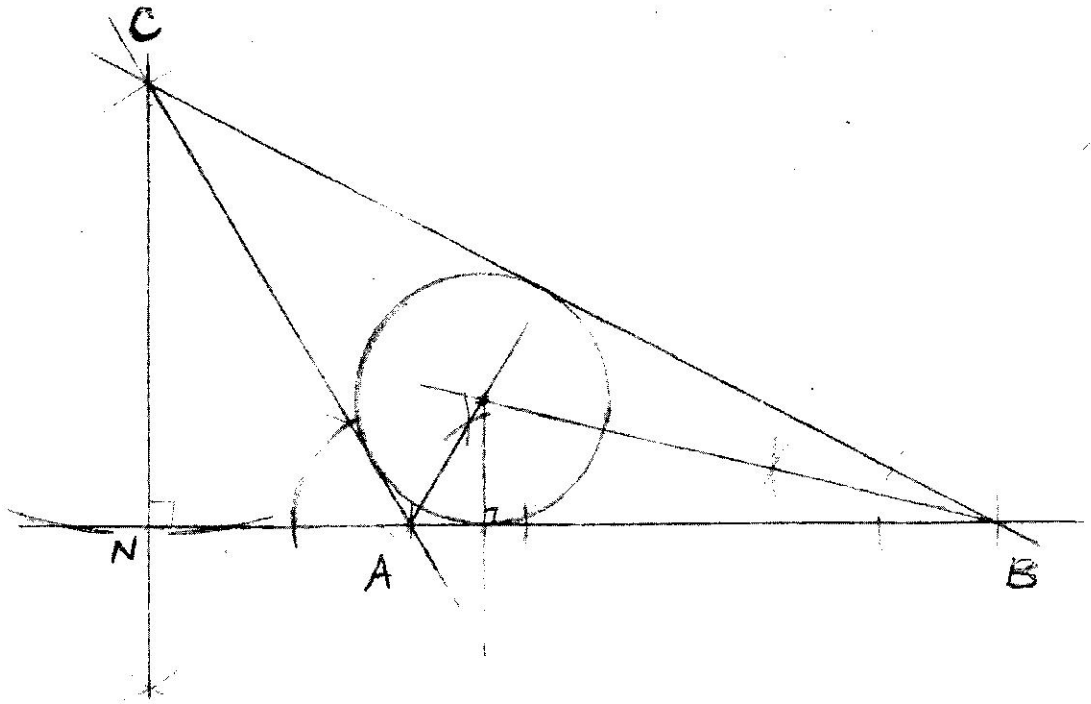
13.	 (a) AB accurately drawn BC accurately drawn (b) distance from A to C = 10.2 x 10 = 102 km	B1 B1 M1 A1 4	AC = 10.2 ± 0.1 cm
14.	(a) height $= \sqrt{13^2 - 5^2}$ $= 12$ cm (b) volume $= \frac{1}{3} \times 8 \times 6 \times 12$ $= 192\ cm^3$	M1 A1 M1 A1 4	
15.	$-5x - 3 > 2x + 4$ $-5x - 2x - 3 > 4$ $-7x > 7$ $x < -1$ 	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) $2 \times \frac{1}{2} \times 5 \times 5 \text{ Sin } 150^\circ$ $= 12.5 \text{ cm}^2$ b) (i) $\frac{\frac{1}{2}BD}{5} = \text{Sin } 75^\circ$ $BD = 9.7$ (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

