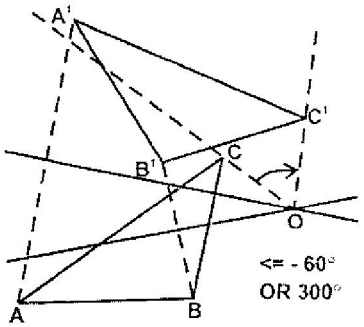
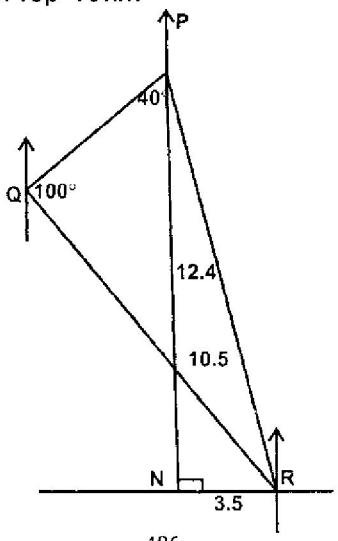
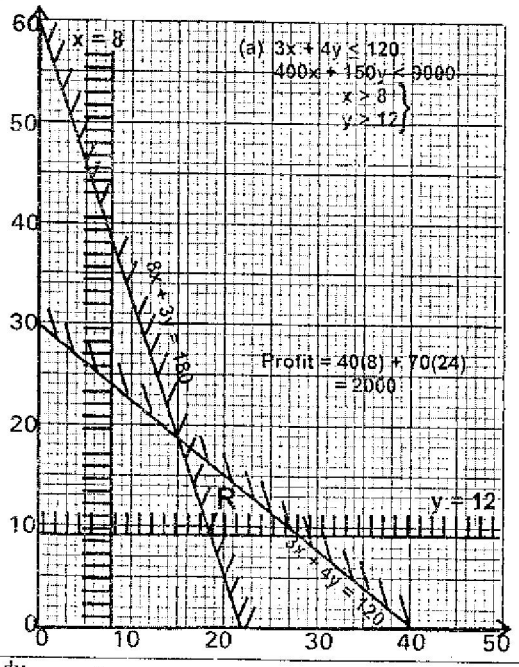
K.C.SE 2003 MATHEMATICS PAPER 121/2 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE
1. $23.47 \longrightarrow 3.3705$ $0.4666 \longrightarrow \bar{1}6689 = 3.0394$ $\sqrt[3]{0.0924} \longrightarrow \bar{2}.9657 = \bar{1}6552$ $2.422 \times 10^3 \longleftarrow 3 = 3.3842$ 2.422×10^3 0.423×10^3 $\quad 2422^3$	M1 M1 M1 A1 4 marks	All 3 logs $3\sqrt{\text{tables}}$ Attempt to add logs M_0 Attempt to divide by 3 & sin M_1 Accept standard form
2. Selling price $= \frac{87}{100} \times 800$ $= 696$ Cost price $= \frac{100}{120} \times 696$ $= 580$	M1 M1 A1 3 marks	
3. (a) Mode = 1 (b) Mead $= \frac{0\times5+1\times6+2\times4+3\times3+4\times1+5\times1}{20}$ $= 1.6$	B1 M1 A1 3 marks	Accept 32 20 Or $1\frac{3}{5}$
4. Gradient of AB $= \frac{-4-8}{3-(-3)} = -2$ Through (3, 40) $\frac{y-4}{x-3} = -2$ $y = 2x + 10$	M1 M1 A1 3 marks	$Y = -2x + C$ $4 = -2(3) + C$ substitute $C = 10$
5. $\log (6x - 2) - \log 10 = \log (x - 3)$ $\log \left[\frac{6x-2}{10}\right] = \log (x-3)$ $\frac{6x-2}{10} \; x - 3$ $6x - 2 = 10x - 30$ $x = 7$	M1 M1 A1 3 marks	For single logs on both s for dropping logs correctly
6. (a) 72km/hr $= \frac{72 \times 100m}{60 \times 605}$ $= 20m/s$ (b) Let l be length of train $\frac{l+80}{20} = 15$ $l = 300 - 80 = 220m$	B1 M1 A1 3 marks	Let length of train & bridge be x $x \div 20 = 15 \quad = 300$ $l = 300 - 80$
7. 	B1 B1 B1 3 marks	for 1 mediator for 2nd mediator and centre labeled Or equivalent
8. $\frac{dy}{dx} = 2 - 8x = 0$ $x = \frac{1}{4}$ $y = 6 + 2\left(\frac{1}{4}\right) - 4\left(\frac{1}{4}\right)^2$ $= 6\frac{1}{4}$ Turning point $\left(\frac{1}{4}, 6\frac{1}{4}\right)$	M1 M1 A1 3 marks	Derivative equated to zero At least 1 term correctly differential

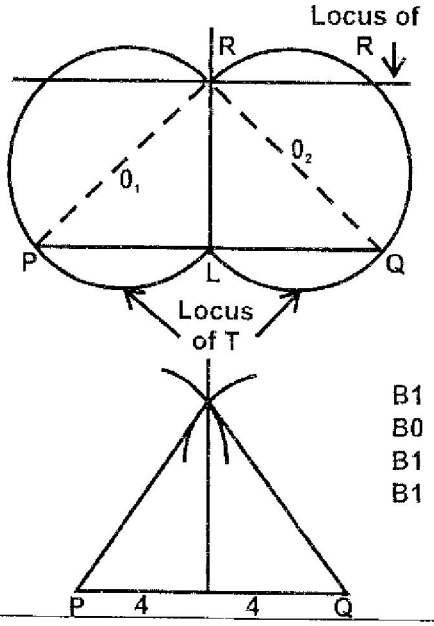
SOLUTION	MARKS	ALTERNATIVE
9. S.A $=\frac{1}{2}(4\pi^2) + \pi r^2 75\pi$ $r^2 = \frac{75\pi}{3\pi} = 25$ $r = 5$ $V = \frac{1}{2}\left[\frac{4}{3}\pi \times 5^3\right]$ $= 88\frac{1}{3}\pi$	M1 A1 M1 A1 4 marks	S.A of sphere MRE – 5 R = 4.331 V = 108.3 Accept $\frac{250}{3}\pi 83.33\pi$
10.A $= \frac{1}{\sqrt{3}} \Rightarrow \sqrt{3a} = 1$ $2\sqrt{3} - 6\sqrt{39} = 2\sqrt{3} - 6\sqrt{3}\sqrt{13}$ $= 2\left[\frac{1}{a}\right] - 6\left[\frac{1}{a}\right]b$ $2 = \frac{2}{a} - \frac{6b}{a}$ $= \frac{2-6b}{a}$ or $\frac{2}{a}(1-3b)$	B1 M1 A1 3 marks	$A = \frac{1}{\sqrt{3}} \Rightarrow a\sqrt{\frac{2}{3}}$ 2(3a) – 6(31)b = 6a – 18ab = 6a(1 – 36)
11.(a) $(8-x)^2 = 2^6 - 6.2^5x + 15.2^4x^2 -$ $20.2^3x^3 + 15.2^2x^4 - 6.2x^5 + x^6$ $= 64 - 192x + 240x^2 - 160x^3$ $+ 60x^4 - 12x^5 + x^6$ (b) $1.993 = (2 - 0.01)^6$ $= 64 - 192(0.01) + 240(0.01)^2$ $= 64 - 1.92 + 0.24$ $= 62.104$	M1 A1 M1 A1 4 marks	Coefficient and correct powers of x
12.$x + y \leq 440$ $y \geq 120$ $x \geq 150$	B1 B1 B1 3 marks	
13.Work done by A $= 3\frac{1}{2} \times \frac{1}{6}$ $\frac{7}{2} \times \frac{1}{6} = \frac{7}{12}$ Remaining work $= 1 - \frac{1}{6} - \frac{7}{14}$ Time taken by B $= \frac{5}{12} \div \frac{1}{9}$ $= \frac{5}{12} \times \frac{9}{1} = \frac{45}{12}$ $= 3\frac{1}{4}$hr	M1 M1 A1 3 marks	
14.A:W:M = 10:8:5 Amount shared $= \frac{23}{5} \times 10000$ $= 46000$ Atieno's extra $= \frac{2}{23} \times 46000$ $= 4000$	M1 M1 A1 3 marks	Or equivalent Or equivalent
15.A = 250, r = 2, n $= \frac{16}{2} + 1 = 9$ $T_9 = 250 \times 2^8$ $= 64000$	B1 M1 A1 3 marks	For a, r and n correct allow for T_8 M_1 M_0 For 250 seen, evidence of doubling and nine terms. For consistent doubling for 64000

Days	0	2	4	6	8	10	12	14	16
Insects	250	500	1000	2000	4000	8000	16000	32000	4000

SOLUTION	MARKS	ALTERNATIVE
16. $S \propto t + \sqrt{t} \Rightarrow S = kt + p\sqrt{t}$ $14 = 4k + p\sqrt{4}$ $27 = 9k + p\sqrt{4}$ $42 = 12k + 6p$ $54 = 18k + 6p$ $-12 = -6k$ $k = 2$ & $p = 3$ $S = 2t + 3\sqrt{t}$	M1 M1 A1 B1 4 marks	For 1 equation Attempt to solve simultaneous equation
17. (a) $\left.\begin{matrix} x+y=19 \\ -x3y=9 \end{matrix}\right\} \Leftrightarrow \begin{bmatrix} 5 & 1 \\ -1 & 3 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 19 \\ 9 \end{bmatrix}$ Inverse $= \frac{1}{16}\begin{bmatrix} 3 & -1 \\ 1 & 5 \end{bmatrix}$ $\frac{1}{16}\begin{bmatrix} 3 & -1 \\ 1 & 5 \end{bmatrix}\begin{bmatrix} 5 & 1 \\ -1 & 3 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{16}\begin{bmatrix} 3 & -1 \\ 1 & 5 \end{bmatrix}\begin{bmatrix} 19 \\ 9 \end{bmatrix}$ $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{16}\begin{bmatrix} 48 \\ 64 \end{bmatrix}$ $x = 3$ and $y = 4$ (b) $\sqrt{(11-3)^2 + (-2-4)^2}$ $= \sqrt{64+36}$ $= 10$cm	B1 B1 M1 M1 A1 M1 M1 A1 8 marks	
18. (a) Cost of 1st brand per kg $= \frac{5 \times 140 + 3 \times 160}{8}$ $= 147.50$ % profit $= \frac{180 - 147.50}{147.50} \times 100\%$ $= 22.03\%$ (b) (i) X: Y = 5:3 $\Rightarrow x = \frac{2}{3}y$ Y: Z = 2:5 $\Rightarrow z = \frac{3}{2}y$ X:Y:Z $= \frac{2}{3}y : y : \frac{3}{2}y$ = 10:6:15 (ii) Cost/kg $= \frac{10 \times 140 + 6 \times 160 + 15 \times 256}{31}$ = Sh. 200 New price $= \frac{130}{100} \times 200$ = Sh. 260	M1 M1 A1 M1 A1 M1 M1 A1 8 marks	
19. 1cm rep 40km  Time $= \frac{496}{1.853 \times 40} = 6.691$hr		

SOLUTION	MARKS	ALTERNATIVE
20.  	B1 B1 B1 L1 L1 L1 M1 A1 4 marks	8x + 3y≤180 Accept if x = 8 given 3x ÷ 4y≤ 120 drawn & shade 8x : 3y≤ 180 drawn & shade x≥8 and y≥ drawn & shade accept if x = 8 drawn

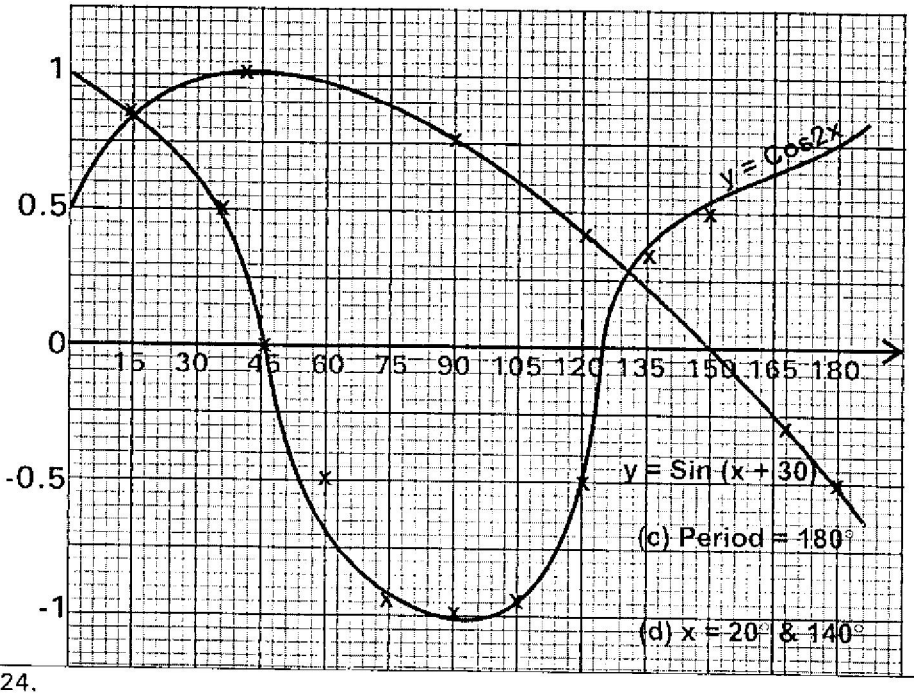
21. $\frac{dy}{dx} = 3x^2 - 3 = 0$
$3(x^2 - 1) = 0$
x = 1, y = 0 & x = -1, y = 4
Coordinates are (1, 0) & (-1, 4)
For (1, 0) $x<1$, $\frac{dy}{dx}$ is –
$x>1$, $\frac{dy}{dx}$ is +
⇒(1, 0) is a minimum
For (-1 4) $x< -1$, $\frac{dy}{dx}$ is –
⇒(-1, 4) is a maximum
	M1
	
	M1
	
	M1
	
	A1
	
	3 marks
		Can try second derivative
		$\frac{d^2y}{dx^2}$

22.  	B1 B0 B1 B1	A perpendicular to PQ drawn A parallel line 3cm above PQ drawn. Perpendicular to PQ drawn at L. R identified Locating centre 0_1. Major arc RPL drawn. Locating centre 0_2. Major arc RQL drawn apply 0w – once if complete circles drawn.

SOLUTION | **Marks** | **Alternative**

23.

x	30	75	105	135	165
Cos x°		0.87	0.97	0.97	
Sin(x+30)°		0.97		0.26	-26



B2

S1

P1

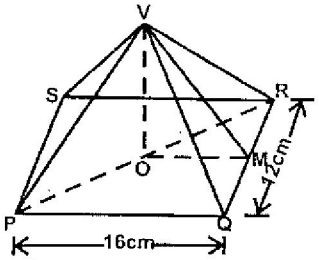
C1

B1

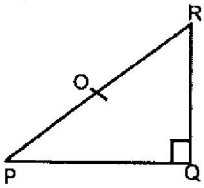
B1

8 marks

24.



(a) Projection of VP on plane PQRS – PO



OP - $\frac{1}{2}\sqrt{16^2 + 12^2}$

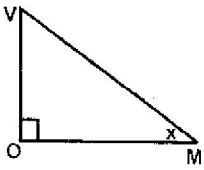
$\frac{1}{2}\sqrt{400} = 10$cm

(b) <between VP and PQRS = <VPO

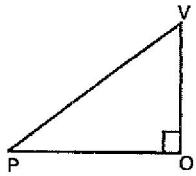
Cos Q = $\frac{10}{13}$

= 0.5556

Q = 56° 15′



(c) <between VQR and PWRS = <VMO = α



VM = $\sqrt{18^2 - 6^2}$

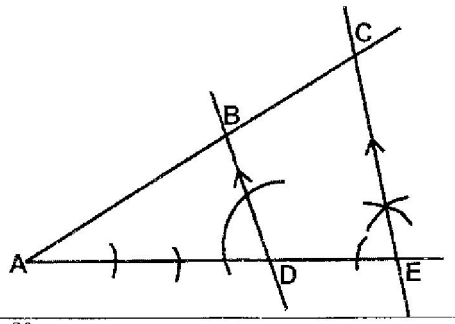
= $\sqrt{288}$ = 16.9

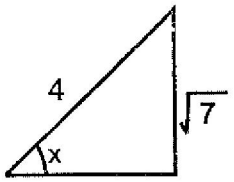
Cos x = $\frac{13}{16.97}$

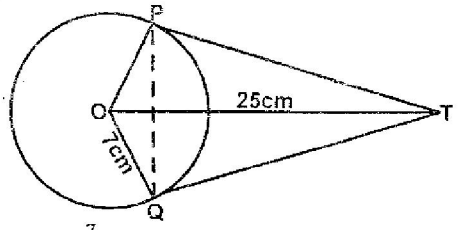
α = 61° 52′

= (61.87°)

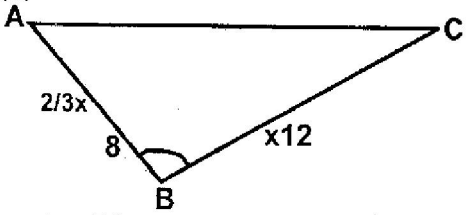
K.C.SE 2004 MATHEMATICS PAPER 121/1 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE
1. $\frac{0.015 \div 0.45 \div 1.5}{4.9 \times 0.2 + 0.07}$ $= \frac{0.015 \div 0.3 + 0.3}{0.98 + 0.07}$ $= \frac{0.315}{1.05}$ $= 0.3$	M1 M1 A1 3 marks	For operations
2. $(180° - 156°)n = 360$ $24n = 360$ $n = \frac{360}{24}$ $= 15$	M1 A1 2 marks	For $\frac{360}{24}$
3. $\frac{(2a + b)(a - 2b)}{(2a + b)(2a - b)}$ $= \frac{a - 2b}{2a - b}$	M1 M1 A1 3 marks	For factorization of nun for factorization of deno
4. $\underline{OB} - \underline{OA} = (\underline{4i} + \underline{j} - \underline{3k}) - (\underline{3i} - \underline{2j} + \underline{k})$ $= \underline{4i} + \underline{j} - \underline{3k} - \underline{3i} + \underline{2j} - \underline{k}$ $AB = \underline{i} + \underline{3j} - \underline{4k}$ Accept column rectors $= \sqrt{1^2 - 3^2 \div (-4)^2}$ $= \sqrt{1 + 3j - 4k}$ $= \sqrt{1 + 9 \div 6}$ $= \sqrt{26}$ $= 5.099$ $= 5.10$ to 2 decimal places	M1 A1 2 marks	$(\underline{3i} - \underline{2j} + \underline{k}) - (\underline{4i} - \underline{j}) - \underline{3k}$ $\underline{3i} - \underline{2j} - \underline{k} - \underline{4i} - \underline{j} + \underline{3k}$ $BA = \underline{-i} - \underline{3j} + \underline{4k}$ $BA = \sqrt{(-1)^2 + (-3)^2 + 4^2}$ $= \sqrt{1 + 9 \div 16}$ $= \sqrt{26}$ $= 5.099$ $= 5.10$ A1
5. $A = 10t - 12$ $= 10 \times 2 - 12$ $= 8ms^{-2}$	M1 M1 A1 3 marks	Sub of $t = 2$
6. 	M1 M1 A1 3 marks	* Division of AE into 5 equal parts B1 * Joining BD drawing a line through E parallel to BD B1 * Identification of point C or equivalent proc. Construction marks must be seen.
7. $\frac{30}{100} \times 1.8 \times 10^6 = 540000$ $= \frac{120000}{1800000} \times \frac{540000}{1800000}$ $= \frac{1}{50}$ or 0.02 or 2%	M1 M1 A1 3 marks	$\frac{30}{100} \times \frac{120\,000}{180\,0000}$ M1 m $= \frac{1}{50}$ or 0.02 or 2%
8. $3 \times 1.485 + 13 \times 6.410$ $= 4.455 + 83.33$ $= 87.785$	M1 M1 A1 3 marks	Reciprocals seen adding the product 130 + 130 0.735 1.56 $30 \times 0.1485 + 130 \times 0.641$ $4.655 + 83.33$ M1 $= 87.785$ A1

SOLUTION	MARKS	ALTERNATIVE
9. $8(1 - \cos^2 x) + 2\cos x - 5 = 0$ $8\cos^2 x - 2\cos x - 3 = 0$ $(2\cos x + 1)(4\cos x - 3) = 0$ $\cos x = \frac{3}{4}$ $\tan x = \sqrt{\frac{7}{3}}$ $(\tan 41.41) = 0.8519$ $(\tan 41.41) = 0.9316$  	M1 M1 A1 B1 4 marks	(substitution) Or $(2p+1)(4p-3)$ M1 Disqualify $\cos x = \frac{1}{2}$ $X = 41.412$ 41.4 or 41.42 or 41 $\tan x = 0.8819$ $\tan 41.42 = 0.88.22$ $\tan 41°25^1 = 0.88.21$
10. $480\,0000 \times \frac{100}{96} = 500\,000$ $800\,0000\left(1 - \frac{r}{100}\right) = 500\,000$ $(1 - \frac{r}{100})^5 = \frac{5}{8} = 0.625$ $1 - \frac{r}{100} = \sqrt[5]{0.625}$ $= 9.103 \times 10^{-1}$ $= 1 - 0.9103$ $= \frac{r}{100} = 0.0897$ $r = 8.97\%$	M1 M1 M1 A1 4 marks	$A = 480\,000\frac{(100)}{96}$ M1 $800000(1-r)^5 = 480000 \times \frac{100}{96}$ $(1-r)^5 = \frac{480000}{800000} \times \frac{100}{97}$ $\frac{1-r}{r} = 50.625$ M $= 8.97\%$ A1 $T.\frac{7959}{5} = 1.955918$ If $480000 \times \frac{100}{96}$ $\text{Log}\frac{5}{8} = 5\log(1 - \frac{r}{100})$ M $0.913 = 1 - \frac{r}{100}$ $r = (1 - 0.9103)\,100$ $= (1 - 0.9103) \times 100$ $= 98.97\%$ A1
11.(a) x: ½, 2½, 4½, 5½ y: 3¼, 9¼, 23¼, 33¼ (b) Mid ordinates 3¼, 5¼, 5¼, 15¼, 23¼, 33¼ Area = 1(3¼: 5¼ - 9¼ + 15¼ 23¼ - 33 = 89½	M1 M1 M1 A1 4 marks	Can be implied If BO is legitimate than M1 M1 then M1 M1 AO
12.(a) Let $\angle QSE = \theta$ $4^2 = 5^2 + 8^2 - 2 \times 5 \times 8\cos\theta$ $\cos\theta = \frac{89 - 16}{80} = \frac{73}{80} = 0.9125$ $\theta = 24°\,9$ $24°\,8$ 24, 14 $24°\,14°$ (b) Area of PQS $= \frac{1}{2} \times 8 \times 10 \sin 24°\,9$ $= 40 \times 0.4091$ $= 10.825\text{cm}^2$ $= 16.36\text{cm}^2$	M1 M1 M1 A1 4 marks	$S = \frac{1}{2}(5+8+4) = 8.5$ Area $= 8.5(3.5)(0.5)(4.5)$ $\frac{1}{2} \times 5 \times 8\sin\theta = 8.5(3.5)(0.5)(4.5)$ 24.15° 24.13° 24.14° 24.15° Sin 24°8 40×0.4089 $= 16.36\text{cm}^2$ $= 16.364\text{cm}^2$
13. Area of equilateral $= \frac{1}{2} \times 5 \times 5 \sin 60°$ $= \frac{1}{2} \times 5 \times 5 \times 0.866$ $= 10.825\text{cm}^2$ x - section area $= 6 \times 10.825$ $= 64.95\text{cm}^2$ Volume of the prism $= 64.95 \times 20$ $= 1299\text{cm}^3$		Logs used 10.82 6×10.82 $= 64.92\text{cm}2$ $= 64.92 \times 20$ M1 1298.4cm3 A1 If logs used thro V = 13000 1298.9 (partial logs)

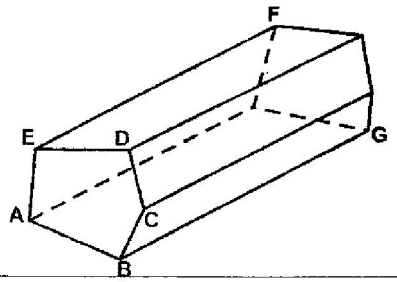
SOLUTION	MARKS	ALTERNATIVE
14.  $\text{Cos} = \frac{7}{25}$ = 73° 44 or 73.74 PQ = 7 x 2 sin 730 44 = 14 x 0.9600 = 13.44cm	M1 M1 A1 B1 4 marks	At t $\text{Sin}\theta = \frac{24}{7}$ $\theta = 73.74$ $\frac{PQ}{\text{Sin }0} = \frac{7}{\text{Cos }0}$ $PQ = \frac{7\,\text{Sin}2\theta = 7\,\text{Sin}}{\text{Cos }0 = \text{Cos }7}$ $= 7 \text{ sin } 32.5 = \frac{7 \text{ sin } 32.5}{\text{Cos } 73.74}$ Cos 0 + 0.28 Accept equivalent Tan $= \frac{24}{7}$ Sin $= \frac{7}{25}$ until $\text{Sin}\,\theta = \frac{2}{2}$ If logs used follow thro Alt PT $= \sqrt{(25)^2 - (7)^2}$ Cos $\theta = \frac{24}{25}$ M1 PM = 6.75 PQ = 2 pm = 2 x 6
15. Bisecting exterior angles or one internal angle at x described circle. Bisecting ∠ZXY and any external < circle to YZ	B1 B1 2 marks	Not radius = 4.6cm Construction area must be seen
16. Grad PQ $= \frac{-4+2}{5+1} = \frac{-1}{3}$ Midpoint of PQ $= \frac{(5+-1,\ -4+-2)}{2}$ = 2, 3) $\frac{y+3}{x-2} = 3$ y = 3x - 9	B1 B1 M1 A1 4 marks	y = mx + c -3 = 3 x 2 + c M1 -9 = c Y = 3x - 9 A1
17. (a) Total monthly income Sh(20600 + 1200 + 2880 + 340) = sh. 35820 (b) 1st 9680 : $\frac{10}{100}$ x 9680 = 968 2nd 9120 : $\frac{15}{100}$ x 9120 = 1368 3rd 9120 : $\frac{20}{100}$ x 9120 = 1824 4th 7900 : $\frac{25}{100}$ x 7900 = 1975 Total tax 6135 Less relief - 1056 Monthly tax paid sh. 5079	M1 A1 M1 M1 M1 M1 M1 A1 8 marks	$\frac{35820}{20} = -1791$ - If monthly income wrongly calculator the (m marks) are - Not scored if a m is lost
18. (a) Turning points $\frac{dy}{dx} = 3x^2 + 8x$ $3x^2 + 8x = 0$ x(3x + 8) = 0 $x = 0$ or $\frac{-8}{3}$ x = = + -2.667 turning points are (0 – 2) and (-2.7, 7.5) (b) x: -4, -3, -2, -1, 0, ; y: , 7, , , -2, 3	M1 A1 B1 B1 4 marks	$x = \frac{0}{3}, -2\,2$ -2.7 used in substitute gives y = 7.477 or 7 Apply PA - 1

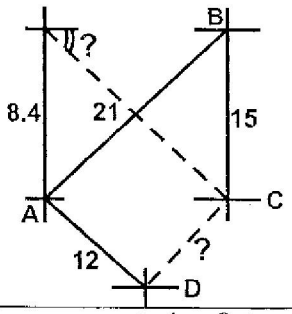
SOLUTION	MARKS	ALTERNATIVE
19.(a) Area of hemispherical part $= \frac{1}{2} \times 4\pi r^2$ $= 2 \times \frac{22}{7} \times 35 \times 35$ $= 7700cm^2$	M1 A1	Follow thro logs used $7698cm^2 - 755$ Small zone $\frac{x}{14} = \frac{x+60}{35}$ $35x = 14x + 840$
(b) Slant height for original/ zone $\frac{L}{L-60} = \frac{35}{14}$ $L = 200cm$	M1 A1	$X = 40$ Original zone is $60 \div 40 = 100cm$
(c) Surface area of frustum $= \pi RL - \pi rl$ $Ni = \frac{22}{7} \times 35 \times 100 - \frac{22}{7} \times 14 \times 40$ $= 11000 - 1760$ $= 924cm^2$ Total surface area $= 7700 + 9240 + \frac{22}{7} \times 14^2$ $= 7700 + 9240 + 616$ $= 17556cm^2$	M1 A1 M1 A1 4 marks	L.S.F = 28570 A.S.F = 4:25 asf = 21:25 or 21:54 S.A of frustun = $\frac{21}{25} \times \frac{22}{7} \times 35 \times 100m$ or = $\frac{21}{4} \times \frac{22}{7} \times 14x40 = 29240$ M. for $\frac{22}{7} \times 4$ for sum
20.(a) $-3(1) + 4p = 5$ $P = 2$ $q(1)^2 - 5(1)(2) + (2)^2 = 0$ $q - 10 + 4 = 0$ $q = 6$	M1 M1 M1	$-3(i) + 4p = 5m$ $Y = 2$ A1
(b) $6x^2 - 5x\frac{(3x+5)}{4} + \frac{(3x+5)^2}{4} = 0$ $6x^2 - 5x\frac{(3x+5)}{4} + \frac{(3x+5)^2}{16} = 0$ $96x - 20x(3x + 5) + (3x + 5)^2 = 0$ $65x^2 - 7x + 25 = 0$ $9x^2 - 14x + 5 = 0$ $(9x - 5)(x - 1) = 0$ $x = \frac{5}{9}$ and $y = 1\frac{2}{3}$	A1 M1 A1 A1 M1 8 marks	$\frac{6x^2-5xy}{(3x-y)} - \frac{5xy+y^2}{(2x-y)} = 0$ $x = \frac{1}{3}y$ or $x = 1y$ From eq(1) $y = \frac{5+3}{4}$ $x + \frac{1}{3}\frac{(5+3x)}{4}$ Minimi $x = \frac{5}{9}$, $y = 1\frac{2}{3}$ A1
21. (a) AB = DC $\begin{pmatrix}4\\0\end{pmatrix} - \begin{pmatrix}2\\-4\end{pmatrix} = \begin{pmatrix}1\\5\end{pmatrix} - \begin{pmatrix}x\\y\end{pmatrix}$ $\begin{pmatrix}x\\y\end{pmatrix} = \begin{pmatrix}1\\5\end{pmatrix} - \begin{pmatrix}2\\4\end{pmatrix}$ D = (-1, 2)	M1 M1 A1	
(b) (i) $PR = \frac{3}{2}q - \frac{1}{2}p - p$ $= \frac{3q}{2} - \frac{3p}{2}$	B1 B1	
(ii) $RQ = q - \frac{3q}{2} + \frac{1p}{2}$ $= \frac{-1q}{2} + \frac{1p}{2}$ $PR = \frac{3}{2}(9 - p)$ $RQ = \frac{-1}{2}(q - p)$ $PR = 3QR$ PR//QR and R is a common point Hence P.Q.R are collinear	B1 B1 B1	Share same duration and R or Q in a common.
(iii) $PQ = q - p$ $QR = \frac{1q}{2} - \frac{1p}{2}$ In PQ, QR = 2:1	B1 8 marks	

SOLUTION	MARKS	ALTERNATIVE
22.(a) $\angle MLN = 40°$ Angle subtended by arc MN	B1 B1	Or equivalent reason Base as isosceles D equal, in semicircle
(b) $\angle OLN = 90° - (40° + 25°)$ $= 25°$ Base as of Isosceles Δ OKL	B1 B1	$180° - (40° + 65° + 65°) = 10°$ < at centre is twice < at 0°
(c) $\angle LNP = 90° = 25° = 65°$ Angles in alternate segment	B1 B1	< sum of triangle = 180
(d) $\angle MPN = 180° - 170°$ $= 10°$ Angles of triangle KNP	B1 B1 8 marks	Trial and error accepted AB : AC = 4:9
23.(a)  Let BC = x AB $= \frac{2}{3}x$ AC $= \frac{2}{3}, \frac{9}{4} = 1\frac{1}{2}x$ $x + \frac{2x}{3} + 1\frac{1}{2}x = 38$ $\frac{19x}{x} = 38$ $x = \frac{38 \times 6}{19}$ = 12m (b) (i) S = ½ x 38 = 19 AB = 8 and AC = 18 Area $= \sqrt{19(19-12)(19-18)(19-8)}$ $= \sqrt{19 \times 7 \times 1 \times 11}$ $= \sqrt{1463}$ = 38.25 ½ x 8 12 Sin 0 = 38.25 0 = 52°, 50' = 127° 10' (ii) 182 =(12)2 + 98)2 – 2 x 12 x 8 Cos $\theta = \frac{-24 + 144 + 64}{492} = \frac{7}{4}$ Cos θ = -0.6042 θ = Cos – (0.6042) 52.83° θ = 127° 17' 127.17°		4AC = 9AB AC $= \frac{9}{4}$AB $= \frac{9}{4} \times \frac{2}{3} \times M$ $\frac{3x}{2} + \frac{2x}{3} + x = 38m$ 9x = 4x + 6x = 228 19x = 228 $x = \frac{228}{19}$ = 12m
24.NOT IN SYLLABUS		

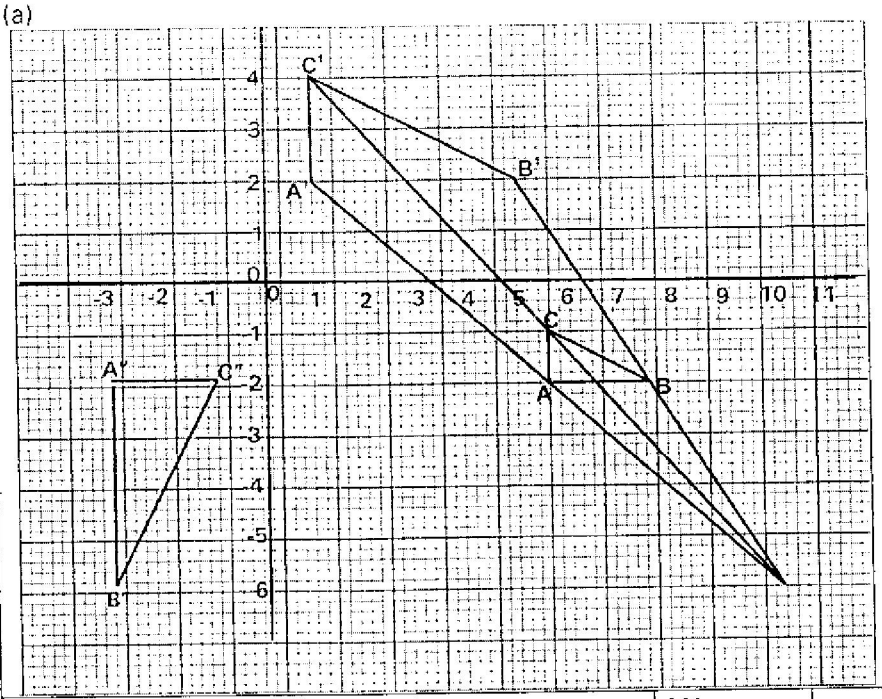
K.C.SE 2004 MATHEMATICS PAPER 121/2 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE
1. $5.25 \longrightarrow 0.702$ $\frac{0.042 \longrightarrow \bar{2}.6232}{\bar{1}.3424}$ ✓ $= \frac{-2}{1.67171}$ ✓ $34.33 - 1.5357$ $\frac{T.6717}{1.8640}$ ✓ $= 73.11$ ✓	M1 M1 M1 A1 4 marks	
2. $\frac{92}{100} \times 400{,}000 \times \frac{100}{115}$ ✓ = Sh. 320,000✓	M1 A1 2 marks	
3. A = 2, d = 4 Sn = n(2 x 2 x (n - 1) 4) = 800 n(4 + (n - 1) 4) = 1600✓ $4n^2 = 1600$ $n^2 = 400$ n = 20✓	M1 A1 2 marks	
4. Distance = 72 + 78 = 150m✓ Speed = 108 + 72 = 180km/h✓ Time = $\frac{150 \times 60 \times 60}{180 \times 1000}$ ✓ = 3 sec✓	M1 M1 A1 3 marks	
5. $2\log_{10}5 - \frac{1}{2}\log_{10}16 + 2\log_{10}40$ $\text{Log}\left(\frac{(25 \times 40}{4} \times 40\text{✓}\right) = \log 10000$✓ = 4✓	M1 A1 2 marks	
6. NOT IN SYLLABUS		
7. $4x + 3y = 18$ $5x - 2y = 11$ $\begin{bmatrix}4 & 3\\5 & -2\end{bmatrix}\begin{bmatrix}x\\y\end{bmatrix} = \begin{bmatrix}18\\11\end{bmatrix}$ $\frac{-1}{23}\begin{bmatrix}-2 & -3\\-5 & 4\end{bmatrix}\begin{bmatrix}4 & 3\\5 & -2\end{bmatrix}\begin{bmatrix}x\\y\end{bmatrix} = \frac{1}{23}\begin{bmatrix}-2 & -3\\-5 & 4\end{bmatrix}\begin{bmatrix}18\\11\end{bmatrix}$ $\begin{bmatrix}x\\y\end{bmatrix} = \frac{-1}{23}\begin{bmatrix}-69\\-46\end{bmatrix}$ $= \begin{bmatrix}3\\2\end{bmatrix}$ x = 3 y = 2		
8. $(1+x)^5 = 1 + 5x + 10x^2 + 10x^3 + 5x^4 + x^5$ (b) x = -0.02 $1 + 5(-0.02) + 10(-0.02)^2$ $= 1 + -0.1 + 0.04$ = 0.904		
9. $a = \frac{bd}{\sqrt{(b^2 - d)}}$ $a^2 = \frac{b^2 d^2}{b^2 - d}$ $a^2 b^2 - a^2 d = b^2 d^2$ $a^2 b^2 - b^2 d^2 = a^2 d^2$ $b = x\sqrt{\frac{a^2 d}{a^2 - d^2}}$		

SOLUTION	MARKS	ALTERNATIVE
10. $\frac{5 \times 6 \times 2}{8} = 7\,{}^{1}/_{2}$ hrs		
11. 		
12. $0.7 \times 450 + 0.9x = 0.75(450 + x)$ $0.7 \times 450 + 0.9x = 0.75(450 + x)$ $0.9x - 0.75x = 450(0.75 - 0.7)$ $x = \frac{0.05 \times 450}{0.15}$ $= 150$	B1 M1 M1 A1 4 marks	
13. $\frac{dy}{dx} = 3x^2 - 8x + 2$ $y = x^3 - 4x^2 + 2x + x$ At $x = 0$ $y = 2$ $2 = 0 - 0 + 0 + C$ $C = 2$ $\Rightarrow y = x^3 - 4x^2 + 2x + 2$	M1 M1 A1 3 marks	
14. Euros to Ksh. 84.15×500 $= 420{,}750$ Balance in Ksh. $= 420750 - 289850$ $= 130{,}900$ Balance in Japan yen $= \frac{130{,}900 \times 100}{65.45}$ $= 200{,}000$	M1 M1 M1 A1 4 marks	
15. $Y > x$ $Y < -x + 4$ $7 < 3x + 3$		
16. $\frac{2}{3-7} - \frac{2}{3+7} = 2(3 + \sqrt{7}) - 2(3\sqrt{7})$ $= \frac{6 + 2\sqrt{7} - 6 + 2\sqrt{7}}{9 - 3\sqrt{7} + 3\sqrt{7} - \sqrt{7}}$ $= \frac{4\sqrt{7}}{2} = 2\sqrt{7}$	M1 M1 A1 3 marks	
17. A & B in 1hr $= \frac{1}{2\,{}^{1}/_{2}}$ $= \frac{2}{5}$ (b) Part done in 1hr 10 min $= \frac{2}{5} \frac{x}{6} \frac{7}{} = \frac{7}{15}$ Remaining $= 1 - \frac{7}{15} = \frac{8}{15}$ (c) 1hr A does $\frac{8}{15} \times \frac{1}{4} = \frac{2}{15}$ Time taken by A $= 15/2 = 7\frac{1}{2}$ hr Work done by B in 1hr $= \frac{2}{5} - \frac{2}{15} = \frac{4}{15}$ Time taken by B $= \frac{15}{4} = 3\frac{3}{4}$ hr	M1 A1 M1 A1 B1 M1 M1 A1 8 marks	

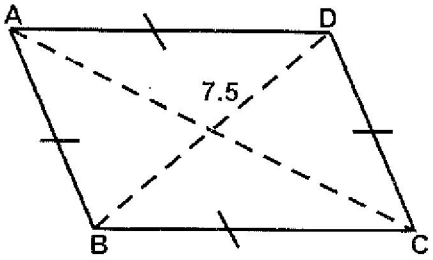
SOLUTION	MARKS	ALTERNATIVE
18.(a)Q1 = $39.5 + \frac{15-10}{12} \times 10$ $= 43.67$ Q3 = $59.5 + \frac{45-40}{17} \times 10$ $= 62.44$ Interquartile range $= 62.44 - 43.67$ $= 18.77$ (b) Let x be no. of people in class 50 – 59 with ages ← 54.5 $49.5 + \frac{x}{18} \times 10 = 54.5$ $x = 9$ Percentage = $\frac{22}{60} + 9 \times 100$ $= 51.67\%$ ($51\frac{2}{3}\%$)	M1 A1 M1 A1 B1 M1 M1 A1 8 marks	
19.  		
20.(a) $A^{-1} = \begin{bmatrix} -4 & 3 \\ 3 & -2 \end{bmatrix}$ (b) (i) $200x + 300y = 800{,}000$✓ $90x + 120y = 360{,}000$✓ (ii) $2x + 3y = 8500$ $3x + 4y = 12{,}000$ $\begin{matrix} x \\ y \end{matrix} = \begin{bmatrix} -4 & 3 \\ 3 & -2 \end{bmatrix} \begin{bmatrix} 8500 \\ 12000 \end{bmatrix}$✓ $x = 2000$ and $y = 1500$✓ Discount on rice (c) $\frac{2}{100} \times 1{,}500 \times 360 = 10800$✓ % discount on sugar $\frac{33300-10800}{225 \times 2000} \times 100$ ✓ $= 5\%$✓	B1 B1 B1 M1 M1 A1 M1 A1 8 marks	
21.(b) $\begin{bmatrix} 2 & 4 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} P & Q & R \\ 5 & 6 & 4 \\ -1 & -1 & -0.5 \end{bmatrix}$✓ $= \begin{bmatrix} A & B & C \\ 6 & 8 & 6 \\ -2 & -2 & -1 \end{bmatrix}$✓ (c) Centre (-3, 2) angle of rotation 270° or -90°✓	B1 B1 B1 B1	

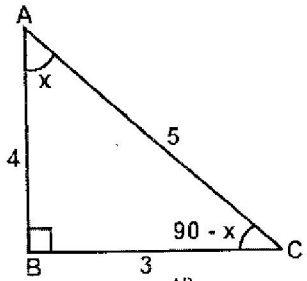
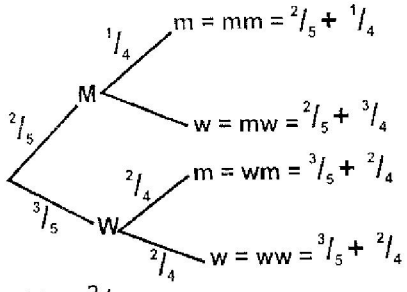
(a)

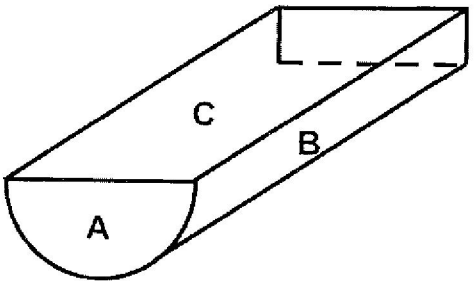


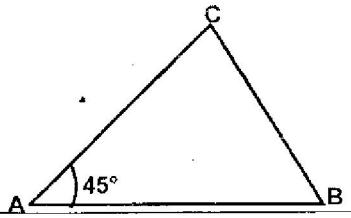
22. $V = \int(6t+4)dt = 3t^2 + 4t + c$✓ At t = 0, 5 = 3, x 0^2+4 x 0 + c✓ C = 5 $V = 3t^2 + 4t + 5$✓ (b) (i) At t = 3, V = 3 x 3^2 + 4 x 3 + 5✓ = 44m/s✓ (ii) Distance from t = 2 to t = 4 $= \int_2^4 (3t^2 + 4t + 5)\,dt$ $t^2 + 2t^2 + 5t]_2^4$✓ $= 4^3 + 2(4^2) + 5 \times 4) - (2^3 + 2 \times 2^2 + 5 \times 2)$✓ = 116 - 26 = 90m✓	M1 M1 A1 M1 A1 M1 M1 A1 8 marks	
23. (a) $p = \frac{KQ^2}{\sqrt{R}}$ When Q = 5, and R = 9, p = 20 $\frac{K5^2}{\sqrt{9}} = 20$✓ $\Rightarrow K = \frac{20}{25} \times 3 = \frac{60}{25}$ or 2.4✓ when Q = 7 and R = 25 $p = 2.4 \times \frac{7^2}{\sqrt{25}} = 23.52$✓ (b) $Q^1 = 1.2Q$ and $R^1 = 0.64R$✓ $P^1 = \frac{K(1.2Q)^2}{\sqrt{0.64R}}$✓ Increase = $\frac{K(1.2Q)^2}{\sqrt{0.64R}} - \frac{KQ^2}{VR}$✓ %increase = $\frac{(1.44KQ^2}{0.8\sqrt{R}} - \frac{KQ^2)}{\sqrt{R}} \times 100\%$✓ = 80%✓	M1 M1 A1 M1 M1 A1 8 marks	
24. (a) (i) $YM = \sqrt{14^2 - 7^2}$✓ $= \sqrt{147} = 12.12$ (ii) $YL = \sqrt{147 - 10^2} = 6.856$✓ (b) Identifying angle θ ✓ Tan θ = $\frac{6.856}{7} = 0.9794$✓ (0.9804) θ = 44°24'✓ (c) Tan x = $\frac{7}{16} = 0.4375$✓ x = 23° 381 (23.63°)✓		

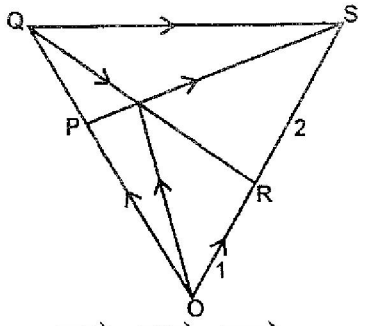
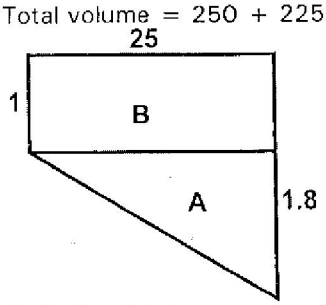
K.C.SE 2005 MATHEMATICS PAPER 121/1 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE
1. $\frac{3/4+1^5/7 \div 4/7 \times 2^1/3}{(1^3/7 - 5/8) \times 2/3} = \frac{3/4 + 1^2/7 \times 7/4 \times 7/3}{\frac{(124-35)}{56} \times 2/3}$ Num. $3/4 + 12/7 \times 7/4 \times 7/3 = 31/4$ Deno. $45/56 \times 2/3 = 15/28$ $31/4 \times 28/15 = 14\,7/15$	M1 M1 A1 4 marks	
2. 2 | 1470 | 7056 | 735 | 3528 2 | | 1764 2 | | 882 2 | | 441 3 | 735 | 441 3 | 245 | 147 5 | 49 | 49 7 | 7 | 7 7 | 1 | 1 $1470 = 2 \times 3 \times 5 \times 7 \times 7$ $= 2 \times 3 \times 5 \times 7^2$ $7056 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 7 \times 7$ $= 24 \times 32 \times 72$ $\frac{1470^2}{\sqrt{7056}} = \frac{2^2 \times 3^3 \times 5^2 \times 7^4}{3 \times 5^2 \times 7^3}$ $= 3 \times 5^2 \times 7^3$ Ans	M1 B1 A1	$1470 = 2 \times 735$ $= 2 \times 3 \times 245$ $= 2 \times 3 \times 5 \times 49$ $= 2 \times 3 \times 5 \times 7 \times 7$ $= 2 \times 3 \times 5 \times 7^2$ $7056 = 3528 \times 2$ $= 3528 \times 2$ $= 2 \times 2 \times 2 \times 882$ $= 2 \times 2 \times 2 \times 2 \times 3 \times 147$ $= 2^4 \times 3 \times 3 \times 49$ $= 2^4 \times 3^2 \times 7 \times 7$ $= 2^4 \times 3^2 \times 7^2$
3.  $AD = \sqrt{7.5^2 + 4^2}$ $= 72.25$ $= 8.5$ Perimeter $= 8.5 \times 4$ $= 34$cm	M1 M1 A1 3 marks	
4. $\frac{9t^2 - 25a^2}{6t^2 + 19st + 15a^2} = \frac{(3t)^2 - (5a)^2}{6t^2 + 9at + 10at + 15a^2}$ $= \frac{(3t+5a)(3t-5a)}{(3t+5)(2t+3a)} = \frac{3t-5a}{2t+3a}$	B1 M1 A1 3 marks	
5. $6x = 180°$ $X = 300°$ $30n = 360$ $n = 12$	B1 M1 A1 3 marks	

SOLUTION	MARKS	ALTERNATIVE
6.   $\overrightarrow{PR} = {}^{3}/_{7}\,PQ$ $\overrightarrow{PR} = {}^{3}/_{5}\,PS$ But $\overrightarrow{PR} = \overrightarrow{PR}$ ${}^{3}/_{7}\,PQ = {}^{3}/_{5}\,PS$ $PS = {}^{5}/_{7}\,PQ$ $\lvert PS\rvert = {}^{5}/_{7} \times 8 = {}^{40}/_{7}$ But $\overrightarrow{RS} = {}^{2}/_{5}\,PS$ $\lvert RS\rvert = {}^{2}/_{5} \times {}^{40}/_{7}$ $= 2{}^{2}/_{7}$ cm	B1 M1 M1 A1 4 marks	
7.  Sin (90 – x) $= \frac{AB}{AC}$ Sin(90 – x) $= {}^{8}/_{10} = {}^{4}/_{5}$ Tan x $= \frac{BC}{AB}$ $= 0.75$	B1 M1 A1 3 marks	
8.  MM $= {}^{2}/_{20}$ MW $= {}^{6}/_{20}$ WM $= {}^{6}/_{20}$ WW $= {}^{6}/_{20}$ (a) P(mm or ww) = (P(mm) + P(ww) $= {}^{2}/_{20} + {}^{6}/_{20} = {}^{2}/_{5}$ Ans (b) P(MW OR WM) = P(MW) + P(WM) $= {}^{6}/_{20} + {}^{6}/_{20}$ $= {}^{3}/_{5}$ Ans	B1 M1 A1 3 marks	