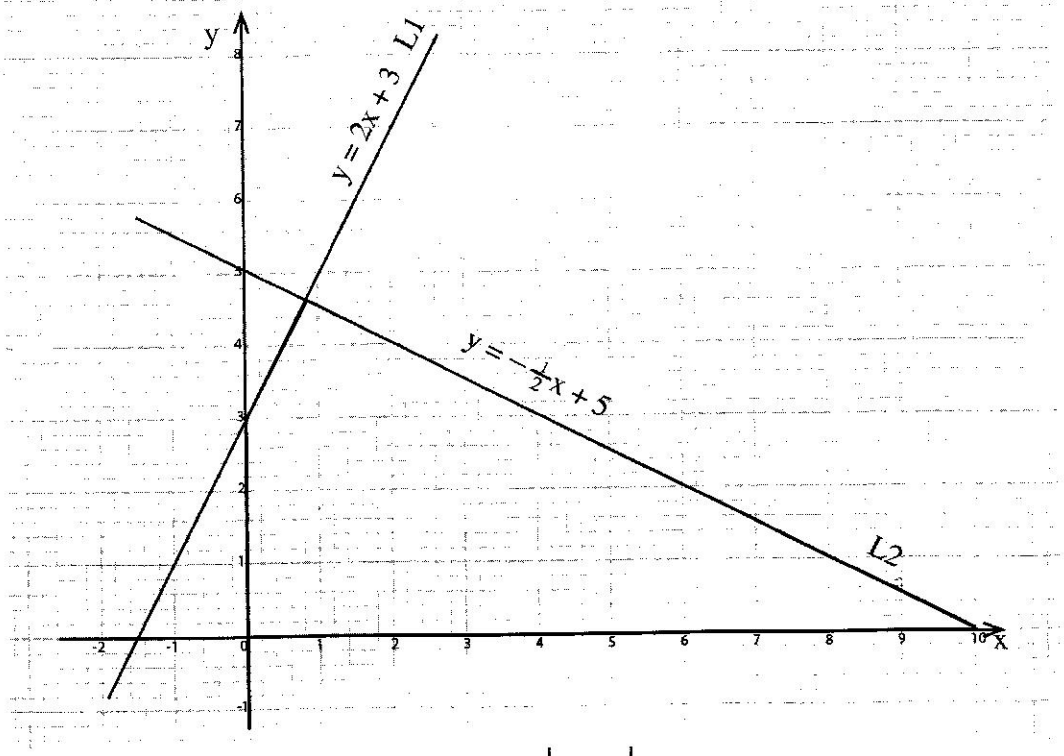
20.	a) (i) 10:800 1:80 height of door on photograph: $= \frac{240}{80}$ $= 3$ cm	 B1 M1 A1	
	(ii) L.S.F = 1:80 A.S.F = 1:6400 ∴ Actual area of the window $= \frac{1.4 \times 6400}{10\,000}$ $= 0.896\ m^2$	 B1 M1 A1	 or equivalent
	b) (i) Volume scale factor $= (\sqrt{16})^3 : (\sqrt{49})^3$ $= 64 : 343$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

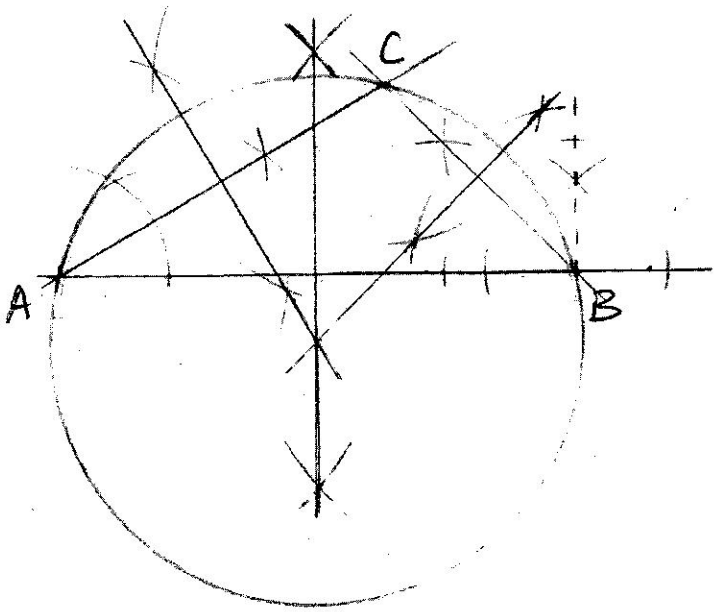
22.	a) $3600 \times 22.07 + 4500 \times 107.93$	M1	√ conversions
		M1	sum
	$= 565137$	A1	
	b) (i) $2000 \times 80.89 + 5000 \times 11.60$	M1	√ conversions
		M1	sum
	$= 219780$	A1	or equivalent e.g. 35% used correctly
	(ii) $219780 \times \frac{65}{100}$	M1	
	$= 142857$		
	Balance:		
	$219780 - 142857$	M1	
	$= 76923$		
	Exchange:		
	$= \frac{76923}{128.55}$	M1	
	$\simeq 598$	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 M1	for 11.5 and 4.6
	$= 26.45$	A1	
		10	