SOLUTION	MARKS	ALTERNATIVE
9. L.U = 1cm A – E = 0.5 Limits of A are 3.5 and 4.5 Limits of 6 are 5.5 and 6.5 Min. Area = ½ x 3.5 x 5.5 = 9,625 Max. Area = ½ x 4.5 x 6.5 = 14,625 Working Area = ½ x 4 x 6 = 12,000 Working Area – Min Area = 12 – 9,625 = 2,375 Max Area – Working Area = 14,625 – 12 = 2,625 Absolute Error in Area $\frac{2,375 + 2,625}{2}$ = 2.5 (b) % Error = $\frac{A.E}{A.M} \times 100$ = $\frac{2.5}{12} \times 100 = 20\frac{5}{6}\%$	M1 A1 2 marks	
10. $P^2 = (p - q)(P - r)$ $P^2 = P^2 - Pr - Pq + qr$ $= -Pr - Pq + qr$ $Pr + Pq = qr$ $P(r + q) = qr$ $P = \frac{qr}{q + r}$	B1 M1 A1 3 marks	
11. $7y - 3x + 30 = 0$ At y – intercept the value of x = 0 Therefore $7y = -30$ $y = -30/7 = -4\frac{2}{7}$ The coordinates are $(0, -4\frac{2}{7})$	B1 M1 A1 3 marks	
12.  Area A = Πr^2 = $\frac{22}{7} \times 4.2 \times 4.4$ = 55.44cm² Area B = $2\Pi rh \times ½$ = $\frac{22}{7} \times 4.2 \times 150$ = 1980cm² Area C = 2 x 4.2 x 150 = 2360cm² Total Area = 55.44 + 1980 + 1260 = 3295.44cm²	B1 M1 M1 A1 4 marks	Surface Area of cylinder $= \frac{2}{2}\pi rh + \pi r^2 + 2rh$ $= \frac{22}{7} \times 4.2 \times 150 + \frac{22}{7} \times 4.2 \times 4.2 + 2 \times 4.2 \times 150$ = 3295.44cm²

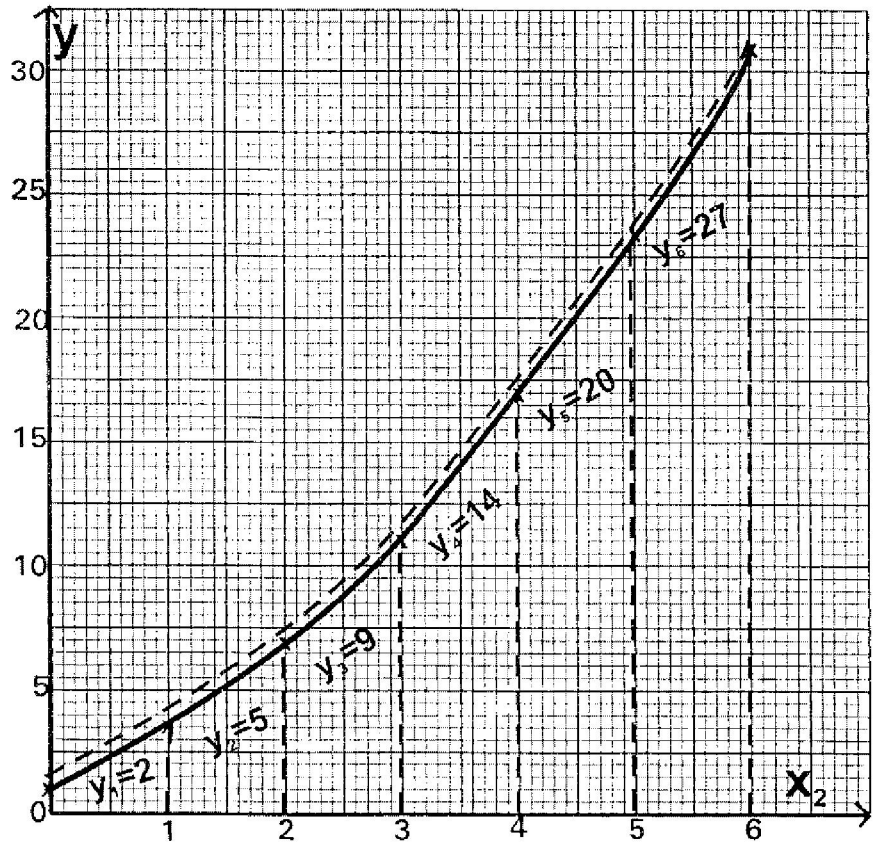
SOLUTION	MARKS	ALTERNATIVE
13. $A = \begin{bmatrix}1\\-1\\1\end{bmatrix}$, $B\begin{bmatrix}x\\y\\z\end{bmatrix}$ and $T = \begin{bmatrix}2\\0\\1.5\end{bmatrix}$ Midpoint – AB = $T = \left[\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}, \frac{z_1+z_2}{2}\right]$ $\left[\frac{1+x}{2}, \frac{y-1}{2}, \frac{1+z}{2}\right] = (2, 0, 1.5)$ $x = 3,\ y = 1$ and $z = 2$ Hence $B\begin{bmatrix}x\\y\\z\end{bmatrix} = \begin{bmatrix}3\\1\\2\end{bmatrix}$	M1 B1 2 marks	
14.(a) $12 \sin 30° = 12 \times ½ = 6cm$ $\angle ADB = 6$ (b) $\frac{8}{\sin D} = \frac{6}{\sin 45°}$ $\sin D = \frac{8 \sin 4.5}{6}$ $= 70° 30^1$  	A1 M1 A1 3 marks	
15. (i) $I = \frac{PRT}{100}$ $= {}^{5}/_{100} \times 2 \times P$ $= 0.1p$ (ii) $A = P(1 + 0.05)^2$ $= 1.1025p$ Interest $= 0.1025p$ Difference in interest $= 0.1025p - 0.1p$ $210 = 0.0025p$ Therefore $P = \frac{210}{0.0025} = 82,000/=$	M1 M1 A1 3 marks	
16. (a) $V = \int a dt = \int (25 - 9t^2) dt$ $= 25t - 3t^3 + c$ $4 = 25t - 3t + c$ when $t = 0$ $4 = c$ Hence $V = 25t - 3t^2 + 4$ (b) $V = 25 \times 2 - 3 \times 2^2 + 4$ $= 50 + 4 - 12$ $= 42ms^{-1}$	B1 M1 A1 A1 4 marks	
17. (a) The speed of the car is $(x + 20)$km/h Time taken by lorry $= {}^{280}/_{x}$ hrs Time taken by the car $= {}^{280}/_{x+20}$ hrs ${}^{280}/_{x} - {}^{280}/_{x+20} = {}^{7}/_{6}$ $\frac{280(x+20) - 280x}{x(x+20)} = {}^{7}/_{6}$ $7x^2 + 140x = 33600$ $x^2 + 20x - 4800 = 0$ $x^2 - 60x + 80x - 4800 = 0$ $x(x - 60) + 80(x - 60) = 0$ $(x - 60)(x + 80) = 0$ $x = -80$ or $x = 60$ (b) Time taken by the lorry $= 12.15$ $= 4$hrs Distance covered by lorry = speed x time $= 60 \times 4 = 240$km Time taken by the car $= \frac{\text{distance}}{\text{time}} = \frac{240}{100} = 2.4$hrs Time left town M = 12.15 – 3 hours = 9.15 a.m	B1 M1 M1 A1 A1 M1 M1 A1 4 marks	

SOLUTION	MARKS	ALTERNATIVE
18.  (a) $\overrightarrow{PS} - \overrightarrow{PO} + \overrightarrow{OS}$ $= -2p + 3r$ $= 3r - 2p$ $\overrightarrow{OT} = \frac{1}{7}\overrightarrow{OS} + \frac{6}{7}\overrightarrow{OP}$ $= \frac{1}{7} \times 3\underline{r} + \frac{6}{7} \times 2p$ $= \frac{3}{7}r + \frac{12}{7}\underline{p}$ $\overrightarrow{QT} = \overrightarrow{QP} + \overrightarrow{PT}$ $= -\frac{7}{6}(3\underline{p}) + \frac{7}{6}(3\underline{r} - 2p)$ $= \frac{3}{7}r - \frac{9}{7}\underline{p}$ (b) $\overrightarrow{QT} = \frac{7}{6}\underline{r} - \frac{9}{7}\underline{p}$ $\overrightarrow{QR} = \underline{r} - 3\underline{p}$ $\overrightarrow{QR} \uparrow\uparrow \overrightarrow{QT}$ if $\overrightarrow{QR} = K\overrightarrow{QT}$ $\underline{r} - 3\underline{p} = K(\frac{3}{7}\underline{r} - \frac{9}{7}\underline{p})$ $r = \frac{3}{7}kr$ $k = \frac{7}{3}$ Also $-3\underline{p} = \frac{-9}{7}pk$ $k = \frac{7}{3}$	M1 A1 A1 M1 4 marks	Hence QR ↑↑ QT Q is common point Hence Q, T, R are Collinear A1 (b) (ii) $\overrightarrow{QT} : \overrightarrow{TR}$ $\overrightarrow{QT} = \frac{3}{7}\underline{r} - \frac{9}{7}\underline{p}$ $\overrightarrow{TR} = \overrightarrow{OT} + \overrightarrow{OR}$ B1 $= \frac{-3}{7}\underline{r} - \frac{12}{9}\underline{p} + \underline{r}$ $= \frac{4}{7}\underline{r} - \frac{12}{7}\underline{p}$ Hence $\overrightarrow{QT} : \overrightarrow{TR}$ $\frac{3}{7}\underline{r} - \frac{9}{7}\underline{p} : \frac{4r}{7} - \frac{12}{7}\underline{p}$ $\Rightarrow \frac{3}{7}\underline{r} : \frac{4}{7}\underline{r}$ 3 : 4 or $\frac{-9}{7}\underline{p} : \frac{-12}{7}p$ Hence QT : TR = 3 : 4 A1
19. (a) Cross sectional area = ½bh + 1 x b = ½ x 25 x 1.8 + 25 x 1 = 47.5m² Volume = 47.5 x 10 = 475m³ (b) (i) Volume A ½ x 25 x 1.8 x 10 = 225 Volume B = 10 x 1 x 25 = 250 Total volume = 250 + 225 = 475m³  (ii) 225m³ = 9 hours Therefore 250m³ = $\frac{250 \times 9}{225}$ = 10	B1 M1 A1 B1 M1 A1 B2 A1 3 marks	

SOLUTION	MARKS	ALTERNATIVE

20.

y_1	y_2	y_3	y_4	y_5	y_6
2	5	9	14	20	27



Mid ordinate
Area = $h(y_1 + y_2 + y_3 + y_4 + y_5 + y_6)$
= $1(2 + 5 + 9 + 14 + 20 + 27)$
= $77cm^2$

(b) Error = $78cm^2 - 77cm^2$
= 1cm
% Error = $\frac{1}{78} \times 100$
= $12\frac{32}{39}\%$ or 12.82

21.(a) $\frac{dy}{dx} = 0$ at turning points — A1

Hence $4x - 3 = 0$
$x = \frac{3}{4}$ — M1
Min. value = y at min. point
Hence at minimum point $x = \frac{3}{4}$ — B2
and $y = \frac{-1}{8}$
$= (4x - 3)dx$
$y = 2x^2 - 3x + c$ subst. $x = \frac{3}{4}$
$c = 1$ $y = \frac{1}{4}$
Hence $y = 2x^2 - 3x + 4$ — A1

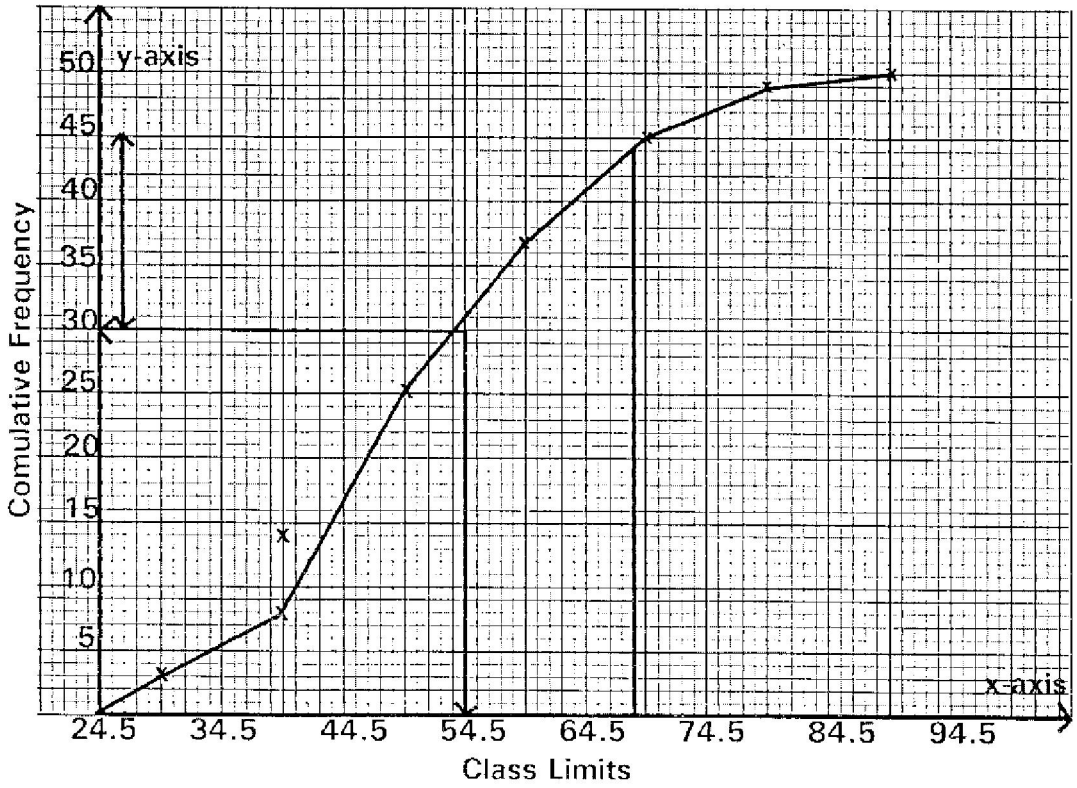
(b) $\frac{dy}{dx} = 4x - 3$

and $\frac{dy}{dx} = 7$

Therefore $4x - 3 = 7$ M1
$x = \frac{5}{2}$ B1
Subst, for x
y = 6
Hence the point is (2.5, 6) A1

22.

Mass (g)	25-34	35-44	45-54	55-64	65-74	75-84	85-94
No. of potatoes	3	6	16	12	8	4	1
C.F	3	9	25	37	45	49	50



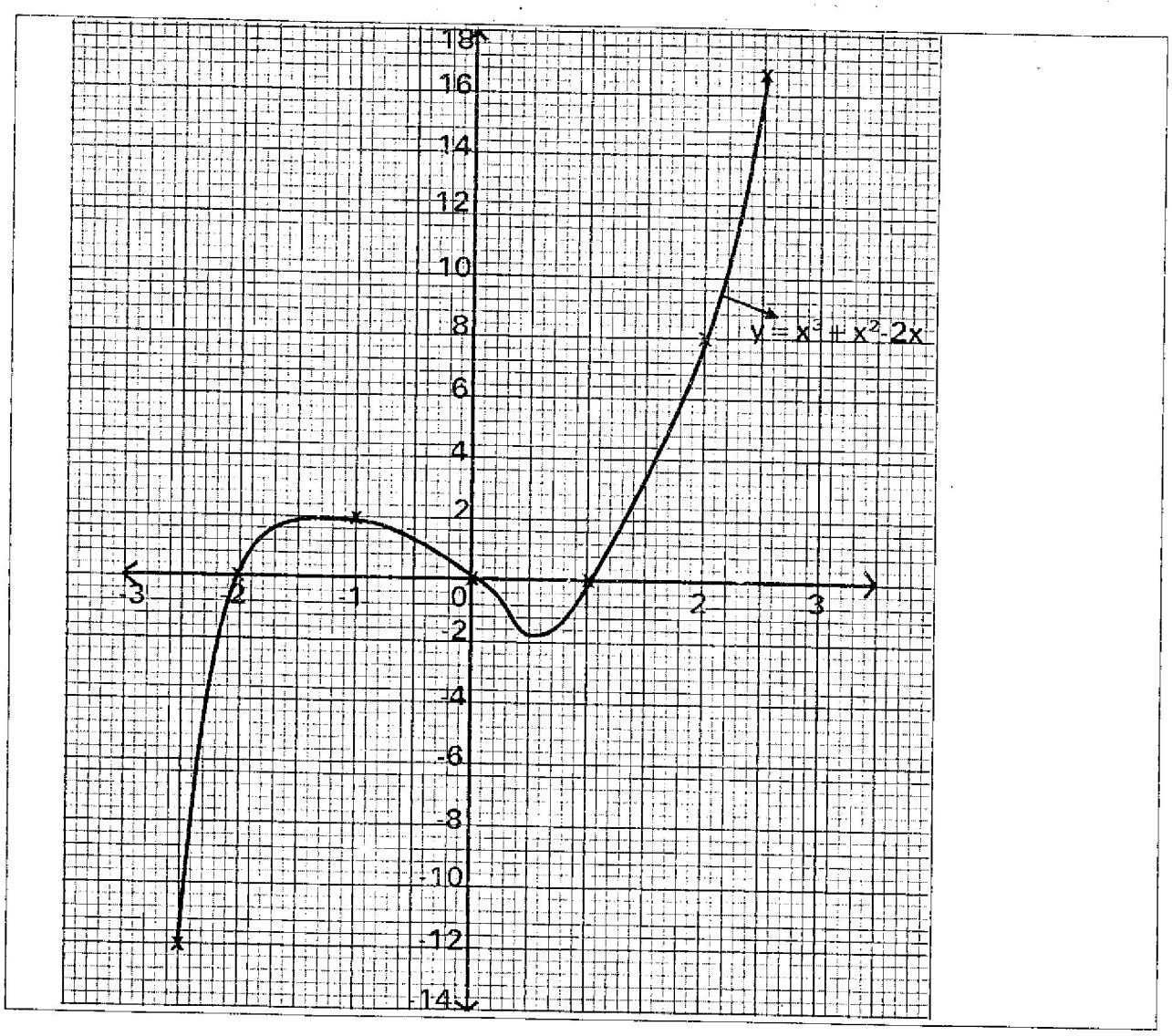
23. OUT OF SYLLABUS

24. (a) (i)

x	-3	-2	-1	0	1	2	2.5
-2x	6	4	2	0	-2	-4	-5
x^2	9	4	1	0	1	4	6.25
x^3	-27	-8	-1	0	1	8	15.625
$y = x^3 + x^2 - 2x$	-12	0	2	0	0	8	16.88

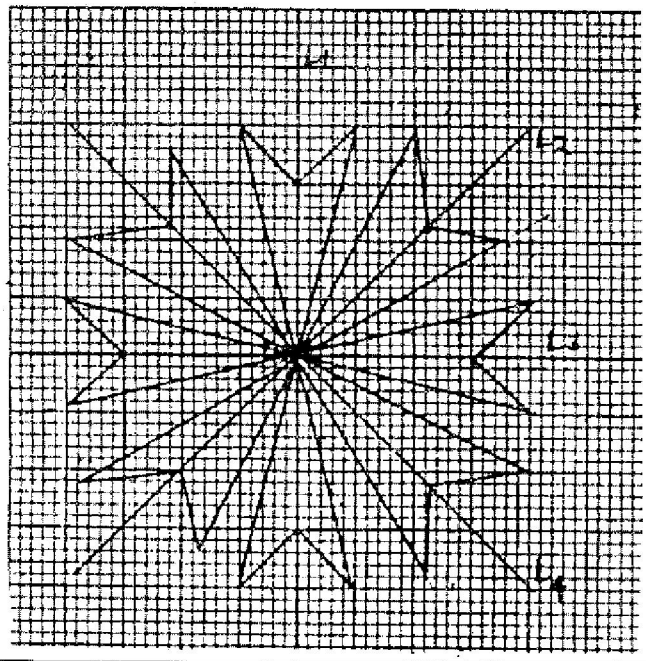
(ii)

(iii) $x < -2$

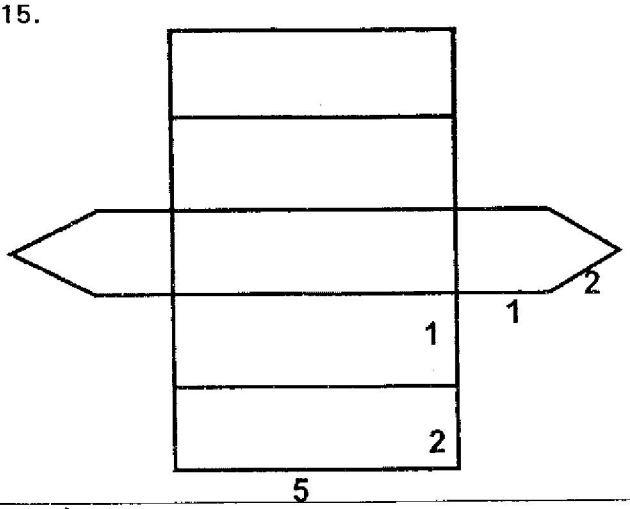

18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-3
-2
-1
1
2
3
$y = x^3 + x^2 - 2x$

K.C.SE 2005 MATHEMATICS PAPER 121/2 MARKING SCHEME

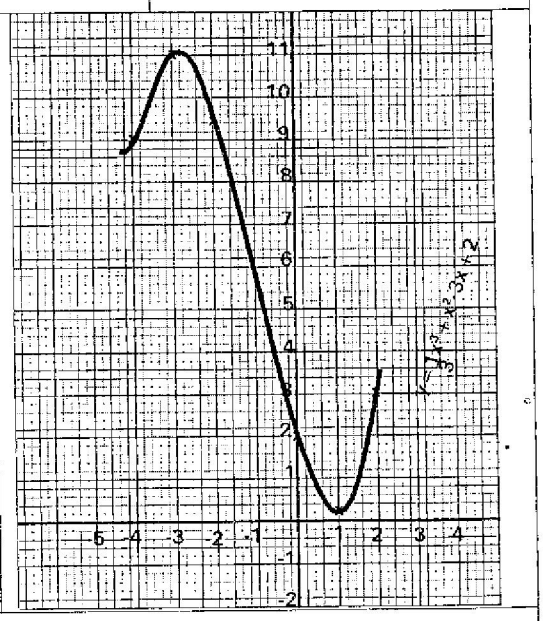
SOLUTION	MARKS	ALTERNATIVE METHOD
1. $\frac{243 \times 3^{2y}}{729 \times 3^{3y} \div 3^{(2y-1)}}$ $= \frac{3^5 \times 3^{2y}}{3^6 \times 3y \div 3^{2y-1}} = 3^5$ $= 3^{5 + 2y}$ $3^{6 + y - (2y - 1)}$ $3^{5 + 2y} = 3^5$ $= 3^{-2 + 3y} = 3^5$ Hence $3y - 2 = 5$ $3y = 7$ $y = {}^3/_7 = 2{}^1/_3$	M1 M1 A1	
2. $\frac{\sqrt{63}+\sqrt{72}}{\sqrt{32}+\sqrt{28}} \times \frac{(\sqrt{32}-\sqrt{28})}{(\sqrt{32}-\sqrt{28})}$ Deno $\Rightarrow 32 - \sqrt{32}\sqrt{28} + \sqrt{28}\sqrt{32} - 28$ $\Rightarrow 4$ Num $\Rightarrow \sqrt{63}\sqrt{32} - \sqrt{63}\sqrt{28} + \sqrt{(72x32)} - \sqrt{(72x28)}$ $\Rightarrow \sqrt{9x7x16x2} - \sqrt{9x7x7x4} + \sqrt{9x4x2x16x2} - \sqrt{9x4x2x7x4}$ $\Rightarrow \sqrt[12]{14} - 42 + 48 - \sqrt[12]{14} = 16$ ${}^6/_4 = 1{}^1/_2$	M1 ½ A1 ½	
3. Men: ${}^7/_9 \times 45 = 35$ Wom: ${}^2/_9 \times 45 = 10$ Let the No. be x Men: ${}^5/_9(45 + x) = 35$ $25 + {}^5/_9x = 35$ ${}^5/_9x = 10$ $x = 18$	M1 M1 A1	Alternatively: ${}^4/_9 (45 + x) = (10 + x)$ $4(45 + x) = 9(10 + x)$ $180 + 4x = 90 + 9x$ $5x = 90$ $x = 18$

SOLUTION	MARKS	ALTERNATIVE METHOD
4. 		
5. $^{x}/_{3} = {}^{16}/_{3x}$ $3x^2 = 48$ $x^2 = 16$ $x = 4$	B1 A1 2 marks	$^{16}/_{3x} = {}^{x}/_{3}$ $xX^{16}/_{x} = xXx$ $x = \sqrt{16}$ $= 4$
6. In 1hr: $^{1}/_{3} + {}^{1}/_{6}$ of water = ½ of tank is filled $^{1}/_{2} - {}^{1}/_{8} = 4 - {}^{1}/_{8} = {}^{3}/_{8}$ $^{3}/_{8}$ is filled in 1hr. All pipes open $^{1}/_{2}$ of the tank = $^{1}/_{2} \times 1 \div {}^{3}/_{8}$ $= {}^{1}/_{2} \times {}^{8}/_{3} = {}^{4}/_{3}$ = 1hr and 20 minutes Total time taken = 2hrs and 20 min	M1 M1 B1 A1 4 marks	In 1hr $^{1}/_{3} + {}^{1}/_{6} - {}^{1}/_{8} = 8 + 4 - {}^{3}/_{24}$ Filled in 1hr = $^{9}/_{24} = {}^{3}/_{8}$ $^{1}/_{2} \times {}^{8}/_{3} = {}^{4}/_{3} = 1\,{}^{1}/_{3}$ hrs Total time = $1 + 1\,{}^{1}/_{3}$ = $2\,{}^{1}/_{3}$ hrs
7. $\log_2(x^2 - 9) = 3\log_2 + 1$ $\log_2(x^2 - 9) = \log_2(8) + \log_2 2$ $\log_2(x^3 - 9) = \log_2(8 \times 2)$ $x^2 - 9 = 16$ $x^2 = 25$ $x = \pm 5$	M1 M1 M1 A1 4 marks	$\log_2(x^2 - 9) = 3\log_2 2 + \log_2 2$ $\log_2(x^2 - 9) = \log_2 16$ $x_2 - 9 = 16$ $x = \pm 5$
8. Volume scale factor = $\frac{4752}{1408}$ = 2 3.376 v.s.f = $(1.s.f)^3$ $1.s.f = 3\sqrt{3.375}$ = 1.5 Area scale factor = $(1.2.f)^2$ = 1.52 = 2.25 Area of larger cylinder = 352 x 2.25 = 792cm²	M1 M1 M1 A1 4 marks	$1.s.f = (v.s.f)\,{}^{1}/_{3} = A.s.f)\,{}^{1}/_{2}$ $(1.s.f)^2 = (A.s.f)$ $(L.s.f)^3 = (v.s.f)$ = 3.776 $1.s.f = (3.376)\,{}^{1}/_{3} = 1.5$ $A.s.f = (1.5)^2 = 2.25$ Area of larger cylinder = Area of smaller x A.s.f = 352 x 2.25 = 792cm²

SOLUTION	MARKS	ALTERNATIVE METHOD
9. Cos 2x° = 0.870 2x° = 36.2, 143.8, 216:2, 328:, 396:2, 503.8, 576.2, 683.8 Hence x° = 18:1, 71:9, 108:1, 161:9, 198:1, 251:9, 288:1, 341:9	B1 M1 M1 A1 4 marks	
10. 120,000 + 15,000 = 105,000 Commission = 105,000 x $^{5}/_{100}$ = 5,250 Discount = 120,000 x $^{5}/_{200}$ = 3,000 Total earnings = 9000 + 2250 = 11,250/=	M1 M1 A1 3 marks	
11. $\frac{9 + 8.2 + 6.7 + 5.4 + 4.7}{5}$ = A $\frac{8.2 + 6.7 + 5.4 + 4.7 + k}{5}$ = B A - B = 0.6 $6.8 - \frac{(25 - k)}{5} = 0.6$ 34 - (25 + k) = 3.0 9 - k = 3.0 k = 6	B1 M1 A1 3 marks	
12. Gradient of $L_1 = \frac{6 - 0}{0 - 4} = \frac{3}{2}$ y - 6 = 3 x - 0 = 2 2y - 12 = 3x y = $^{3}/_{2}$x + 6 Atp; $L_1 = L_2$ $^{1}/_{2}$x + 6 = 2x - 2 1.5x = 2x - 8 = 16 Substitute y = 30	M1 M1 A1 3 marks	Gradient of $L_1 = \frac{0 - 6}{-4 - 0}$ = $^{3}/_{2}$ y intercept = 6 Therefore y = mx + c general eq. y = $^{1}/_{2}$x + 6 At p; L1 = L2 $^{3}/_{2}$x + 6 = 2x - 2 x = 16 sub. Y = 30
13. $(3x - y)^4 \Rightarrow (3x)^4y^0, (3x)^3y^1, (3x)^2y^2, (3x)^1y^3, (3x)^0y^4$ $\Rightarrow 81x^4 = 27x^3y, 9x^2y^2$ $3xy^3, y^4$ With coeff. $(3x - y)^4 = 81x^4 - 4 \times 27x^3y + 6 \times 9 \times -4 \times 9xy^3 + y^4$ $= 81x^4 - 108x^3y + 54x^2y^2 - 36xy^3 + y4$ x = 2 and y = 0.2 $(6 - 0.2)^4 = 81 \times 2 - 108 \times 2 \times 0.2 + 54 \times 2^2 \times 0.2^2$ = 162 - 43.2 + 86.4 = 205.2	B1 M1 M1 A1 4 marks	(3x-y)⁴ = 81x⁴ - 108x³y + 54x²y² - 36xy³ + y⁴ (6 - 0.2)⁴ = (3 x 2 - 0.2) ⇒ x = 2 and y = 0.2 (6 - 0.2)⁴ = 162-43.2+ 86.4 = 205.2
14. $d\alpha {}^{km}/_{13}$ $D = \frac{500}{5^3}$ $2 = 4k$ $2 = {}^{5}/_{9}$ $k = {}^{1}/_{2}$ $d = \frac{m}{2r^3}$ $10 = \frac{540}{2r^3}$ $r^3 = 27$ r = 3	 M1 A1	$d\alpha \frac{m}{r^3}$ $d = \frac{km}{r^3}$; k = constant $2 = \frac{500k}{5^3}$ k = $^{1}/_{2}$ $d = \frac{m}{2r^3}$ $r^3 = \frac{m}{2d}$ subst $r^3 = \frac{540}{20}$ 3 = r

SOLUTION	MARKS	ALTERNATIVE METHOD
15. 	B1 M1 A1	
16. $\frac{ds}{dt} = 0$ at maximum $= 29.4 - 9.8t$ $9.8t = 29.4$ $t = 3$ hence $S = 29.4 \times 3 - 4.9 \times 3^2$ $= 44.1m$	B1 M1 A1	
17. $\frac{dx}{dx} = x^2 + 2x - 3$ at turning points; $\frac{dx}{dx} = 0$ $x^2 + 2x - 3 = 0$ $x^2 - x + 3x - 3 = 0$ $x(x - 1) + 3(x - 1) = 0$ $(x - 1)(x + 3) = 0$ $X = 1$ or -3 Subst $y = \frac{1}{3}$ or 11 The turning points are $(1, \frac{1}{3})$ and $(-3, 11)$		

x	1	3	0	2	-4	-2
y	$\frac{1}{3}$	$1\frac{1}{3}$	2	$2\frac{2}{3}$	$8\frac{2}{3}$	$9\frac{1}{3}$



18. (a) $\begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} 2 & 2 & 4 \\ 0 & 4 & 4 \end{bmatrix} = \begin{bmatrix} 2a & 2a+4b & 4a+4d \\ 2c & 2c+4d & 4c+4d \end{bmatrix}$

$\begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} 2a & 2a+4b & 4a+4d \\ 2c & 2c+4d & 4c+4d \end{bmatrix} = \begin{bmatrix} -2c & -2c-4d-4c-4d \\ -2a & -2a-4b-4a-4d \end{bmatrix}$

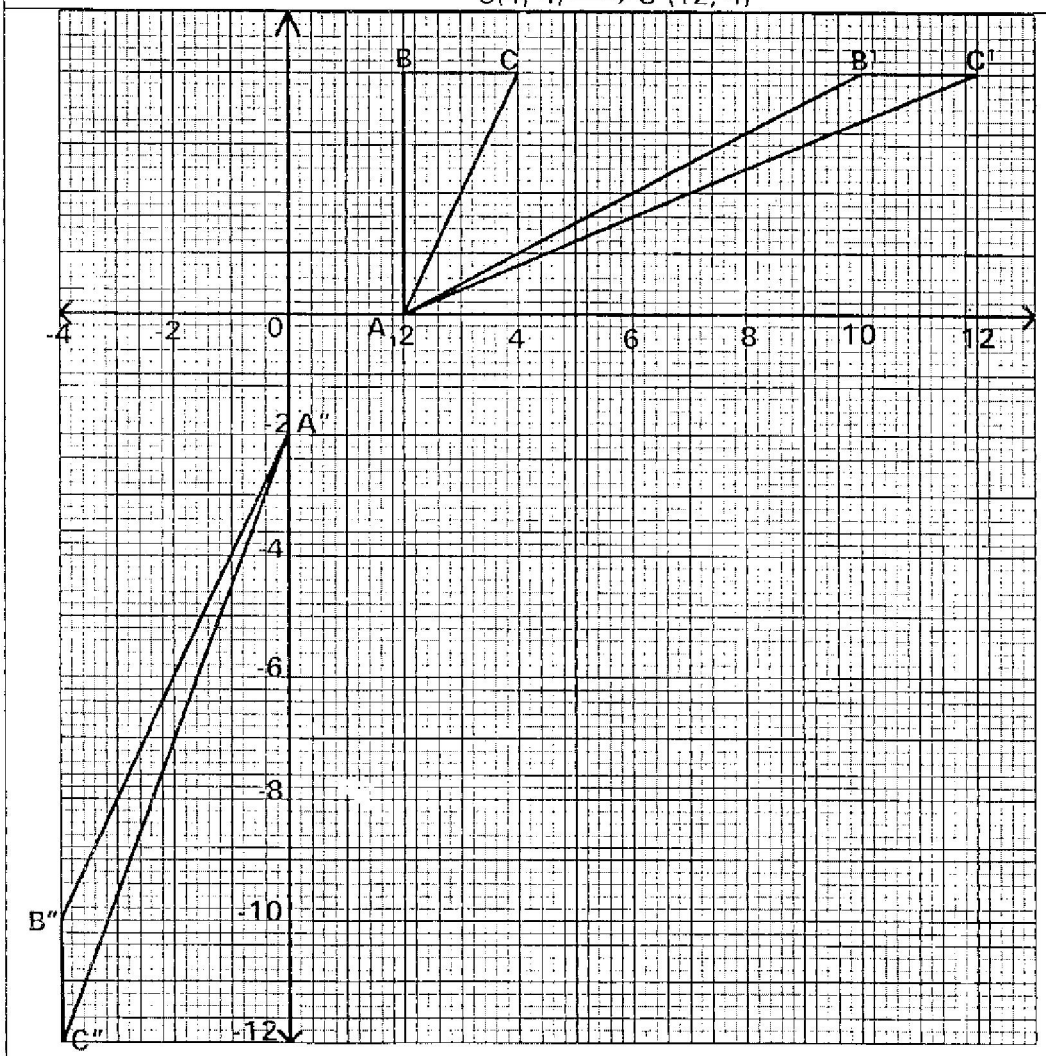
$\begin{bmatrix} 0 & -4 & -4 \\ -2 & -10 & -12 \end{bmatrix} = \begin{bmatrix} -2c-2c-4d & -4c-4d \\ -2a-2a-4d & -4a-4d \end{bmatrix}$

$-2c = 0 \Rightarrow c = 0 \quad -4d = -4 \quad -2a - 4b = -10$
$-2a = 2 \Rightarrow a = 1 \quad d = 1 \quad -2 - 4b = 10$
$b = 2$

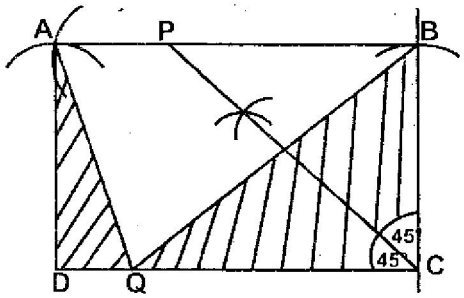
Hence $R = \begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$

(b) $\begin{bmatrix}1 & 2\\ 0 & 1\end{bmatrix}\begin{bmatrix}2 & 2 & 4\\ 0 & 4 & 4\end{bmatrix} = \begin{bmatrix}2+0 & 2+8 & 4+8\\ 0+0 & 0+4 & 0+4\end{bmatrix} = \begin{matrix}A^1 & B^1 & C^1\end{matrix}\begin{bmatrix}2 & 10 & 12\\ 0 & 4 & 4\end{bmatrix}$

(c) Shear x – axis invariant and B(2, 4) ⟶ B^1(10, 4) or
C(4, 4) ⟶ C^1(12, 4)

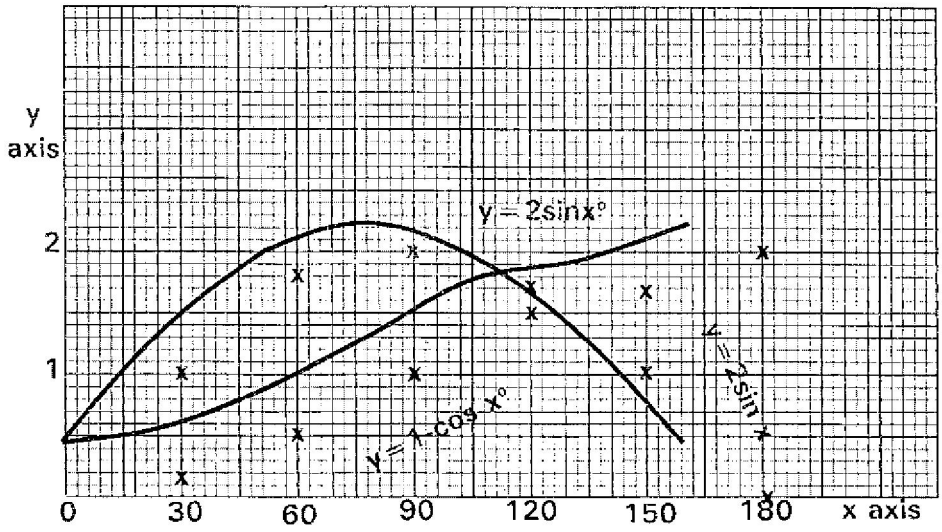


19. (a) c.d = 64800 – 60000 = 69600 = 64800 = 4800 a = 60000 n^{th} term = a + (-1)d =60000 + (n – 1) 4800	M1 B1	
(b) Common ratio $=\frac{64800}{60000} = \frac{69984}{64800} = 1.08$ n^{th} term = ar^{n-1} where a = 60000 r = 1.08 = $60000(1.08)^{n-1}$	M1 A1	
7^{th} term: Abdi = 60000 + (7 – 1) 48000 = 88800	M1	
Amoit = arn-1 = $60000(1.08)^6$ = 95213	M1	
Difference = 95213 – 88800 = sh 6413	B1 8 marks	

SOLUTION	MARKS	ALTERNATIVE METHOD
20.(a) P lies on any point along cp AQB $\leq 60° \leq 90°$  (b) Q lies on the unshaded region.	Rect 3 mks Drawing M2 A1	

21.(a)

$x°$	0	30	60	90	120	150	180
$2 \sin x°$	0	1	1.732	2	1.732	1	0
$1 - \cos x°$	0	0.134	0.5	1	1.5	1.866	2

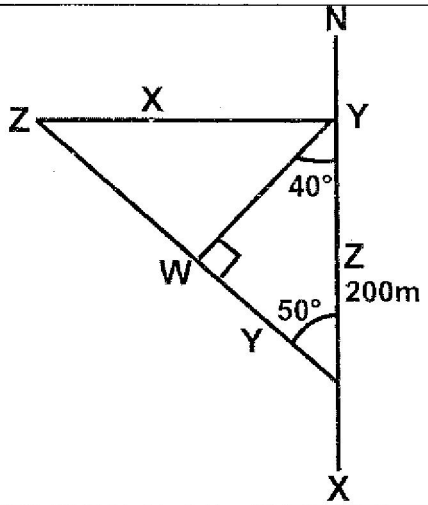


(c) (i) 129°
(ii) $0 < x < 129°$

22.(a) $x^2 = y^2 + z^2 - 2xy \cos x$
$= 40000 + 40000 - 2 \times 40000 \cos 50$
$= 80000 - 51424$
$x^2 = 28576$
$x = 169.04$
Sin rule $\frac{y}{\text{Sin } y} = \frac{x}{\sin x}$
$200 - 169$
Sin y = sin 50
Sin y = $\frac{200 \sin 50}{169}$
Sin y = 0.90656
y = 65°
bearing z from y = (180 + 65°)
= 245°

M1

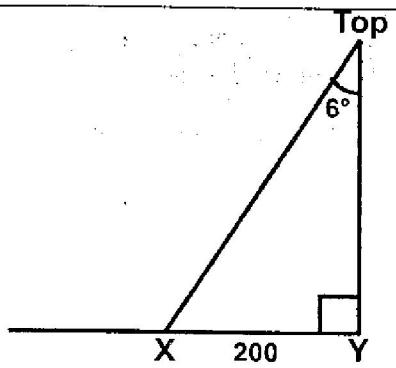
A1



(b) wy = 200
sin 50 sin 90
$wy = \frac{\sin 50 \times 200}{\sin 90}$
=0.90656 x 200
wy = 181m

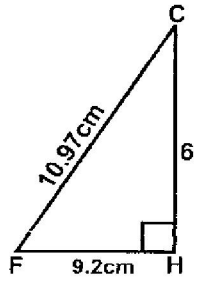
(c) TYX = ⌐ (right angled triangle)
XTY = 6°(given)
Therefore XYT = (90 – 6)
= 84°
Angle of elevation of the top = 84°

M1
A1
B1
M1
A1
8 marks

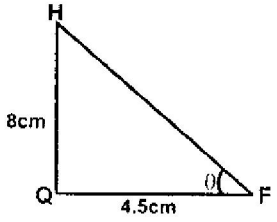


23.(a) $PH^2 = \sqrt{4.5^2 + 8^2}$
$= \sqrt{20.25 + 64}$
= 9.2
$fe = \sqrt{9.2^2 + hc^2}$
$= \sqrt{9.2^2 + 6^2}$
= 10.97cm

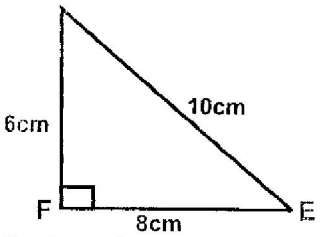
(b)
(i) $\tan 0 = {}^{6}/_{9.2}$
tan 0 = 0.6522
0 = 33°



(ii) $\tan \theta = {}^{8}/_{4.5}$
A1
tan θ 1.7750
θ = 60.60°



(c)



Cosine rule
$6^2 = 10^2 + 8^2 - 2 \times 8 \times 10 \cos 0$
$36 = 100 + 64 - 160 \cos 0$
$36 = 164 - 160 \cos 0$
$\text{Cos } 0 = {}^{128}/_{16}$
0 = 0.8
= 36°.9¹

A1
A1
A1
B1
A1
M1
A1
8 marks

tan e = $^{6}/_{8}$
= 0.75
=36°.9¹

24.(a) (i) = 75x + 75y>6
= 25x + 25y>2

(ii) 75x≤175
3x≤7

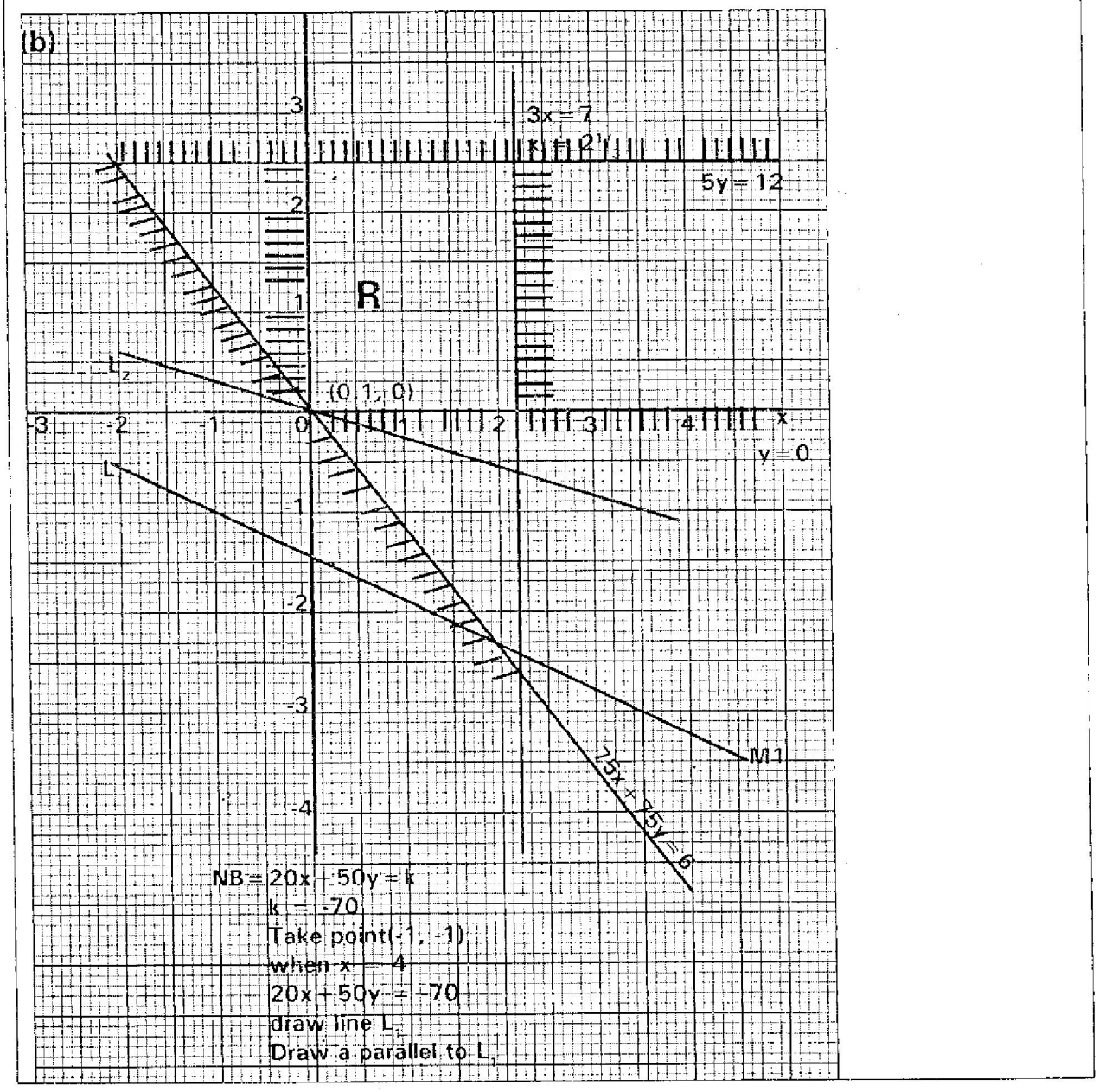
(iii) 75≤180
5y≤12

(iv) y≥0

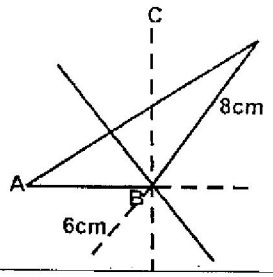
(v) x≥0

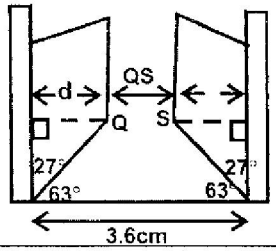
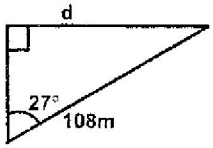
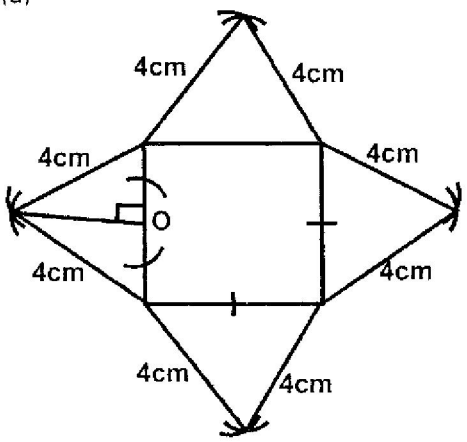
M1
M1
M1

(b) See diagram next page	4 mks	
(c) (i) Lowest cost = 20x + 50y At(0.1, 0) c = 20 x 0.1 + 50 x 0 c = 2/=	A1	
(ii) Max cost = 20 x 2.3 + 50 x 2.4 c = 46 + 120 c = 166/=	8 marks	

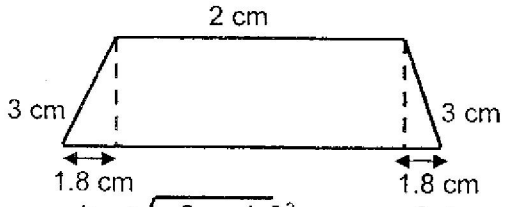


K.C.SE 2006 MATHEMATICS PAPER 121/1 MARKING SCHEME

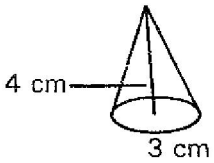
SOLUTION	MARKS	ALTERNATIVE METHOD
1. $\frac{3\sqrt{675 \times 135}}{\sqrt{2025}} = \frac{3\sqrt{3^3 \times 5^2 \times 5}}{\sqrt{3^4 \times 5^2}} = \frac{3^2 \times 5}{3^2 \times 5} = 1$	M1 A1 2 marks	$3\sqrt{91125} = 45$ Working must be shown $x^3 = 3\sqrt{\frac{675 \times 135}{45}} = \frac{675 \times 135}{45 \times 45 \times 45}$ $x = 1$
2. (a) 7532 (b) 500	B1 B1	
3. $\frac{(p+q)(p+q)}{p(p^2-q^2)+q(p^2-q^2)}$ $= \frac{(p+q)(p+q)}{(p+q)(p+q)(p-q)}$ $= \frac{1}{p+q}$	M1 M1 M1 M1 4 marks	Full factorization Partial factorization Denominator $(p + q)(p + q)$..... m1 $(p_1 + q)(p^2 + q)$ .....m1 $\frac{1}{p-q}$ m1
4. (a) $\angle ADE = \frac{180° - 108}{2} = 36°$ (b) $\angle AEF = \{180° - (108° - 60°\} \div 2$ $= 66°$ (c) $\angle DAE = 108° - (60° + 36°)$ $= 12°$	B1 B1 B1 3 marks	Mark the diagram $48° - 36° = 12°$
5. $3 - 2x < x$ $3 - 2x + 2x < x + 2x$ $3 < 3x$ $1 < x$ $x \leq \frac{2x + 5}{}$ $3x < 2x + 5$ $3x - 2x < 5$ or $x < 5$ $1 < x \leq 5$ 0 1 3 4 5 6 7	M1 M1 A1 3 marks	A_1 can be implied in numbering graph
6. $(3x + 1)(3x - 2) = 28$ $3x2 - x - 10 = 0$ $(3x + 50(x - 2) = 0$ $x = 2$ or $x = {}^{-5}/_{3}$ Length $3x^2 + 1$ $= 7cm$	M1 M1 A1 3 marks	$L_1(l - 3) = 28$ .....M1 $L_2 - 3l - 28 = 0$ $(l - 7)(l + 4) = 0$..... M1 $L = 7$.....A1
7. 105000×9.74 $=$ sh. 1022700 $\frac{1022700 - 403879}{12.11} = \frac{618821}{12.11}$ $= 51000$ rands	M1 M1 A1 3 marks	
8. 		