24.	a) $(3x + 1)2x = 6x^2 + 2x$	B1	
	b) (i) $(2x + 2)4x = 6x^2 + 2x + 36$	M1	
	$2x^2 + 6x - 36 = 0$		
	$(2x + 12)(x - 3) = 0$	M1	
	$x = 3$	A1	
	(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	

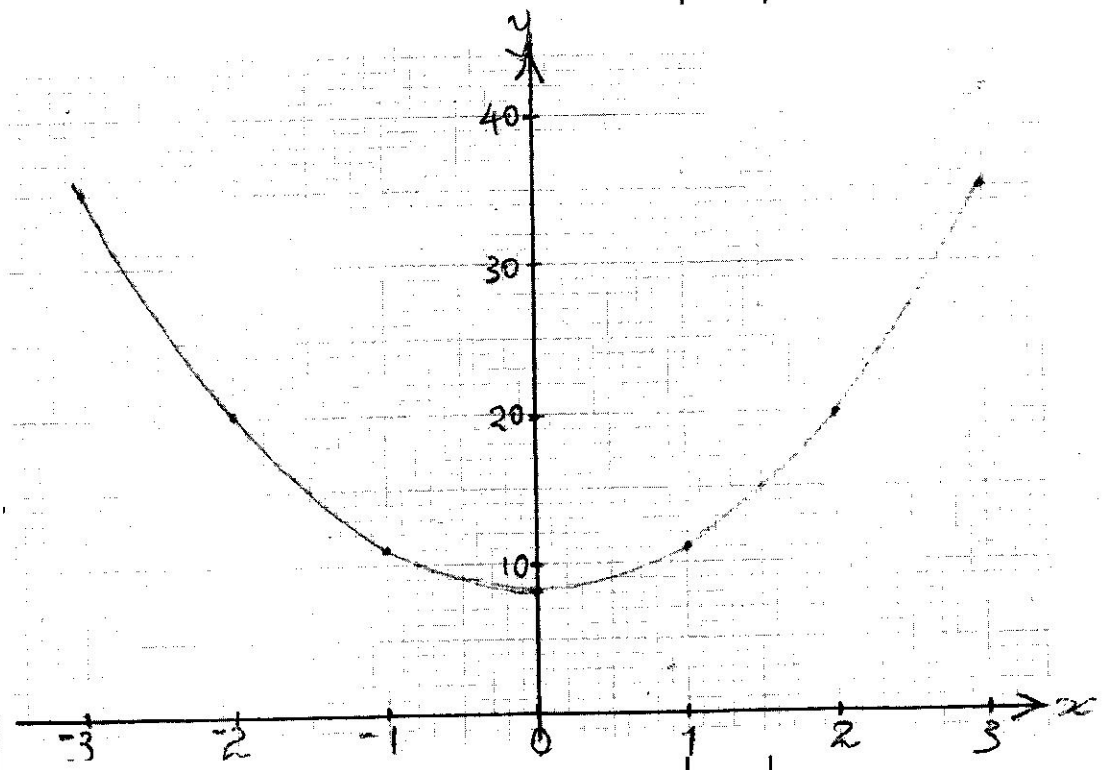
5.1.4 Mathematics Alternative B Paper 2 (122/2)