SOLUTION	MARKS	ALTERNATIVE METHOD
9. $\frac{k-8}{3-k} = -3$ $k = 1/2$ $\frac{y-8}{x-1/2} = -3$	M1 B1 A1 3 marks	$\frac{8-k}{k-3} = -3$ $6x + 2y = 19$ $3x + y = 9½$
10. $6\log_2 3\sqrt{2^6} + 10\log_3 5\sqrt{3^5}$ $= 6\log_2 2^2 + 10\log_3 3$ $= 6 \times 2 + 10 \times 1$ $= 12 + 10$ $= 22$	M1 M1 A1 3 marks	
11. $x = 1.8 \cos 63°$ $= 1.8 \times 0.454$ $= 0.8172$ $QS = 3.6 - 2 \times 0.8172$ $= 3.6 - 1.6344$ $= 1.9656$ $= 1.966m$ 	M1 M1 A1 3 marks	 $\frac{OX}{\text{Sin } 63} = \frac{1.8}{\sin}$ $QX = \frac{1.8 \sin 63}{\sin 58.5}$ $QS = \frac{1.8810 \sin 63°}{\sin 83.5°}$ $= 1.966$
12.(a) p(-2, 3) P^1(10, 10) $T = \begin{bmatrix} 10-2 \\ 10-3 \end{bmatrix}$ $= \begin{bmatrix} 12 \\ 7 \end{bmatrix}$ $Q^1 = (1 + 12, 3 + 7)$ $= (13, 10)$ (b) $m\begin{bmatrix} -2 \\ 3 \end{bmatrix} - n\begin{bmatrix} 1 \\ 3 \end{bmatrix} = \begin{bmatrix} -12 \\ 9 \end{bmatrix}$ $-2m - n = 12$ $3m - 3n = 9$ $m = n + 3$ $2(n + 3) + n = 12$ $3n = 6 \quad m = 5 \quad n = 2$	M1 M1 A1 B1 M1 A1 8 marks	
13.(a)  (b) VO = 3.7cm (Not to scale)		

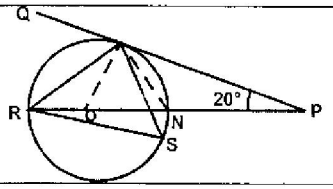
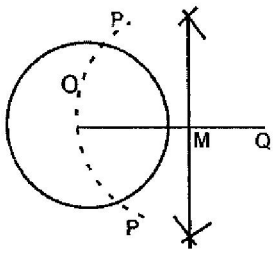
SOLUTION	MARKS	ALTERNATIVE METHOD
14. $2p + 3b = 78$.....(i) x 3 $3p + 4b = 108$.....(ii) x 2 $6p + 9b = 234$ $6p + 8b = 216$ $b = 18$ Substituting for b in e.g ii $3p + 72 = 108$ $3p = 36$ $p = 12$	M1 M1 A1 8 marks	
15. Area A = 5 x 3.2 B = 10 x 1.2 16 :12 = f : 6 f = 8	M1 M1 A1 3 marks	For both A or B accept equivalent Area B = 10 x 1.2 = 12 12k = 6 k = ½ Area A = 3.2 x 5 = 16 f = ½ x 16 = 8
16.(a) x: 0 | 0.4 | 0.8 | 1.2 | 1.6 | 2.0 y: 2.00 | 1.96 | 1.83 | 1.60 | 1.20 | 0 (b) Area of ¼ circle $\frac{1}{2}(0.4)x(2+0)+2(1.96+1.83+1.60+1.20)$ $= 3.036cm^2$ = Area of circle = 4 x 3.036 $= 12.144cm^2$	 M1 A1 M1 A1 4 marks	
17.(a) 240 x 12000 = sh. 2,888,000 (b) (i) New price $= \frac{125}{100}$ x 12000 = sh. 15,000 New No. of sets $= \frac{90}{100}$ x 240 = 216 Amount from sale = 216 x 15,000 = Sh. 3,240,000 Increase = 3,240,000 – 2,880,000 = 360,000 % increase $= \frac{360,240,000}{2,880,000}$ x 100 = 12.5% (ii) $\frac{16}{15}$ x 15,000 = Sh. 16,000 (c) Let the No. of sets sold in 2003 be x 16000 x = 2,880,000 $x = \frac{2,880,000}{16,000}$ $\therefore x = 180$ $p\% = \frac{240 - 180}{240}$ x 100 = 25% $\therefore p = 25$	M1 A1 M1 A1 B1 M1 M1 A1 8 marks	1.25 x 0.9 = 1.125 1.125 – 1 = 0.125 0.125 x 100 ..... M1 M1 12.5% ..... A1 Let number of sets be y 10000y = 2880 000 y = 180 $\frac{240+80}{240}$ x 100 ..... M1 M1 $\frac{100-p \times 240}{100}$ x 26000 = 25% A1

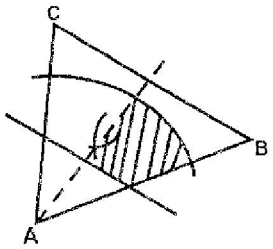
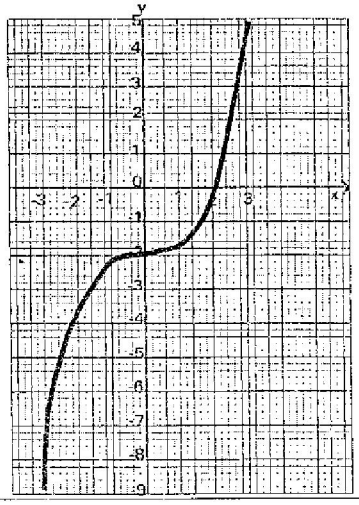
SOLUTION	MARKS	ALTERNATIVE METHOD
18.(a) Reflection along y-axis. (x = 0) (b) (on graph) (c) Rotation about (0,0) through 90° (d) On the graph (e) P″ Q″ R″ and P‴ Q‴ R‴ ΔPQR and ΔP″ Q″ R″ ΔP′ Q′ R′ and ΔP‴ Q‴ R‴ ΔPQR and ΔP′Q′R′ ΔP″Q″R″ and ΔP‴Q‴R‴	B2 B2 B2 B2 B2 8 marks	+ve three quarter twin about (0, 0) or about origin All 4 pairs B1 for any two pairs Accept P′Q′ = P″R″Q″
19.  $h = \sqrt{3_2 - 1.8^2} = 2.4.$ v = Cross-section Area x Height = ½ x 2.4 x (2 + 5.6) x 8 = 72.96 cm³ (b) Mass = 72.96 x 5.75 = 419.52g (c) (i) 246.24 = cross-section Area x 8 Cross-section Area = $\frac{246.24}{30}$ x 30.85cm² (ii) $\frac{419.52g}{246.24cm^2} \times {}^{2}/_{5} = 4.259g/cm^3$ M1 Area of x solution = 9.12 x 2.25 = 20.52cm² A1	M1 M1 A1 M1 M1 A1 M1 A1 8 marks	
20.(a) Distance covered by bus in 2½ hrs = 60 x $\frac{5}{2}$ = 150 km. (i) 500 – 150 = 350 km (ii) Overtaking speed = 100 – 60 = 40 kmh⁻¹ Distance = 150 km Time taken to overtake $\frac{150}{40}$ = 3¾ hrs. Distance travelled by car to catch up = 100 x $\frac{15}{4}$ = = 375 km. (b) Distance remaining = 500 – 375 = 125 km Time taken by bus to cover 125 km = $\frac{125}{60}$ = = 2½ Time left for the car after rest = 2 hrs 5 min – 25 min = 1 hr 40 min ∴New average speed = $125 \div 1\frac{2}{3} = 75kmh^{-1}$	M1 A1 M1 A1 A1 B1 M1 A1 8 marks	

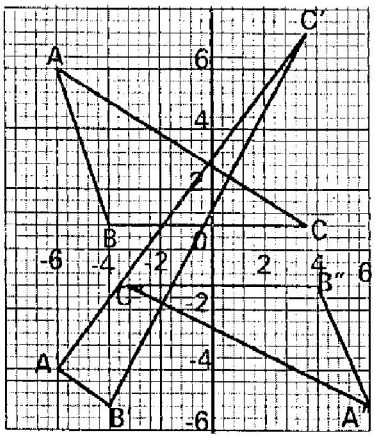
SOLUTION	MARKS	ALTERNATIVE METHOD
21.(a) (i) Length At $= 100 \tan 30°$ $= 100 \times 0.5774$ $= 57.74$	M1 A1	 $\times \tan 60° - 100$
(ii) Length AD $AC = \sqrt{57.74^2 + 57.74^2}$ $= 81.66$ OR 81.65 $AD^2 = 51.66 + 80^2$ $= 2 \times 8166 \times 80 \text{Cos } 100°$ $= 6668 + 6400 - 2 \times 81.66 \times 80 \times (-0.1736)$ $AD = \sqrt{15336}$ $= 123.8$	M1 A1 M1	$AC - \frac{57.74}{\text{Sin } 45}$ $AC = \frac{57.74}{\text{Cos } 45°}$ $\frac{100}{\text{Cos } 30}$ or $\frac{57.74}{\text{Sin } 60°}$ $AB \frac{57.74}{\text{Sin } 30°} = \frac{57.74}{\text{Cos } 60°}$
(iii) Perimeter $AB + B + CC + CD + DA$ $AB = \sqrt{100^3 + 57.74^2} = \sqrt{13334} = 115.5$ $= 11.55 + 100 + 57.74 + 80 + 123.8$ $= 477.04$ $= 477.0$(4SF)	A1 M1 M1	Accept 57.73 of table model
(b) Rolls of wire Length -$477.04 + 57.74 + 81.66$ $= 666.44$ $= 616.4$ Rolls to be bought $\frac{(616.4 - 3 \times 2.8) \times 5}{480}$ $= 6.33$ $= 7$ rolls	A1 M1 M1 A2 10 marks	477.1 in case 123.84 is used 6.3375 if 4477.1 used
22.(a) $\underline{OL} = 3\begin{bmatrix}1\\6\end{bmatrix}$ $= \begin{bmatrix}3\\18\end{bmatrix}$	B1	
$\underline{ON} = \frac{2}{3}\begin{bmatrix}15\\6\end{bmatrix}$ $= \begin{bmatrix}10\\4\end{bmatrix}$	B1	
$\underline{LN} = \underline{ON} - \underline{OL}$ $= \begin{bmatrix}10\\4\end{bmatrix} - \begin{bmatrix}3\\18\end{bmatrix} = \begin{bmatrix}7\\-14\end{bmatrix}$	B1	
(b) $\underline{OM} = \underline{OL} + \frac{3}{7}\underline{LN}$ $= \begin{bmatrix}3\\18\end{bmatrix} + \frac{3}{7}\begin{bmatrix}7\\-14\end{bmatrix}$ $= \begin{bmatrix}3\\18\end{bmatrix} + \begin{bmatrix}3\\6\end{bmatrix}$ $= \begin{bmatrix}6\\12\end{bmatrix}$ $= M(6, 12)$	M1 A1	
(c) (i) $\underline{OT} = \frac{7}{6}OM$ $= \frac{7}{6}\begin{bmatrix}6\\12\end{bmatrix}$ $= \begin{bmatrix}7\\14\end{bmatrix}$	B1	
(ii) $\underline{LT} = \begin{bmatrix}7\\14\end{bmatrix} - \begin{bmatrix}3\\18\end{bmatrix} = \begin{bmatrix}4\\-4\end{bmatrix}$ $\underline{LB} = \begin{bmatrix}15\\6\end{bmatrix} - \begin{bmatrix}3\\18\end{bmatrix}$	B1 B1 8 marks	

SOLUTION	MARKS	ALTERNATIVE METHOD
23.(a) $L = \sqrt{4^2 + 3^2}$ $L = \sqrt{25} = 5cm$  $A_c = \prod rl$ $= 3.142 \times 3 \times 5$ $= 47.13\ cm^2$ $A_{cs} = \prod Dh$ $= 3.142 \times 6 \times 8$ $= 150.82\ cm^2$ $As = \frac{1}{2}\ 4\prod r^2 = 2\prod r^2$ $= 2 \times 3.142 \times 9$ $= 56.56\ cm^2$ Ext. S.A = 47.13 + 150.82 + 56.56 = $254.5cm^2$ (b) c.s.f $= \frac{15}{600} = \frac{1}{40}$ $\therefore A.s.f = \frac{1}{1600}$ $\frac{254.5}{\text{Actual Area}} = \frac{1}{1600}$ Actual Area $= 407,200cm^2$ $= 40.72m^2$ $\frac{40.72}{20} \times 0.75 = 1.527$ ltrs		
24. (a) $S = 5^3 - 5(5^2) + 3(5) + 4$ $= 125 - 125 + 15 + 4$ $= 19m$ (b) $V = \frac{ds}{dt}$ $= 3t^2 - 10t + 3$ $= 3(5)^2 - 10(5) + 3$ $= 75 - 50 + 3$ $= 28ms^{-1}$ (a) At rest V = 0 $\therefore 3t^2 - 10t + 3 = 0$ $(3t - 1)(t - 3) = 0$ $t = \frac{1}{3}$seconds or t = 3 seconds (b) $a = \frac{dv}{dt}$ $= 6t - 10$ $= 6(2) - 10$ $= 2ms^{-2}$		

K.C.SE 2006 MATHEMATICS PAPER 121/2 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE METHOD
1. No | Log $(0.46)^2$ | $\bar{1}.6628 \times 2$ | 2.3256 + 36.72 | 1.5649 | 0.8905 185.4 | -2.2682 | $\bar{2}.6223 \times 1/3$ | $(3 + 1.6223)\ 1/3$ $10^{-1} \times 3.473$ ← | 1.5408 | $= 0.3473$	M1 M1 M1 A1 4 marks	All 3 logs Operations (x3, +, -) Correct attempt Accept standard form
2. $p = r^2(1 - as^2)$ $s^2 = \frac{1}{a}(1 - \frac{p}{r^2})$ $s = \pm\sqrt{\frac{1}{a}(1 - \frac{p}{r^2})}$	M1 M1 A1 3 marks	For squaring both sides or equivalent for s^2 subject CAO $\pm\sqrt{\frac{r^2 - p}{ar^2}}$
3. $\angle PTO = 90°$ or $\angle RTN = 90°$ $\angle TOR = 110°$ or $\angle TOP = 70°$ $\angle RST = 55°$	B1 B1 A1 3 marks	
4. $800 \times 0.006 = 4.8$ $\%\text{error} = \frac{4.8 - (788 \times 0.006)}{788 \times 0.006} \times 100\%$ $= \frac{0.072}{4.728} \times 100\%$ $= 1.523\%$	B1 M1 A1 3 marks	Accept 52284264% Rounded off to at least 3 d.p
5. $\bar{x} = \frac{9 + 11 + 12 + 13 + 11 + 10}{6}$ $(x - \bar{x})^2 = 4, 0, 1, 4, 0, 1 = 11$ $s^2 = \frac{4 + 0 + 1 + 4 + 0 + 1}{6}$ $1.6 = x = 10 \div 6 = 2\frac{2}{3}$	M1 M1 A1 3 marks	
6. $\frac{(3\sqrt{2} - \sqrt{3})(2\sqrt{3} + \sqrt{2})}{(2\sqrt{3} - \sqrt{2})(2\sqrt{3} + \sqrt{2})}$ $= \frac{6\sqrt{6} + 6 - 6 - \sqrt{6}}{12 - 2}$ $= \frac{1}{2}\sqrt{6}$	M1 M1 A1 3 marks	
7. 	B1 B1 2 marks	Mid point OQ determined by construction Arc centre M radius OM cutting circle at P
8. Tax on 1st 9680 $= \frac{10}{100} \times 9680 = 968$ Monthly income (shs) $\frac{(1916 - 968)\ 100 + 9680}{15}$ $= 6320 + 9680 = 16000$	M1 M1 A1 3 marks	

SOLUTION	MARKS	ALTERNATIVE METHOD
9. $\sqrt{q^2 + (1/3)^2 + (2/3)^2} = 1$ $\sqrt{q^2 + 1/9 + 4/9} = 1$ $\sqrt{q^2 + 5/9} = 1$ $q = 2/3$ or $-2/3$	B1 M1 M1 A1 4 marks	
10. (a) Coordinates of A: $\left(\frac{5+3}{2}, \frac{5/2+-1}{2}\right) = A(1, 2)$ (b) $r^2 = (5-2)^2 + (5-1)^2$ $r = 5$ Equ. $(x-1)^2 + (y-2)^2 = 5^2$ $x^2 - 2x + 1 + y^2 - 4y + 4 = 25$ $x^2 + y2 - 2x - 4y - 20 = 0$	B1 M1 M1 A1 4 marks	
11. $(2+\frac{1}{2})^5 + 2^5 + 5(2^4)\left(\frac{1}{2}\right) + 10(2^3)(\frac{1}{2})^2 +$ $10(2^2)(\frac{1}{\sqrt{2}})^3 + 5(2)(\frac{1}{\sqrt{2}})^4 + (\frac{1}{2})^5$ $(2-\frac{1}{\sqrt{2}})^5 = 2^5 - 5(2^4)\left(\frac{1}{\sqrt{2}}\right) + 10(2^3)(\frac{1}{\sqrt{2}})^2$ $- 10(2^2)(\frac{1}{\sqrt{2}})^3 + 5(2)(\frac{1}{2})^4 - (\frac{1}{2})^5$ $= 2\left[2^5 + 10(2^3)(\frac{1}{\sqrt{2}})^2 + 5(2)(\frac{1}{\sqrt{2}})^4\right]$ $= 64 + 80 + 5$ $= 149$	M1 M1 M1 A1 4 marks	
12. $t = k^x/\sqrt{y} = t_1 = k^{0.96x}/\sqrt{1.44y} = 0.8t$ Decrease $= t - 0.8t = 0.2t$ % decrease $= \frac{0.2t}{t} \times 100\% = 20\%$	M1 M1 M1 A1 4 marks	
13. 	B1 B1 B1 B1 4 marks	⊥Arc centre A radius 6cm drawn bisector of BC drawn & dotted parallel 4cm from BC drawn region shaded. Apply if to BC is a full line NB: All boundaries must enclose the required region
14. 	P1 C1 B1	Plotting of all points Smooth curve For $x = 2.5 \pm 0.1$ at $y = 2$

SOLUTION	MARKS	ALTERNATIVE METHOD
15. $V = \int a\,dt = 10t - {}^{2}/_{2}t^2 + c$ at $t = 0$, $v = 9 \Rightarrow c = 9$ $\therefore = 10t - t^2 + 9$ at $t = 3$, $v = 10(3) - 3^2 + 9$ $= 30$m/s	B1 M1 A1 4 marks	
16. $\angle POG = 180 - (36 \times 2)$ $= 108°$ Dist. PQ $= 108 \times 60$ $= 6480$mm	B1 M1 A1 3 marks	
17. (a) (i) Principal $= 358400 - (12800 \times 3)$ $= 320000$ (ii) $r = \frac{12800}{320000} \times 100\% = 4\%$ (b) (i) Deposit $= \frac{25}{100} \times 56000 = 14000$ Instalments $= \frac{56000-14000}{2625} = 16$ (ii) Cash price $\frac{100-12.5}{100} \times 4000 = 35000$ %difference $= \frac{56000-35000}{35000} \times 100\%$ $= 60\%$	M1 A1 M1 A1 M1 A1 M1 A1 M1 A1 10 marks	
18. Let width of the path be x Area $= (10 + 2x)(8 + 2x) = 168$ $\Leftrightarrow 80 + 20x + 16x + 4x^2 = 168$ $4x^2 + 36x - 88 = 0$ $\Leftrightarrow x^2 + 9x - 22 = 0$ $(x - 2)(x + 11) = 0$ $(x - 2)(x + 11) = 0$ $x = 2$ or -11 width of path $= 2$m (b) Area covered by small slabs $= 14 \times 12 - (10 \times 8 + 4(2 \times 2)$ $= 72$m^2 No of slabs $= \frac{72}{0.5 \times 0.5} = 288$ Cost of slabs Large $= 600 \times 4 = 2400$ Small $= 50 \times 288 = 14400$ Total cost $= 2400 + 14400 = 16800$	M1 M1 M1 A1 M1 M1 A1 M1 M1 A1 10 marks	Or equivalent Or equivalent
19. (a) (i)  Shear maps(1, 0) - 1(1, 1½)	B1 B1 B1	B' (-4, -5) plotted C' (3, 6½) plotted A'B'C' drawn

(ii) shear maps 1(1,) 1(1, 1½) Matrix = $\begin{pmatrix} 1 & 0 \\ 1\frac{1}{2} & 1 \end{pmatrix}$ A′ B′ C′ A″ B″ C″ (b) (i) $\begin{pmatrix} -1 & 0 \\ 1\frac{1}{2} & -1 \end{pmatrix}\begin{pmatrix} -6 & -4 & 3 \\ -4 & -1 & -2 \end{pmatrix} = \begin{pmatrix} 6 & 4 & -3 \\ -5 & -1 & -2 \end{pmatrix}$ (ii) Half turn, about (0, 0)	M1 A1 M1 A1 B1 B1 B1 10 marks	OR $\begin{pmatrix} 1 & 0 \\ k & 1 \end{pmatrix}\begin{pmatrix} -6 \\ 5 \end{pmatrix} = \begin{pmatrix} -6 \\ -4 \end{pmatrix}$ Accept general form after formation of 4 possible equation A″B″C″ drawn & labelled
20.(a) Dots listing table missing (i) p(1x – y1 = 2) favourable outcomes = 12 p(1x –y1 = 2) = $\frac{12}{64} = \frac{3}{16}$ (ii) p(1x –y/5) favourable outcomes p(1x –y5) = $\frac{12}{64} = \frac{3}{16}$ (iii) p(x>y) favourable outcomes p(x>y) = $\frac{28}{64} = \frac{3}{16}$ (b) (i) k + 2k+3k+4k+5k+6k = 1 21k = 1 k = $^1/_{21}$ (ii) p(11) = $^5/_{21} \times {}^6/_{21} + {}^6/_{21} \times {}^5/_{21}$ = $^{60}/_{441}$ = $^{20}/_{147}$	B1 B1 B1 B1 B1 B1 M1 A1 M1 A1 10 marks	On the table or listed O on the table or listed *on the table or listed
21.(a) Alcoholic vol. in the mixture = $\frac{60}{100} \times 80 = 48$ litres New proportion of alcohol = $\frac{48}{80+x}$ $\therefore \frac{40}{80+x} = \frac{40}{100}$ x = 40 (b) % of alcohol in the new solution is $\frac{48}{120+30} \times 100 = \frac{48}{150} \times 100 = 32$ (c) Alcohol volume in the mixture in litres = 5 x $\frac{32}{100}$ + 2 x $\frac{60}{100}$ = 1.6 + 12 = 2.8 The ratio = 7 – 2.8) : 2.8 = 4.2 : 2.8 = 3 : 2	 B1 B1 M1 A1 M1 A1 M1 A1 M1 A1 10 marks	The volume of the water $\frac{40}{100} \times 80 = 32$ litres New proportion of water = 32 + x $\frac{32+x}{80+x} = \frac{60}{100}$ x = 40 water volume in this mixture = 5 x $\frac{68}{100}$ + 2 x $\frac{40}{100}$ 3.4 + 0.8 = 4.2 The ratio = 4.2 : (7 – 4.2) = 4.2 : 2.8 = 3 : 2

22. (a) $a \times ar \times ar^2 = 64$

$a^3r^3 = 64 \quad r = 3\frac{\sqrt{64}}{a^3}$

$= \frac{4}{a}$

(b) (i) $a + a \times 3 + \frac{4}{a}\left(\frac{4}{a}\right)^2 = 14$

$a2 - 10a + 16 = 0$

$a = 8$ or 2

$\therefore r = ½$ or 2

8, 4, 2, 1

(ii) The product $= 8(½)^{50-1} \times 2 \times 2^{50-1} = 16$

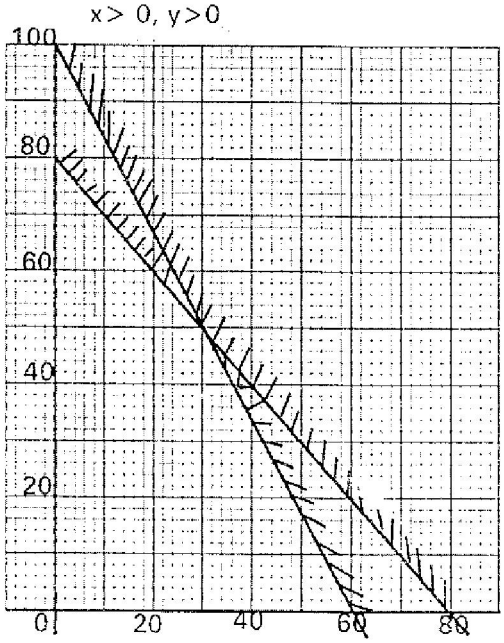
M1
M1
A1
M1
A1
B1
B1
B1
M1
A1
10 marks

23. (a) $300x + 180 < 18000$

$5x + 3y < 300$

$x + y < 80$

$x > 0, y > 0$



$x = 30, y = 50$

Max profit $= 50 \times 4000 + 30 \times 6000$

$= 380000$

B1
B1
B1

S1
B1
B1
B1
B1

B1
M1
A1
10 marks

24. (a) $3x = 4 - x2$

$(x + 4)(x - 1) = 0$

$x = -4$ or $x = 1$

$\therefore$ The coordinator of P(1, -3)

The coordinator of Q(-4, -12)

(b) $\int_{-4}^{-2}(14 - x^2)dx = \left[4x - \frac{1}{3}x^3\right]_{-4}^{-3}$

$= (4 \times 2 - \frac{1}{3}x(-2)^3 - (4x - 4 - \frac{1}{3}(-4)^3$

$= 10^2/_3$

The shaded area $= ½ \times 4 \times 12 - 10^2/_3$

below x axis $= 13^1/_3$

shaded area $= 13\frac{1}{13} + [4x - \frac{1}{3}x^3]^0$

$= 13\frac{1}{3} + 0 = \left[4x2 - \frac{1}{3}\right](8)$

$= 13\frac{1}{3} + 5\frac{1}{3}$

$= 18\frac{2}{3}$

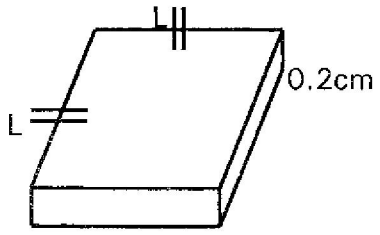
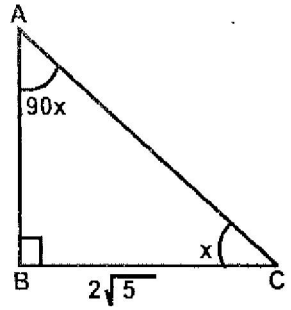
M1
A1
M1
B1
M1

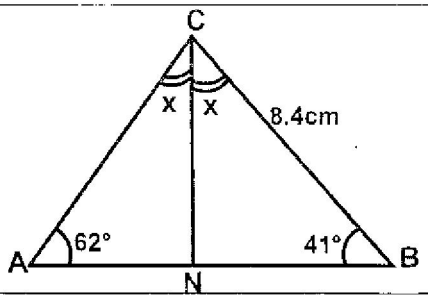
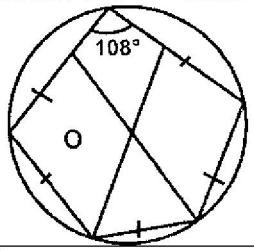
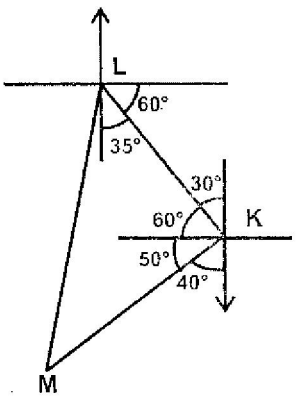
A1

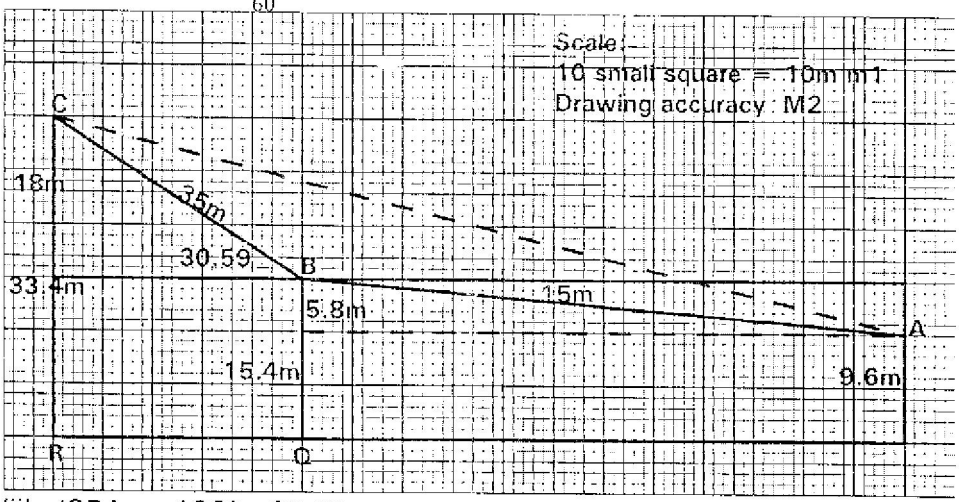
M1
A1
M1
A1

10 marks

K.C.SE 2007 MATHEMATICS PAPER 121/1 MARKING SCHEME

SOLUTION	MARKS
1. $\frac{0.0084 \times 1.23 \times 3.5}{2.87 \times 0.056} = \frac{84 \times 123 \times 35}{28 \times 56} = \frac{10^7}{10^7}$ $= 0.225$	M1 A1 2 marks
2. $3x° + (x - 20)° = 180°$ $4x° - 20 = 180°$ M½ $4x° = 160°$ $x = 40°$ Let n = no. of sides $\frac{360°}{n} = 40°$ $40°n = 360°$ $n = 9$	M½ M1 A1 3 marks
3. $(x^2-y^2)(x^2+y^2)(x^4-y^4) = (x+y)(x-y)(x^2+y^2)(x^2-y^2)$ $= (x^4+x^2y^2 - y^4 - x^2y^2 \Rightarrow (x^4 - y^4)(x^4 - y^4)$ $= x^8 - x^4y^4 - x^4y^4 + y^8$ $= x^8 - 2x^4y^4 + y^8$	M1 A1 2 marks
4. 118 yens = Kshs. 76 $\therefore$ 2,950,000 yens $= \frac{2,950,00}{118} \times 76 =$ Kshs. 1,900,000 The duty paid $= {}^{20}/_{100} \times 1,900,000 =$ Kshs. 380,000	M1 M1 A1 3 marks
5. $\frac{dy}{dx} = 3ax^2 + b$ $3a + b = -5$ $a + b = 1$ $a = -3$ $b = 4$	M1 M2 A1 4 marks
6. $\frac{15a^2b - 10ab^2}{3a^2 - 5ab + 2b^2} = \frac{5ab(3a - 2b)}{3a^2 - 3ab - 2ab + 2b^2} = \frac{5ab(3a - 2b)}{(a - b)(3a - 2b)} = \frac{5ab}{a - b}$	M1 M1 A1
7. Volume $= \frac{\text{Mass}}{\text{Density}}$ $= \frac{1050cm^3}{8.4} = 125cm^3$ $\therefore L \times L \times 0.2cm = 125cm^3$ $L^2 = \frac{125cm}{0.2} = 625$ $L = \sqrt{625} = 25cm$  	M1 M1 A1
8. Cos x $= \frac{\text{Adjacent}}{\text{Hypo}}$ $= \frac{2\sqrt{5}}{5}$ Pythogras: $AB = \sqrt{5^2 - (2\sqrt{5})^2} = \sqrt{5}$ $\text{Tan}(90° - x) = \frac{2\sqrt{5}}{\sqrt{5}} = 2$  	M1 A1
9. X = Area = πDL $= 3.142 \times 10 \times 12$ $= 377.04cm^2$ X – Area in Contract $= 377.04 \times \frac{2.5}{10}$ $= 94.26cm^2$	

SOLUTION	MARKS
10. $\angle ACB = 180° - (62° + 4°)$ $= 77°$ $\therefore x = \frac{77°}{2} = 38.5°$ $\angle CNB = 180° - (41° + 38.5°)$ $\frac{8.4}{\text{Sin } 100.5} = \frac{CN}{\text{Sin } 41°}$ $\therefore CN = \frac{8.4}{\text{Sin } 100.5°} = 5.6\text{cm}$ 	M1 A1 M1
11. Let Mother's years be x and son's be y now: $x + 14 = 2(y + 14)$ ..... (i) $x + 14 = 2y + 28$ $x - 2y = 14$ ..... (ii) $(x - 4) + (y - 4) = 30$ $X + y = 38$ ..... (iii) (iii) – (ii) $x + y = 38$ $+ \underline{-x + 2 = -14}$ $3y = 24$ $y = 24 \quad x = 30$ At son's birth: mother's age = 30 – 8 = 22 years	M1 M1 M1 M1 A1 5 marks
12. (i) Construct $\angle 108°$, sides 4cm (ii) Bisect two angles to produce centre O. (iii) Draw a circle touching the vertices 	
13. $x + y = 40$ $y = 40 - x$ $x^2 + (40 - x)^2$ $x^2 - 80x + x^2 + 1600$ $2x2 - 80 + 1600$ $\frac{dy}{dx} = 4x - 80$ for min. value $\frac{dy}{dx} = 0$ $\therefore 4x - 80 = 0$ $X = 20$ Subst. $y = 20$ $X^2 + y^2 = 400 + 400$ $= 800$	M1 M1 M1 A1
14. Area of Sector QPR $= \frac{60}{360} \times 6 \times 6 \times 3.142 = 18.852\text{cm}^2$ Area of triangle QPR $= \frac{6 \times 6 \sin 60°}{2} = 15.559\text{cm}^2$ Area of Segment $= 18.852 - 15.559 = 3.2935\text{cm}^2$ Area of Shaded region $= 2 \times 3.2935 + 15.559 = 22.15\text{cm}^2$	M1 M1 M1 A1 4 marks
15. ΔLKM is Isosceles KL = KM (given) $\angle LKM = 50° + 60°$ $= 110°$ (Construction) $\angle KML = KLM$ (Base < s) $= 35°$ Bearing of m from L = 90° + 60° + 35° = 185° 	M1 B1 A1

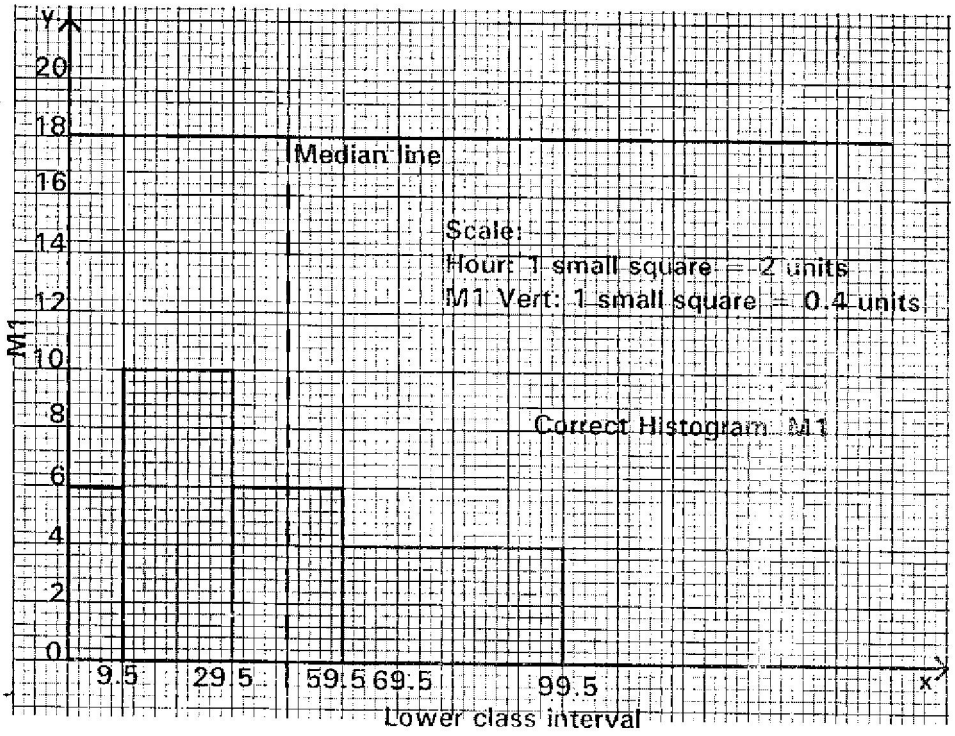
SOLUTION	MARKS
16. Amount of fuel used $= \frac{120}{4} \times \frac{8}{3}$ Amount of money spent $= 80 \times 59 = 4720$	B1 M1 A1
17. (a) Retained profit $= 225{,}000 \times \frac{25}{100} =$ Kshs. 56,250 Remaining after retained $= 225{,}000 - 56{,}250 =$ Shs. 168,750 Taxes and insurance $= 168{,}750 \times \frac{40}{100} =$ Shs. 67,500 Remaining $= 168{,}750 - 67{,}500 =$ Shs. 101,250 Cherop's share of profit $= \frac{105{,}000}{250{,}000} \times 101{,}250 =$ Kshs. 42,525 Nangila's share of profit $= \frac{85{,}000}{250{,}000} \times 101{,}250 =$ Kshs. 34,425 Asha's share of profit $= \frac{60{,}000}{250{,}000} \times 101{,}250 =$ Kshs. 24,300 Cherop's – Asha's $= 42{,}525 - 24{,}300 =$ Kshs. 18,225 (b) Profit 2nd year $= {}^{10}/_{9} \times 225{,}000$ $=$ Kshs. 250,000 Nangila's share of profit $= \frac{110{,}000 \times 250{,}000}{275{,}000} =$ Kshs. 100,000	M1 M1 M1 A1 M1 A1 B1 M1 M2 10 marks
18. (a) $\frac{5.8}{\sin 5.5^\circ} = \frac{x}{\sin 84.5^\circ}$ $x = \frac{5.8 \sin 84.5^\circ}{\sin 5.5^\circ} = 60.2$m $\frac{105.8}{\sin 149.5^\circ} = \frac{60.2}{\sin C}$ $\sin C = \frac{60.2 \sin 149.5}{105.8} = 0.2888$ (b) (i) 60mm = 33.4m $\therefore 190\text{mm} = \frac{190 \times 33.4}{60} = 105.77$m  (ii) $\angle CBA = 180^\circ - 30.5^\circ$ $\therefore \angle BCA = 16.8^\circ$	M1 A1 M1 M1 M2 M1 A1 8 marks
19. (i)	

Marks	0 - 10	10 - 30	30 - 60	60 - 70	70 - 100
Frequency	12	40	36	8	24
Area of rectangle	60	200		40	120
Height of rectangle	6	10		4	4

M1
A1

NB: Area (A) $= \frac{C.I}{2} \times F$ When C.I is doubled the frequency, (F) is halved — M1

(ii) Height (H) $= \frac{Area}{C.I}$ — A1



2 marks — M1 — M1

(b) Median mark = 30 - 60 — M1

Or 29.5 – 59.6

(ii) $\frac{(35.5)}{2} + \frac{(39.5)}{2} = 17.5 + 19.75 = 37.5$ — A1

$= 37.5$

10 marks

20.(a) Let the no. of computers be x — M1

Price per unit $= \frac{1,800,000}{X}$

After reduction: — M1

Price per unit $= \frac{1,800,000}{x} - 4000$

New no. of units purchased $= (x + 5)$

$(x + 5)\frac{(1,800,000-4000x)}{x} = 1,8000,000x$

$1,800,000x - 4000x^2 + 9,000,000 - 20,000x = 1,800,000x$ — B1

$+ 4000x^2 + 20,000x - 9,000,000 = 0$

$x^2 + 5x = 2250 = 0$

$x^2 + 50x - 2250 = 0$

$x(x + 50) - 45(x + 50) = 0$

$(x + 50)(x - 45) = 0$ — M2

$x = 45$ or $x = -50$

He bought $45 + 5 = 50 = 50$ computers — A1

(b) Remaining computers $= 50 - 2 = 48$ — M1

Total Profit $= \frac{215}{100} \times 1,800,000$ — M1

$=$ Kshs. 270,000 — A1

Profit per computer $= \frac{270,000}{48} =$ Kshs. 5,625 — A1

10 marks

21.(a) (i) $XR = -OX + OR$

$= r - \frac{1}{3}q$ M1

(ii) $YQ = q - \frac{3}{7}r$ M1

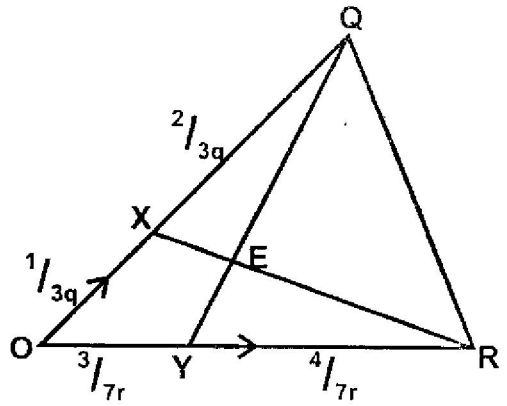
(b) (i) $XE = m(r - \frac{1}{3q})$ M1

(ii) $YE = n(q - \frac{1}{3r})$ M1

(c) (i) $OE = OX + XE$

$= \frac{1}{3q} + m(r - \frac{1}{3}q)$ M1

$= \frac{(1-m)}{3}q + mr$ A1



(ii) Also $OE = OY + YE$

$\frac{3}{7}r - \frac{3}{7}nr + nq$ M1

$= \frac{1-m}{3}n$ ..... (i) A1

$M = 1 - 3n$ ..... (ii) A1

Subst. and solving $n = \frac{2}{9}$ and $m = \frac{1}{3}$ A1

10 marks

22.(a) $(A.S.F)\frac{1}{2} = (L.S.F)$ M1

$L.S.F = \left[\frac{45}{20}\right]\frac{1}{2} = 1.5$

$(L.S.F)^3 = (V.S.F)$

$\therefore V.S.F = (1.5)^3 = 3.375$ M1

$= \frac{0.945}{y} = 3.375$ M1

$\therefore y = \frac{0.945}{3.375} = 0.28$ litres A1

(b) From A.S.F

$A = \frac{3}{2}B$ B1

$\therefore \frac{3}{2}B(13 - h) = Bh$ M1

$2 \times \frac{3}{2}(13 - h) = h \times 2$

$39 - 3h = 2h$ A1

$5h = 39$

$h = \frac{39}{5} = 7.8cm$ M1

(c) Volume in larger $= \frac{3}{2}Bh$ A1

Cylinder $= \frac{3}{2} \times 7.8B$

$= 11.7Bcm^3$ M1

$\frac{1}{5}$ of $11.7B = 2.34Bcm^3$

Total volume of juice in smaller container $= 2.34B + Bh$

$= 2.34B + 7.8B$ A1

$= 101.14B$

12 marks

23. (a) $\begin{bmatrix} 9 & 8 \\ 7 & 6 \end{bmatrix}$ det. $= (9 \times 6) - (8 \times 7)$

$= 54 - 56 = -2$ M1

$A^{-1} = \begin{bmatrix} 6 & -8 \\ -7 & 9 \end{bmatrix} - \frac{1}{2} = \begin{bmatrix} -3 & 4 \\ 3.5 & -4.5 \end{bmatrix}$ A1

(b) Let price of bicycle be x and radio be y

Bicycle Radio

$A = \begin{bmatrix} 36 & 32 \\ 28 & 24 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 227,280 \\ 174,960 \end{bmatrix}$ M1

Det $= (36 \times 24) - (32 \times 28) = 864 - 896 = -32$

$A^{-1} = -\frac{1}{32}\begin{bmatrix} 24 & 32 \\ -28 & 36 \end{bmatrix} = \begin{bmatrix} -0.75 & +1 \\ +0.875 & -1.125 \end{bmatrix}$ M1

$A^{-1} = \begin{bmatrix} x \\ y \end{bmatrix} = A^{-1} \begin{bmatrix} 227,280 \\ 174,960 \end{bmatrix}$

$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -0.75 & 1 \\ 0.85 & -1.125 \end{bmatrix} = \begin{bmatrix} 227,280 \\ 174,960 \end{bmatrix}$

$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4,500 \\ 2,040 \end{bmatrix}$

(c) New Costs:

Bicycle $= \frac{90}{100} \times 4,500 = 4,050/=$

Radio $= \frac{110}{100} \times 2040 = \frac{2244}{=}$

$\begin{bmatrix} 36 & 38 \\ 32 & 24 \end{bmatrix} \begin{bmatrix} 4050 & 2244 \\ 4050 & 2244 \end{bmatrix} = \begin{bmatrix} 145800 + 113400 \\ 71,808 + 53,856 \end{bmatrix}$

Total for Bicycles $\begin{bmatrix} 259,200 \end{bmatrix}$

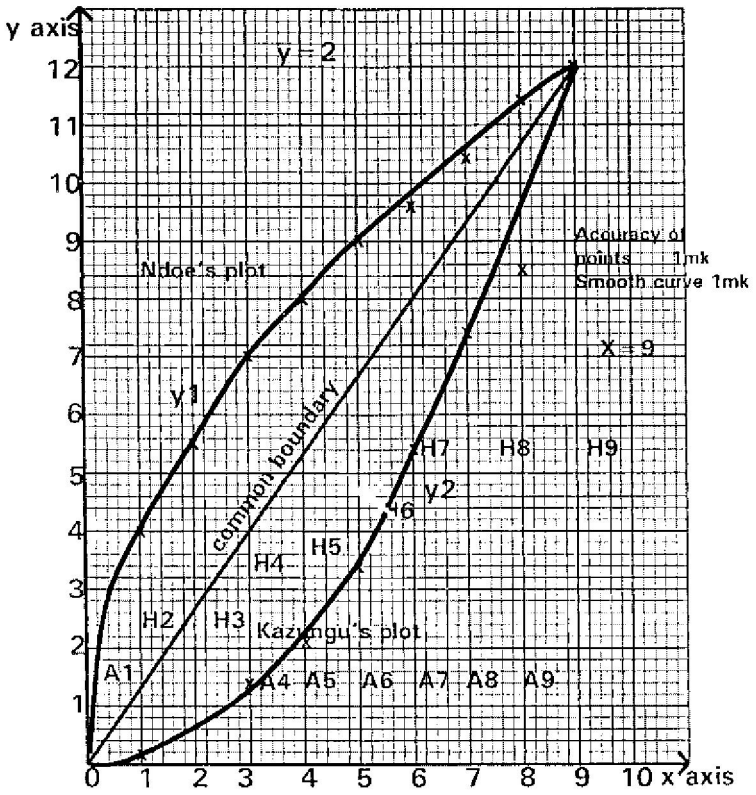
Total for Radios $\begin{bmatrix} 125,664 \end{bmatrix}$

M1

A1

8 marks

24.