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 3	classes frequencies
(b)	modal class $= 21 - 30$	B1	
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.	$AC^2 = 8^2 + 6^2 - 2 \times 8 \times 6 \cos 120°$ $= 64 + 36 - 96 \times -0.5$ $AC = \sqrt{148} = 12.17$	M1 M1 A1 3	
11. (a)		B1	
(b)		P1 C1 3	

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



12.	1st *bracket*: $9680 \times \frac{10}{100}$ $= 968$ 2nd *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* $= 15° + 6 = 21°$ *Time diference* $= 21 \times 4 = 84$ min *local time at* $R = 8.30 + 1h\ 24$ min $= 9.54$ *pm*	B1 B1 B1 3	
15.	$\begin{array}{cc} & \begin{array}{ccc} P & Q & R \end{array} \\ \begin{pmatrix} a & b \\ c & d \end{pmatrix} & \begin{pmatrix} -3 & 1 & 4 \\ 1 & 3 & -2 \end{pmatrix} \end{array} = \begin{array}{c} \begin{array}{ccc} P' & Q' & R' \end{array} \\ \begin{pmatrix} 6 & -2 & -8 \\ -2 & -6 & 4 \end{pmatrix} \end{array}$ $-3a + b = 6 \qquad c + 3d = -6$ $a + 3b = -2 \qquad 4c - 2d = 4$ $a = -2 \qquad c = 0$ $b = 0 \qquad d = -2$ *Matrix* $= \begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$	M1 M1 A1 B1 4	

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

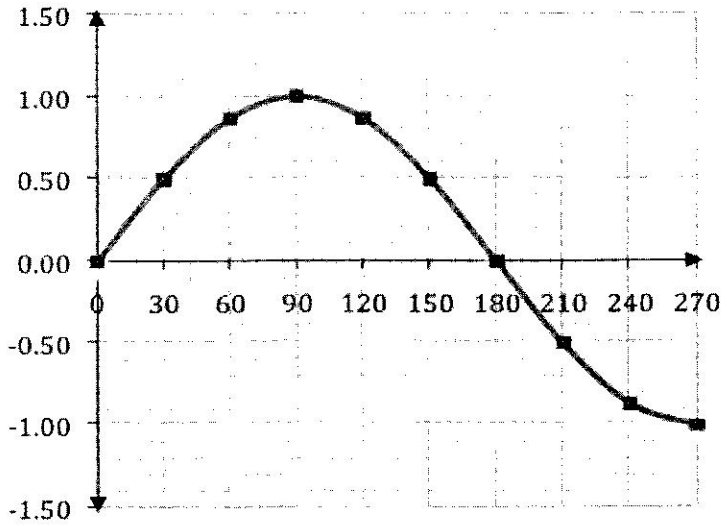
18.	(a) $R = \begin{pmatrix} x & 3 \\ 2x & 3x \end{pmatrix}$		
	$\therefore 3x^2 - 6x = 0$	M1	
	$3x(x-2) = 0$	M1	
	$x = 0$ *or* $x = 2$	A1	
	(b) (i) $BA = \begin{pmatrix} 2 & -1 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 3 & 1 \\ 2 & 4 \end{pmatrix}$	B1	
	$= \begin{pmatrix} 4 & -2 \\ 2 & 4 \end{pmatrix}$		
	(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