2 marks

(b) (i) $A_1 = \frac{1}{2}(1 \times 0.2) + \frac{1}{2}(0.2 + 0.6)1 + \frac{1}{2}(0.6 + 1.3) + \frac{1}{2}(1.3 + 2.4) +$
$\frac{1}{2}(2.4 + 3.7) + \frac{1}{2}(3.7 + 5.3) + \frac{1}{2}(5.3 + 7.3) + \frac{1}{2}(7.3 + 9.5) + \frac{1}{2}(9.5 + 12)$

$= 36.30$sq units

$A_2 = (\frac{1}{2} \times 4 \times 1) + \frac{1}{2}(4 + 5.7) + \frac{1}{2}(5.7 + 6.9) + \frac{1}{2}(6.9 + 8) + \frac{1}{2}(8 + 9) +$
$\frac{1}{2}(9 + 9.8 + \frac{1}{2}(9.8 + 1.06) + \frac{1}{2}(10.6 + 11.3) + \frac{1}{2}(11.3 + 2)$

$= 59.65$sq units

Disputed land $= 59.65 - 36.30 = 23.35$sq units

M1

A1

M1

M1

A1

M1

(ii) $10,000m^2 = 1$hactare

1 unit = 20m

$\therefore 1 \times 1$ unit squared $= 20 \times 20m^2$

Hence 23.35 unit squared $= 23.35 \times 40' = 9.340m^2$

But $10,000m^2 = 1$ hactare

$\therefore 9.34m^2 = \frac{9.340}{10,000} \times 1$

$= 0.934$ hactares

M1

A1

10 marks

K.C.S.E 2007 MATHEMATICS PAPER 121/2 MARKING SCHEME

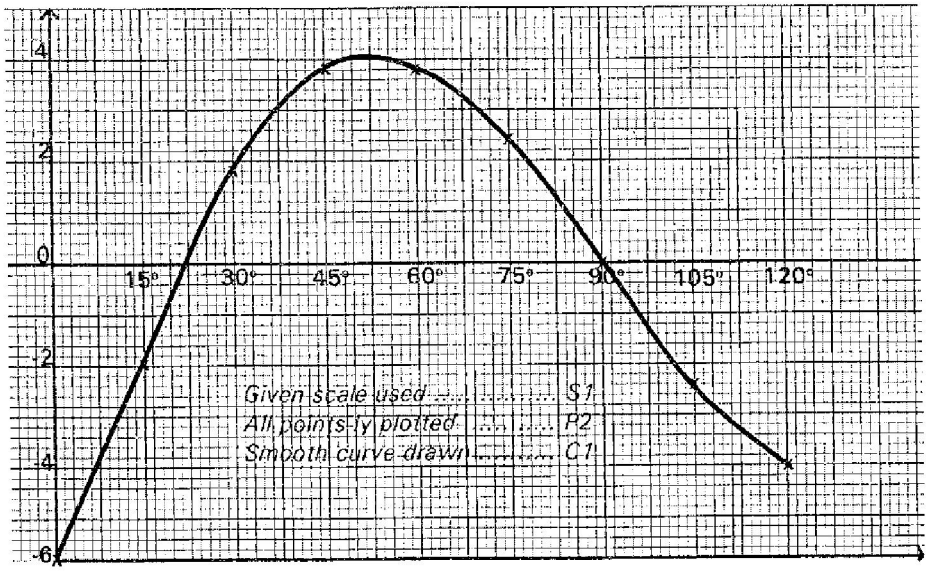
SOLUTION	MARKS	ALTERNATIVE METHOD
1. No | Log 0.32 | $\bar{2}.5051$ 14.26 | 1.1541 + $\bar{1}.6592$ 0.006 | 3.7782 - 1.8810 (4) | 1.8810 x $^2/_3$ 17.95 ← 1.2540 = 17.95	M1 M1 A1 3 marks	All 3 logs Division 3 By 2
2. $yx + 3yz = 2x - 2$ $yx - 2x = 03z - 2$ $x(y - 2) = -3yz - z$ $x = \frac{-3yz - 2}{y - 2}$	M1 M1 A1 3 marks	Or equivalent
3. $3 \cos x = 2(1 - \cos^2 x)$ $3 \cos x = 2 - 2 \cos^2 x$ $2y^2 + 3yz - 2 = 0$ $(2y - 1)(y + 2) = 0$ $y = ½$ or $y = -2$ $\cos x = 0.5$ $x = 60°, 300°$	M1 M1 A1 B1 4 marks	Or equivalent
4. (a) $1.1^5\left[\frac{1}{2}x\right]^0 + 5.1^4\left[\frac{1}{2}x\right]^1 + 10.1^3\left[\frac{1}{2}x\right]^2 + 10.1^2\left[\frac{1}{2}x\right]^3 + 1.1^0\left(\frac{1}{2}x\right)^5$ (b) $\left[1\frac{1}{20}\right]^5 = 1 + \frac{5}{2}\times\frac{1}{10} + \frac{5}{2}\times\frac{1}{100}$ $= 1\frac{11}{40}$ or 1.275	M1 A1 M1 A1 4 marks	Or 1 + 0.25 + 0.25 M1 = 1.275 AL
5. $S = \int(2 - t)dt$ $S = 2t - {}^{t^2}/_2 + c$ When $s = 5, t = 2$ $5 = 2 \times 2 - {}^{2^2}/_2 + c = 3$ $S = 2t - {}^{-1}/_{2t^2} + 3$	M1 M1 A1 3 marks	
6. Interest $= (13\,800 - 2280) \times \frac{20}{100} \times 2$ $= 11520x\ 0.2x1 = 4608$ Each monthly instalments $= \frac{11520 + 4608}{24}$ = Ksh 672	M1 M1 A1 3 marks	
7. $\left[\frac{6+2}{2}, \frac{1+3}{2}\right] = (4, 2)$ $M_1M_2 = \frac{1-3}{6-2} \times m2 = -1$ $\frac{y-2}{x-4} = 2$ $\therefore 2x - y = 6$	B1 M1 M1 A1 4 marks	Or equivalent

SOLUTION	MARKS	ALTERNATIVE METHOD
8. Greatest possible error $=\frac{64(3.15-3.05)}{2}$ $=\frac{201.6-195.2}{2}$ $=3.2\ cm^3$	M1 A1 2 marks	
9. 2.5 litres $= 2500cm^3$ $^4/_5 \times 2500 = 2000cm^2$ (water) $^1/_5 \times 2500 = 500cm^3$ (milk) $200 \times 1 + 500 \times 1.2$ $= 2600gm$	M1 M1 A1 3 marks	$\frac{4 \times 1 + 1 \times 1.2}{5} = 1.04$ $1.04 \times 2500 = 2600g$
10. $\frac{67-32}{14} = \frac{37}{14}$ $= 2.5$ $67 - 6 \times 2.5$ $= 52cm$	M1 M1 A1 3 marks	
11. (a) $NR = \sqrt{4^2 + 7.5^2}$ $= 8.5$ (b) $QR = (14 + 8.5) = 7.52$ $QR = 4 \times AN = 14 \times (8.5 - 2.5)$ $AN = \frac{14 \times 6}{4} = 12cm$	B1 M1 M1 A1 4 marks	
12. $\lvert P\rvert = \sqrt{3^2 + (-1)^2 + (1\,^1/_2)^2}$ $Q = 2p$ or $-2p$ $Q = 6i - 2j + 3k$ or $6i + 2j - 3k$	B1 B1 2 marks	
13. Longitude difference $= 360° - (133° + 118°) = 109$ $\therefore 109 \times 60 \cos x = 5422$ $\cos x = 0.8291$ $x = 22.99°$ $\therefore$ Longitude of A or B $= 34°N$	M1 M1 A1 3 marks	
14. When $x = 0, y = 2$ $\therefore 2 = k \times 1 \times 2$ $2 = -2k$ $\therefore k = -1$	M1 A1 2 marks	
15. $\frac{3}{\sqrt{5}-2} + \frac{1}{\sqrt{5}} = \frac{3(\sqrt{5}+2)}{5-4} + \frac{1}{5}\sqrt{5}$ $= 3\sqrt{5} + 6 + \frac{1}{5}\sqrt{5}$ $= 6 + \frac{16}{5}\sqrt{5}$	M1 M1 A1 3 marks	
16. $x^2 + y^2 - {}^3/_2 x + y = {}^1/_4$ $x^2 - {}^3/_2 x + {}^9/_{16} + y^2 + y + {}^1/_4$ $= -{}^1/_4 + {}^9/_{16} + {}^1/_4 = {}^9/_{16}$ $\left(x + \frac{3}{4}\right)^2 + \left(y + \frac{1}{2}\right)^2 = {}^9/_{16}$ Centre $= ({}^3/_4, -{}^1/_2)$ Radius $= {}^3/_4$	B1 B1 B1 B1 4 marks	
17. (a) (i) Fraction filled in 1hr (P & Q) $\frac{2}{9} + \frac{1}{3} = \frac{5}{9}$ Time taken $= 1\,^4/_5$ hr	M1 A1	

(ii) Fraction filled in 1hr (P, Q & R) $= \frac{5}{9} - \frac{1}{2} = \frac{1}{18}$ Time taken to fill tank = 18 hrs (b) (i) Fraction filled by 9.00 a.m P - $\frac{2}{9}$ x 1hr = $\frac{2}{9}$ Q - $\frac{1}{3} + \frac{1}{4}$h = $\frac{1}{12}$ P & Q - $\frac{2}{9} + \frac{1}{12} = \frac{11}{36}$ (ii) Fraction to be filled = $\frac{25}{36}$ Time taken $\frac{25}{36}$ x 18 = $12\frac{1}{2}$hr Time tank will fill up 0900 + 12.30 = 2130h(9.30 pm)	M1 A1 M1 M1 A1 M1 M1 A1 10 marks	
18.(a) (i) $y = \frac{K}{x^n}$ (ii) k = 12 x 2^n and k = 3 x 4^n $\Leftrightarrow$12 x 2^n = 3 x 4^n 4 x 2^n = 4^n $2^{n+2} = 2^{2n}$ N = 2 or n = 2 K = 48 or n = 2 (b) $y = \frac{48}{(5\frac{1}{3})^2} = \frac{48 \times 9}{16^2}$ $= {}^{27}/_{16} = 1\,{}^{11}/_{16}$ or 1.6875	B1 B1 B1 M1 M1 M1 A1 B1 8 marks	K = 12 x (2^n) K = 3 x 4^n $k/12 = 2^n$ and $k/3 = (2^n)^2$ $k^2/144 = (2^n)^2$ $k/3 = k^2/144$ $48k = k^2$ $K^2 - 48k = 0$ K(k - 48) = 0 K = 0 or k = 48

19.(a)

x	0°	15°	30°	45°	60°	75°	90°	105°	120°
Y = 8 sin 2x – 6cos									

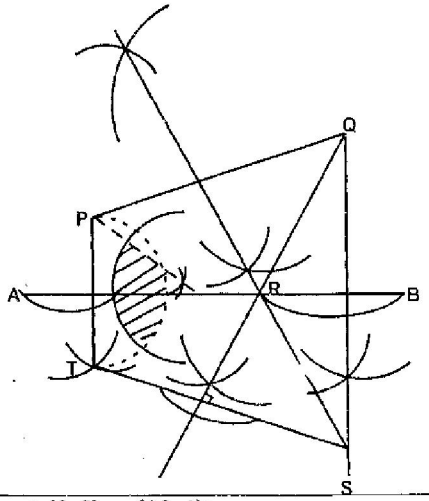
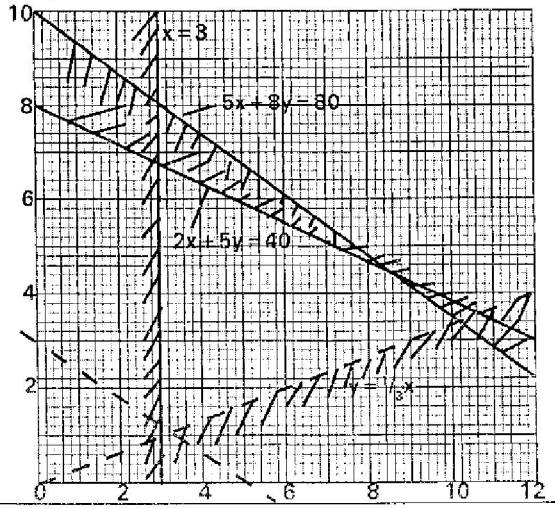


(c) (i) Maximum y = 4.1 ± 0.1

(ii) 8sin 2x – 6cos x = -2

X = 31.5 ± 0.75°

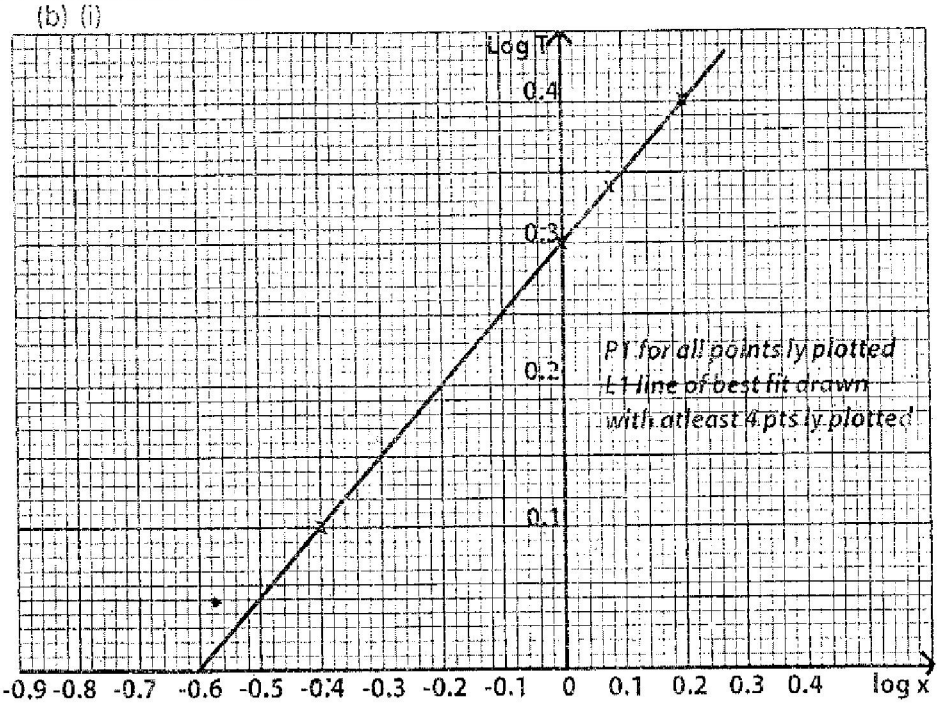
X = 78 ± 0.75°

20. (a) (i) $y = \frac{2x^2}{2} + x + c$ At $x = -4$, $y = 6$ $6 = (-4)^2 - 4 + c$ $C = -6$ $Y = x^2 + x - 6$ (ii) $x^2 + x - 6 = 0$ $(x - 2)(x + 3) = 0$ $X = 2$ or $x = -3$ (b) $\int_{-3}^{2}(x^2 + x - 6)dx$ $= \left[x^3/3 + x^2/2 - 6x\right]_{-3}^{2}$ $= \left[8/3 + 4/2 - 12\right] - \left[27/3 + 9/2 - 18\right]$ $= -7\frac{1}{3} - 13.5$ $= -20\frac{5}{6}$ square units	M1 M1 A1 M1 M1 A1 M1 M1 A1 B1 10 marks	
21.  	B1 B1 B1 B1 B1 B1 B1 B1 B1 10 marks	⊥bisector of PQ constructed and point R marked ⊥dropped from Q to AB or ∠PRB transferred to ∠BRS RS 1 form P to AB constructed PT = 2 length of 1 and polygon completed R from TS = 4.6 ± 0.1 Bisect of ∠QPT drawn dotted Arc centre R with radius 4.5cm drawn semicircle with PT as diameter drawn dotted correct region shaded.
22. (a) $\begin{bmatrix}(0,8) & (10,4)\\(0,10) & (8,5)\end{bmatrix}$ $2x + 5y < 40$ $5x + 8y < 80$ $x > 3$ $y > \frac{1}{3}x$ (b)  		

23. (a)

Log x	-0.4	0.00	0.08	0.15	0.20
Log T	0.10	0.30	0.34	0.37	0.40

(b) (i)



(ii) a = log-1 0.3 = 2.00

b = gradient = $\frac{0.4-0.1}{0.1-(-0.4)}$ or equivalent

= 0.5

(c) Lot T = b log x + log a

0 = 0.5 log x + 0.3

Log x = $\frac{-0.3}{0.5}$ = −0.6x

= 0.25

24. (a) P(RR) = $\frac{4}{6} \times \frac{2}{5} = \frac{8}{30} = \frac{4}{15}$ M1

P(YY) = $\frac{2}{6} \times \frac{3}{5} = \frac{6}{30} = 8\frac{1}{5}$ M1

P(same colour) = $\frac{8}{30} + \frac{6}{30} = \frac{14}{30} = \frac{7}{15}$ M1 A1

(b) (i) P($R_A R_A$) $\frac{4}{6} \times \frac{3}{5} = \frac{2}{5}$ M1

P($R_A R_A$) $\frac{2}{5} \times \frac{1}{1} = \frac{1}{10}$ M1

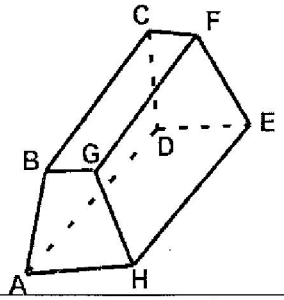
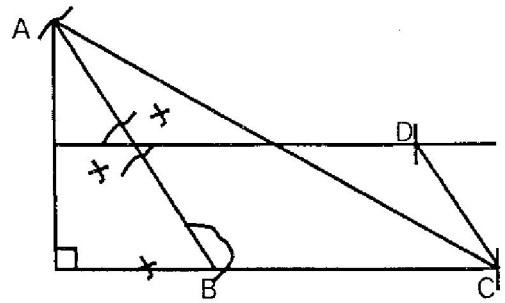
P(Both RED for A or B)

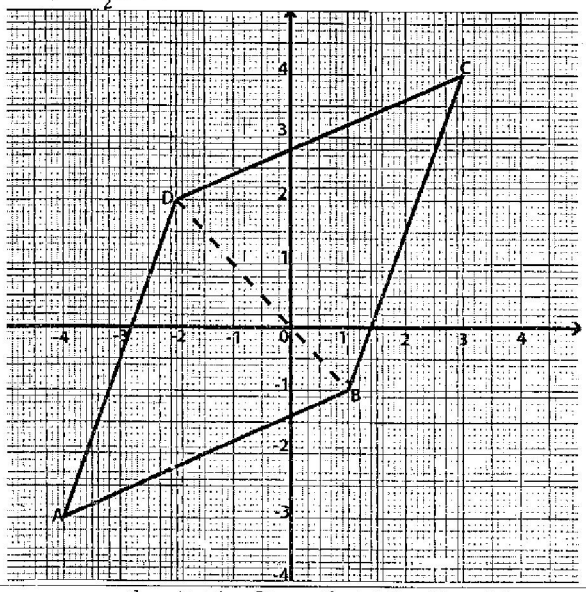
= $\frac{2}{5} + \frac{1}{10} = \frac{4+1}{10} = \frac{1}{2}$ M1 A1 M1 A1

(ii) P (all RED) = $\frac{2}{5} \times \frac{1}{10} = \frac{1}{25}$

10 marks

K.C.SE 2008 MATHEMATICS PAPER 121/1 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE METHOD
1. $\frac{-8+(-5)\times(-8)-(-6)}{-3+(-8)\div 2\times 4} = \frac{-8+40+6}{-3+-4\times 4}$ $= \frac{38}{-19} = -2$	M1 A1 2 marks	
2. $\frac{(3^3)^{2/3}\div 2^4}{(2^5)^{-3/5}} = \frac{3^2\div 2^4}{2^{-3}}$ $= \frac{3^2}{2^4\times 2^{-3}}$ $= 9/2 = 4\,1/2$ or 4.5	M1 M1 A1 3 marks	Or equivalent For $2^4 \times 2^{-3}$ or equivalent $9/2$ is not simplified
3. $\frac{a^4-b^4}{a^3-ab^2} = \frac{(a^2+b^2)(a^2-b^2)}{a(a^2-b^2)}$ $= \frac{a^2+b^2}{a}$ or $\frac{a+b^2}{a}$	M1 M1 A1 3 marks	Factorization of numerator Factorization of denominator
4. 23.50 + (7h 15min + 45min + 5h 40min) = 1330h = 1.30pm on Monday	B1 B1 2 marks	
5. 2 Trapezoidal faces B1 3 Rectangular faces B1 Completion of sketch with hidden edges dotted  	B1 B1 B1 3 marks	For trapezoidal x-sectional faces For hidden lines dotted For 3 triangular faces CD parallel and equal to AB GH parallel and equal to FE Completion of sketch with hidden edges dotted
6. Sales: Petrol – $1/3 \times 900\,000$ Diesel – $2/3 \times 900\,000$ Profit: $\frac{1}{3} \times \frac{900000}{1000} \times 520 + 2/3 \times \frac{900000}{1000} \times 480$ $= 156000 + 288000$ $= 444\,000$	M1 M1 A1 3 marks	
7. Volume of liquid $= \frac{384}{0.6}$ Height of liquid $= \frac{640}{\pi \times 3.2^2}$ = 19.89 2dp	M1 M1 A1 3 marks	
8.  	B1 B1 B1 B1 4 marks	$<120^\circ$ constructed at B and completion of Δ Dropping arc from A to CB produced Bisection of height to determination of point D and completion of parallelogram BCDE.

9. Volume of sphere $= {}^{4}/_{3}\pi \times 4.2^3$ $\therefore$ Side of cube $= \sqrt[3]{{}^{4}/_{3}\pi \times 4.2^3}$ $= 6.77$	M1 M1 A1 3 marks	
10. Radius of circle $= \frac{23.4}{1.8} = 13\text{cm}$ Area of sector $= \frac{1.8}{2\pi} \times \pi \times 13^2 = 152.1\text{cm}^2$	M1 A1 M1 A1 4 marks	Are length r θ° where θ is in radians $\Rightarrow 243 = r \times 1.8$ $\therefore r = \frac{24.3}{1.8}$ Follow through
11. Equation of line AD $\frac{y - -3}{x - -4} = \frac{5}{3}$ $y = \frac{5}{2}x + 7$  	M1 A1 B1 B1 4 marks	Or $\frac{y-2}{x+2} = \frac{5}{2}$ Plotting points A, B and C Location of point D(-2, 2)
12. $AB = \begin{bmatrix} k & 4 \\ 3 & 2 \end{bmatrix}\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} k+12 & 2k+16 \\ 3+6 & 6+8 \end{bmatrix}$ $= \begin{bmatrix} k+12 & 2k+16 \\ 9 & 14 \end{bmatrix}$ Det AB $= (k+12)\times 14 - (2k+16)\times 9 = 4$ $14k + 168 - 18k - 144 = 4$ $-4k = -20$ $k = 5$	M1 M1 A1 3 marks	If brackets missing wait for $-18k - 144 + 14k + 168 = 4$
13. Area of rectangular part $= 2 \times 5.2 \times \Pi \times 18$ $= 187.2\Pi$ Area of circular parts $= 2 \times 5.2^2 \times \Pi$ $= 54.08\Pi$ $\Pi(187.2 + 54.08) = 241.28\Pi$	M1 M1 A1 3 marks	
14. $\text{Log } 0.096 = \log(4^2 \times 6 \times 10^{-3})$ $= 2(0.6021) + \bar{3}.7782$ $= \bar{2}.9824$ Or (-1.0176)	M1 M1 A1 3 marks	
15. $2y = 5x + 8$ $y = \frac{5}{2}x + 4$ Gradient of L $= \frac{5}{2}$ Gradient of $L_2 = \frac{0+4}{-5-5} = \frac{4}{10} = \frac{-2}{3}$ $\frac{5}{2} \times \frac{-2}{5} = -1$ $\therefore L_1$ and L_2 are perpendicular	B1 B1 B1 3 marks	If the gradient of L_1 and L_2 are negative reciprocals of each other then $L_1 \perp L_2$.