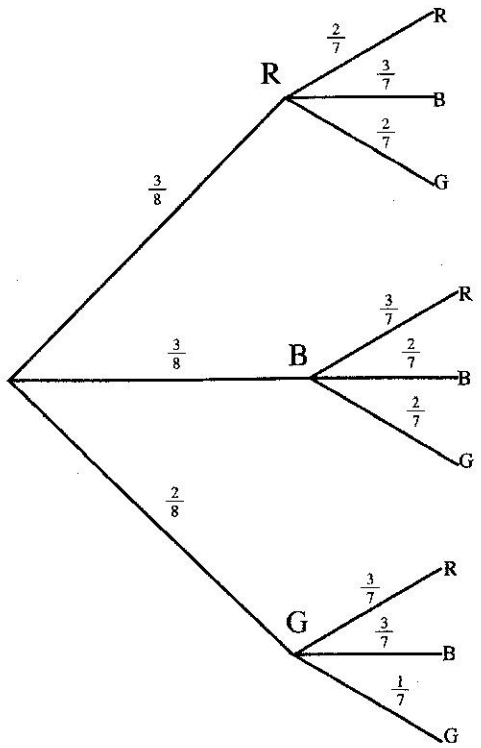
(c) x when y = 0.7

x = 45° B1
= 135° B1

(d) sin x = - 0.4 B1
x = 204° B1

10

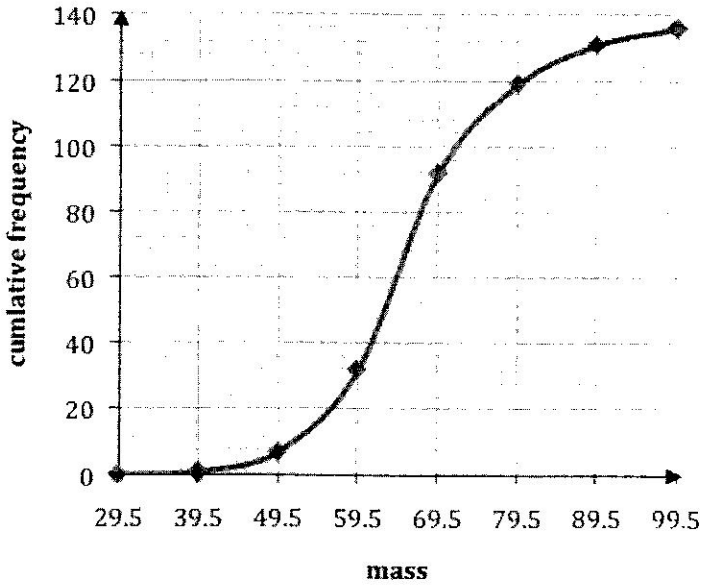
20.	(a) (i) $OP = \frac{2.5}{\sin 50°}$	M1	
	$= 3.26$ cm	A1	
	(ii) $AP = \frac{2.5 \sin 40°}{\sin 50}$	M1	
	$= 2.10$	A1	
	(iii) $AC = 2\ AE$		
	$= 2 \times 2.5 \sin 40°$	M1	
	$= 3.21$	A1	
	(b) (i) $\angle PAC = 40°$ (sum of $\angle$s in $\triangle$ AEP)	B1	
	$\angle ADC = 40°$ (angle in alt. segment)	B1	
	(ii) $\angle ACD = \frac{1}{2}(180° - 40°)$	M1	
	$= 70°$	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 B1	1st set branches 2nd set branches
	(b) (i) P (both balls red) $= \frac{3}{8} \times \frac{2}{7}$ $= \frac{3}{28}$	M1 A1	
	(ii) P (one ball red and one ball green) $= \frac{3}{8} \times \frac{2}{7} + \frac{2}{8} \times \frac{3}{7}$ $= \frac{6}{56} + \frac{6}{56} = \frac{3}{14}$	M1 M1 A1	
	(iii) P (different colours) $= 1 - \left[\left(\frac{3}{8} \times \frac{2}{7}\right) + \left(\frac{3}{8} \times \frac{2}{7}\right) + \left(\frac{2}{8} \times \frac{1}{7}\right)\right]$ $= 1 - \frac{14}{56} = \frac{3}{4}$	M1 M1 A1	P (same colours) 1 - P (same colours)
		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 points
C1	

(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	