16. $2\cos 2\theta = 1$
$\cos 2\theta = \frac{1}{2}$
$\therefore 2\theta = 60°, 300°, 420°, 660°$
$\theta = 30°, 150°, 210°, 330°$

B1
B1
B1 B1
4 marks

17. (a) Juma earnings before increase
$112\% \rightarrow 8400$
$100\% \rightarrow 8400 \times \frac{100}{112}$
Akinyi's earnings before increase
$= \frac{3}{5} \times 7500 = 4500$
Increase in Akinyi's earnings
$= 14,100 - 8400 - 4500 = 1200$
% increase in Akinyi's earnings
$= \frac{1200}{4500} \times 100 = 26\frac{2}{3}$ or 26.67
(b) No. of bags bought
$= \frac{14100}{1175} = 12$ bags
Profit $= (1762.50 - 1175) \times 12$
$= 7050$
Ratio $= 5700 : 8400 = 19 : 28$
Profit for Akinyi $= 7050 \times \frac{19}{47} = 2850$
Total earning for Akinyi; $5700 + 2850$
$= 8550$

M1
A1
M1
M1
M1
A1
M1
M1
A1
10 marks

Or equivalent
Sale price 1762.50×12
$= 21050$ M1
Ratio $84 : 57 = \frac{57}{141} \times 21150$ M1
$= 8550$ A1

18. (a) Trapezium rule

x	-2	-1	0	1
y	7	5	5	7

$\text{Arc} = \frac{1}{2} \times [(11+11) + 2(7+5+5+7)]$
$= \frac{1}{2}(22 + 48)$
$= 35$
Arc $= 11 \times 5 = 55$
$= 55 - 35$
$= 20$ square units

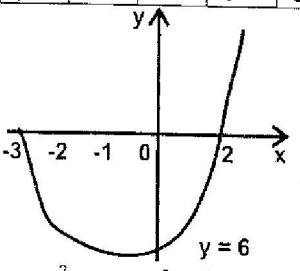
(b) Mid - ordinates

x	-2.5	-1.5	-0.5	0.5	1.5
y	8.75	5.75	4.75	5.75	8.75

$AC = (8.75+5.75+4.75+5.75+8.75)\times 1$
$= 33.75$
$A = 55 - 33.75$
$= 21.25$
Difference $= 21.25 - 20$
$= 1.25$ sq units

B1
M1
A1
M1
A1
B2
M1
M1
A1
10 marks

x	-3	-2	-1	0	1	2
y	0	4	6	6	4	0



$y = x^2 + x - 6$ M1 A1
$A = \frac{1}{2}(0 + 2(20)$ M1
$= 20$ A1

xm	-2.5	-1.5	-0.5	0.5	1.5	
ym	2.25	6.25	6.25	5.25	2.25	21.25

$A = 1 \times 21.25$ M1
$= 21.25$ A1
Difference $= 21.25 - 20$ M1
$= 1.25$ B1

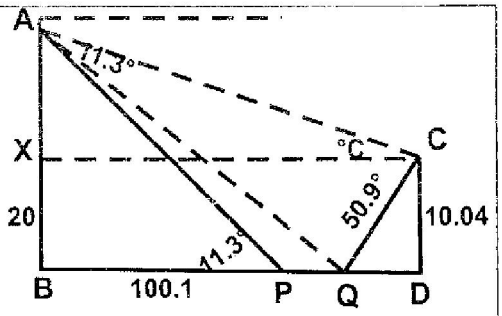
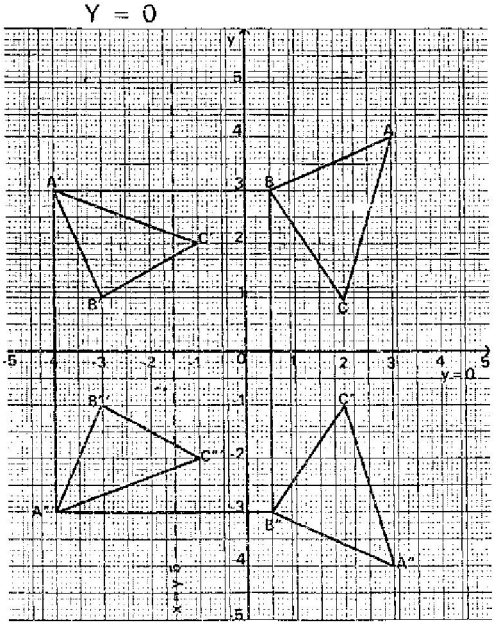
19. (a) (i) $\underline{BD} = \underline{q} - \underline{p}$
(ii) $\underline{BC} = \frac{2}{3}(\underline{q} - \underline{P})$
(iii) $\underline{CD} = \frac{1}{3}(\underline{q} - \underline{P})$
(iv) $\underline{AC} = \underline{P} + \frac{2}{3}\underline{q} - \frac{2}{3}\underline{P}$
$= \frac{1}{3}\underline{q} + \frac{2}{3}\underline{q}$
(b) (i) $\underline{CE} = \underline{CD} + \underline{DE}$
$= \frac{1}{3}\underline{q} - \frac{1}{3}\underline{P} + \frac{1}{2}\underline{P}$
$= \frac{1}{3}\underline{q} + \frac{1}{6}\underline{P}$
$\underline{AC} = K(\frac{1}{3}\underline{q} + \frac{1}{6}\underline{P})$
$\frac{1}{3}\underline{P} + \frac{2}{3}\underline{q} = \frac{1}{3}k\underline{q} + \frac{1}{6}k\underline{p}$
$\frac{1}{6}k = \frac{1}{3} \rightarrow k = 2$
(ii) $AC = 2CE$
$AC : CE = 2:1$

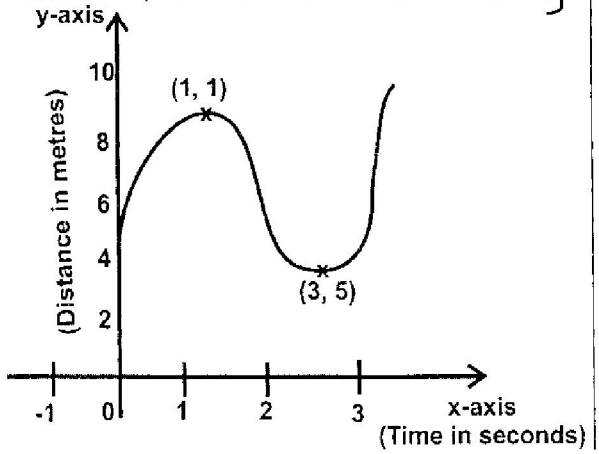
B1
B1
B1
M1
A1
M1
A1
M1
A1
B1
10 marks

If ratio theorem used M1 will be implied give M1 A1

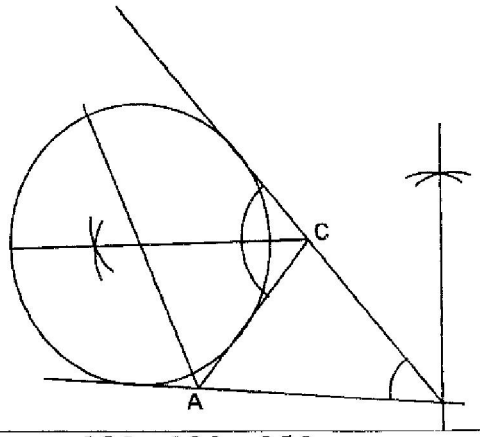
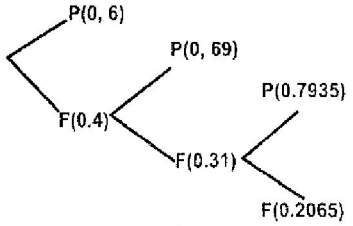
Ratio theorem could be used or equivalent.

With no vector sign used at all 0W-1

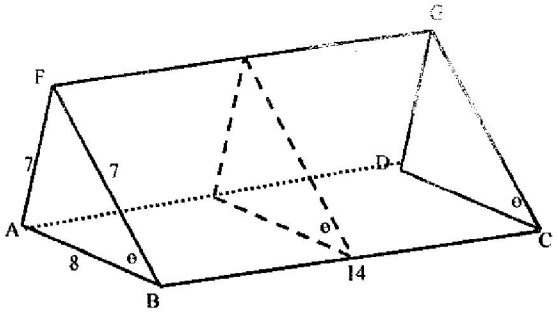
20. (a) Tan 11.3° = $20/x \rightarrow x = \frac{20}{\tan 11.3°}$ $= \frac{20}{0.1998197} = 100.09022$ $\sim$ 100.1m (b) PQ = $\frac{36 \times 1000}{60 \times 60} \times 5 = 50$m BQ = 100.1 + 50 = 150.1m Tan θ = $\frac{20}{150.1} = 0.1332445$ θ = 7.5896426 θ = 7.59° (c) (i) QD = 200 – 150.1 = 49.9 CD = $\sqrt{50.9^2 - 49.9^2}$ = 10.03991 $\sim$ 10.04m (ii) AX = 20 – 10.04 = 9.96 Tan α = $\frac{9.96}{200} = 0.0498$ α = 2.8509745 α = 3°	M1 A1 M1 M1 A1 M1 A1 M1 M1 A1 10 marks	
21. (a) ΔA'B'C' ✓ly drawn (b) ΔA"B"C" ✓ly drawn (c) ΔA"'B"'C"'✓ly drawn (d) Reflection in line y = -x X = -1.5 Y = 0 	B2 B2 B2 B2 B1 B1 10 marks	Allow B1 for two vertices For B1 above B0 if B1 above
22. (a) $\frac{1}{3} \times \frac{22}{7} \times 21 \times 21 \times 30 = 13860$ (b) (i) $\frac{r}{21} = \frac{36}{30}$ $r = \frac{36 \times 21}{30} = 25.2$ (ii) $\frac{1}{3} \times \frac{22}{7} \times 25.2 \times 5.2 \times 36 = 23950.08$ = 23950.08 – 13860 = 10090.08cm³ (iii) $\frac{4}{3} \times \frac{22}{7} \times r^3 = 10090.08$ $r^3 = \frac{10090.08 \times 21}{4 \times 22}$ $r = 3\sqrt{2407.86} = 13.40$cm	M1 A1 M1 A1 M1 A1 A1 M1 M1 A1 10 marks	13858.22 if Π = 3.142 138544236 if Π in the calculator used Ratio of heights 30 : 36 = 5 : 6 Volume of big cane = $\frac{216}{125} \times 13869$ = 23950 Vol. of sphere – 10090.08 M1 A1 23950-08 – 13860 = 10090.08 $\frac{4}{3}\pi r^3 = 10090.08$ M1 $r^3 = 10090.08 \times \frac{3}{4} \times \frac{7}{22}$ $r^3 = 2407.8$ M1 r = 13.40cm A1

23.(a) Let the original number be n. Original contribution $= \frac{2000000}{n}$ Amount per member after withdrawal of 40 $= \frac{2000000}{n-40}$ $\frac{2000000}{n-40} - \frac{2000000}{n} = 2500$ $2000000 - 2000000n + 80000000 = 2500(n - 40)n$ $2000000n = 2500n^2 + 2000000n -$ $1000000 - 80{,}000000$ $n^2 - 40n - 3200 = 0$ $(n - 200)(n + 160) = 0$ $n = 200$ (b) New contribution $= \frac{55}{100} \times 2000000$ Contribution per member $\frac{55}{100} \times 2000000 \times \frac{1}{160} = 6875$ (c) Actual cash contribution by members $\frac{55}{100} \times 2000000 \times \frac{19}{25} = 836{,}000$	B1 M1 M1 M1 A1 M1 M1 A1 M1 A1 10 marks	For either $\frac{2000000}{n}$ or $\frac{2000000}{n-40}$ For removal of denominator and expression Or $6875 \times \frac{19}{25} \times 160$
24.(a) $\frac{ds}{dt} = 3t^2 - 12t + 9$ $\frac{ds}{dt}(0.5) = 3(0.5)^2 - 12(0.5) + 9 = 3.75$ (b) $\frac{ds}{dt} \Rightarrow 0 \Rightarrow 3t^2 - 12t + 9 = 0$ $t^2 - 4t + 3 = 0$ $(t - 3)(t - 1) = 0$ $t = 3 \quad t = 1$ when $t = 3$, $s = 3^3 - 6 \times 3^2 + 9 \times 3 + 5$ when $t = 1$, $s = 1^3 - 6 \times 1 + 9 \times 1 + 5 = 9$  	M1 M1 A1 M1 M1 A1 B1 B1 B1 B1 10 marks	

K.C.S.E 2008 MATHEMATICS PAPER 121/2 MARKING SCHEME

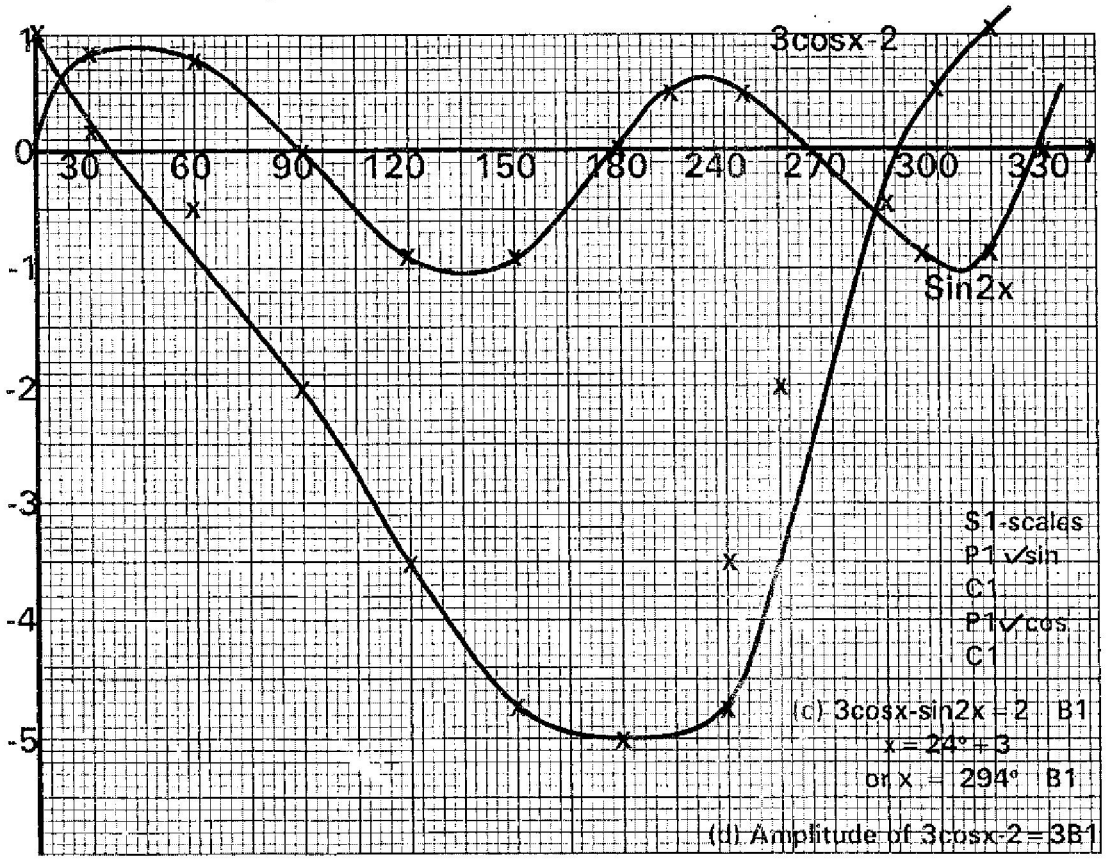
SOLUTION	MARKS	ALTERNATIVE METHOD
1. No: 6.373, 0.6944, $\sqrt{0.004636}$ Log: 0.8043, $\bar{1}.8416$, 0.6459, $\bar{3}.6661$, $\bar{2}.8331$, 1.8128 ↓ 64.98	M1 M1 A1 3 marks	All 3 logs correct 2nd log and all operations (+, ÷, -)
2. $q - htq = 1 + rh$ $q - 1 = rh + htq$ $q - 1 = h(r + tq)$ $h = \frac{q-1}{r+tq}$	M1 A1 2 marks	Grouping
3.  	B1 B1 B1 3 marks	Construction of 45° and completion of Δ Bisecting two angles to determine the centre. Dropping a perpendicular from centre to a size and drawing the circle.
4. $AB = \begin{bmatrix}8\\-6\\6\end{bmatrix} - \begin{bmatrix}3\\-1\\-4\end{bmatrix} = \begin{bmatrix}5\\-5\\10\end{bmatrix}$ $\underline{OP} = \underline{OA} + \underline{AP}$ $= \begin{bmatrix}3\\-1\\-4\end{bmatrix} + \frac{2}{5}\begin{bmatrix}5\\-5\\10\end{bmatrix} = \begin{bmatrix}5\\-3\\0\end{bmatrix}$	M1 M1 A1 3 marks	
5. $0.05 \times 6 = 0.3$ % error $= \frac{0.3}{50 \times 6} \times 100\%$ $= 0.1\%$	M1 M1 A1 3 marks	
6.  P(passing in 2nd attempt) = 0.4 x 0.69 P(passing in 3rd attempt) = 0.4 x 0.31 x 0.7935 P(passing in 2nd or 3rd attempt) = 0.4x0.69+0.4x0.31x0.7935 + 0.276 + 0.098394 = 0.374394	M1 M1 A1 3 marks	Or either of the two For adding the two probabilities Allow for (0.3 + 0.09) Accept 4 s.f

7. (i) Distance = $500 \times \frac{9}{4} = 1125$nm (ii) $\theta \times 60 \times \cos 53.4 = 1125$ $\theta = \frac{1125}{60 \cos 53.4°}$ Longitude of θ = 84.85°E	B1 M1 A1 3 marks	 Allow without E
8. (a) $(10+\frac{2}{x})^5 = 10^5 + 10^4\left(\frac{2}{x}\right) + 10^3\left(\frac{2}{x}\right)^2 + 10^2\left(\frac{2}{x}\right)^3 + 5.10\left(\frac{2}{x}\right)^4$ $= 100000 + \frac{100000}{x} + \frac{40000}{x^2} + \frac{2000}{x^3} + \frac{800}{x^4} + \frac{32}{x^5}$ (b) $14^5 = (10+\frac{2}{x})^5 \Rightarrow \frac{2}{x} = 4 \quad x = \frac{2}{4} = \frac{1}{2}$ $= 100000 + \frac{100000}{1/2} + \frac{40000}{(\frac{1}{2})^2} + \frac{2000}{(\frac{1}{2})^3} + \frac{800}{(\frac{1}{2})^4} + \frac{32}{(\frac{1}{2})^5}$ $= 100000 + 200000 + 16000 + 64000 + 12800 + 1024 = 537824$	M1 M1 M1 A1 4 marks	 Give if any 4 terms in the expression are correct.
9. ΔADC and ΔBAC are similar $\frac{AC}{BC} = \frac{4}{3}$ Area scale factor = $(4/3)^2 = 16/9$ Area of $\Delta ADC = 16/9 \times 24 = 42\frac{2}{3}$ cm^2	M1 M1 A1 3 marks	Or equivalent Accept 42.67cm^2
10. Let $T = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ $\begin{bmatrix} a & b \\ c & d \end{bmatrix}\begin{bmatrix} 2 & 4 \\ 2 & 3 \end{bmatrix} = \begin{bmatrix} 2 & 4 \\ 8 & 15 \end{bmatrix}$ $2a + 2b = 2 \quad 2c + 2d = 8$ $4a + 3b = 4 \quad 4c + 3d = 15$ $4a + 4b = 4 \quad 4c + 4d = 16$ $4a + 3b = 4 \quad 4c + 3d = 15$ $b = 0 \quad d = 1$ $a = 1 \quad c = 3$ $\therefore T = \begin{bmatrix} 1 & 0 \\ 3 & 1 \end{bmatrix}$		
11. $x^2 + y^2 - 2x + 5y = 7/4$ $x^2 - 2x + 1 + y^2 + 5y + \frac{25}{4} = \frac{7}{4} + 1 + \frac{25}{4}$ $(x-1)^2 + (y + 5/2)^2 = 9$ Centre = (1, -2½)	B1 B1 B1 3 marks	
12. Log $\frac{(3y+2)}{10} = \log(y-4)$ $\frac{3y+2}{10} = 4$ $3y + 2 = 10y - 40$ $y = 6$	M1 M1 A1 3 marks	✓single logs Dropping of logs
13. $\frac{\sqrt{3}}{1-\cos 30°} = \frac{\sqrt{3}}{1-\frac{\sqrt{3}}{2}}$ $= \frac{2\sqrt{3} - (2+\sqrt{3})}{(2-\sqrt{3})(2+\sqrt{3})}$ $= \frac{2\sqrt{3}(2+\sqrt{3})}{4-3}$ $= 4\sqrt{3} + 6$	B1 M1 A1 3 marks	 For $\cos 30° = \frac{\sqrt{3}}{2}$ in the expression (Rationalisation)
14. Cos $\theta = 4/7$ $\theta = 55.1500954°$ $\simeq 55.15°$	M1 B1 A1 3 marks	Identifying the angles may be implied Or equivalent

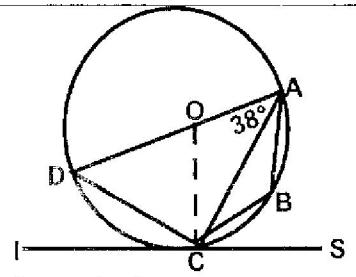
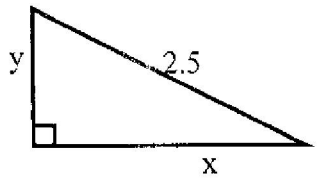
		
15. Distance travelled $= \left[\frac{9}{3}t^3 - \frac{4}{2}t^2 + t\right]_2^3$ $\left[3 \times 3^3 - \frac{4}{2} \times 3^2 + 3\right] - [3 \times 2^3 - 2 \times 2^2 + 2]$ $= 66 - 21$ $= 45m$	M1 M1 A1 3 marks	For ✓ integration Allow if two terms without units
16. $2(1 - \sin^2 x) - \sin x = 1$ $2\sin^2 x + \sin x - 1 = 0$ $2\sin^2 x + 2\sin x - \sin x - 1 = 0$ $(2\sin x - 1)(\sin x + 1) = 0$ $\sin x = \frac{1}{2}$ or $\sin x = -1$ $x = \frac{1}{6}\pi^c, \frac{5}{6}\pi^c, \frac{3}{2}\pi^c$	M1 M1 A1 B1 4 marks	Substitution Factors Both Allow if C is quitted
17. (a) CP $= 400 \times 30 + 350 \times 50$ $= 29500$ SP $= \frac{120}{100} \times 29500 = 35400$ 1 bag $= 35400 \div 80 =$ sh. 442.50 (b) CP $= \frac{400x + 350y}{x + y} = 383.50$ $400 \times 350y = 383.5x + 383.5y$ $\Leftrightarrow 16.5x = 33.5y$ $x : y = 33.5 : 16.5$ $= 67 : 33$ (c) $\left[\frac{3}{8} + \frac{67}{100}\right] : \left[\frac{5}{8} + \frac{33}{100}\right]$ $= 209 : 191$	M1 M1 M1 A1 M1 M1 M1 A1 M1 A1 10 marks	ALT 400 350 383.50 400-383.5 = 16.5 33.5 16.50 383.5 - 350 = 33.5 ⇒ 33.5:16.5
18. (a) $P = \frac{kq}{r^2}$ $q = \frac{k(12)}{4}$ $k = 3$ $p = \frac{3(15)}{5^2}$ $= 1.8$ (b) $q = \frac{pr^2}{3}$ (c) $q_1 = 1.2p(0.9r)^2$ $= 0.972\frac{pr^2}{3}$ $\Delta_q = 0.972\frac{pr^2}{3} - \frac{pr^2}{3}$ $= -0.028\frac{pr^2}{3}$ $\%\Delta = (-0.028\frac{pr^2}{3} \div \frac{pr^3}{3}) \times 100$ $= -2.8\%$	B1 M1 M1 A1 B1 M1 M1 A1 M1 A1 10 marks	May be implied Lost if k is not substituted Allow if k is not substituted Or $\frac{pr^2}{3} - 0.972\frac{pr^2}{3}$ $= 0.028\frac{pr^2}{3}$

19.

x	30°	60°	90°	150°	180°	240°	270°	300°	330°
Sin 2	0.87		0	-0.87			0	-0.87	-0.87
3 cos x		-0.5		-4.60	-5	-3.5	-2		0.60

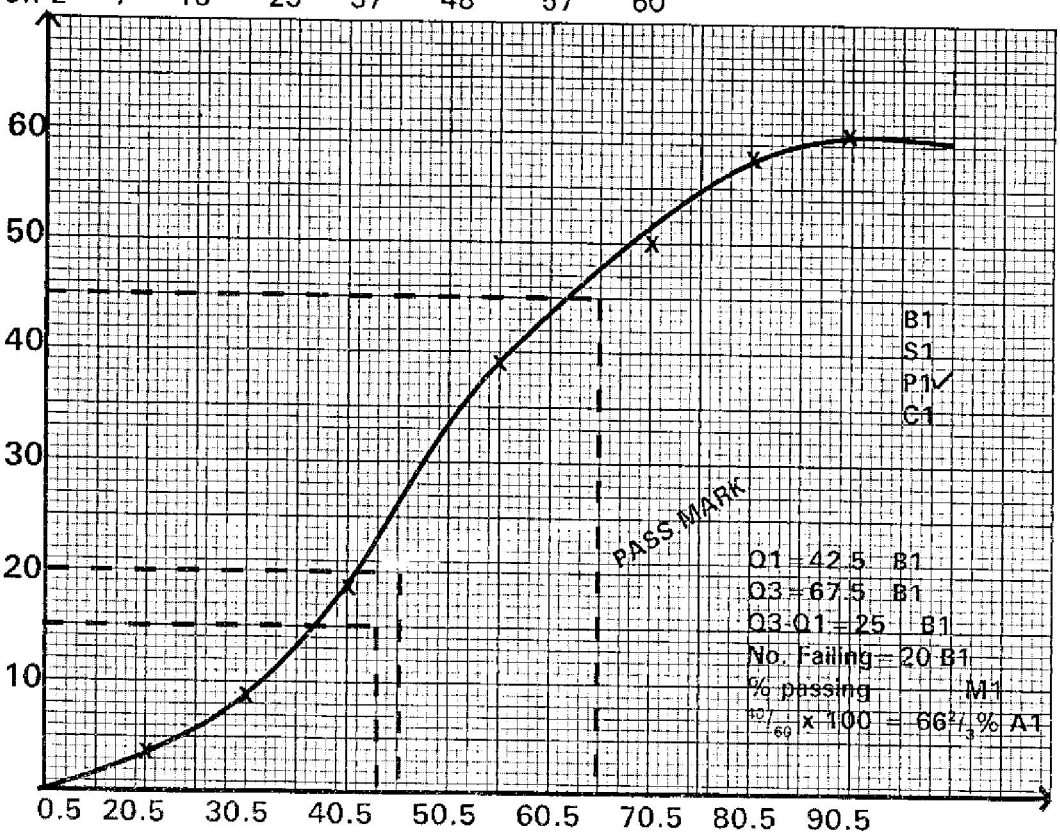


S1-scales
P1 ✓sin
C1
P1✓cos
C1
(c) 3cosx-sin2x = 2 B1
x = 24° ± 3
or x = 294° B1
(d) Amplitude of 3cosx-2 = 3B1

20.(a) (i) ∠ADC = 52° or ∠DCA = 90° or ∠DCT = 38° or ∠ACS = 52° (ii) ∠CBA = 128° ∠BCA = 26° (b) (i) AC = 20 cos 38° = 15.76cm (ii) $\frac{AB}{\text{Sin } 26°} = \frac{15.76}{\text{Sin } 128°}$ $AB = \frac{15.76 \text{ sin } 26°}{\text{Sin } 128°}$ $= \frac{15.76 \times 0.4384}{0.7880}$ = 8.768cm	B1 B1 B1 M1 A1 M1 M1 M1 M1 A1 10 marks	 Or equivalent AB subject May be implied with ✓answer 4.s.f
21.(a)  (b) (i) $x^2 + y^2 = 2.5^2$ $\frac{y}{2.4} = \frac{x}{3.2}$	B1 B1 B1 M1 M1	2.5/90° must be marked

(ii) $y = {}^{3}/_{4}x$ $x^2 + ({}^{3}/_{4}x)^2 = 2.5^2$ $16x^2 + 19x^2 = 6.25 \times 16$ $x^2 = \frac{6.25 \times 16}{25}$ $x = 2km$ (iii) Time taken $= {}^{2}/_{3.2}$ of ${}^{1.5}/_{2.4}$ $= 0.625hrs$	M1 M1 A1 B1 M1 A1 10 marks	Are the subject, ✓substitution Or 37 ½ minutes or 5/8 hours

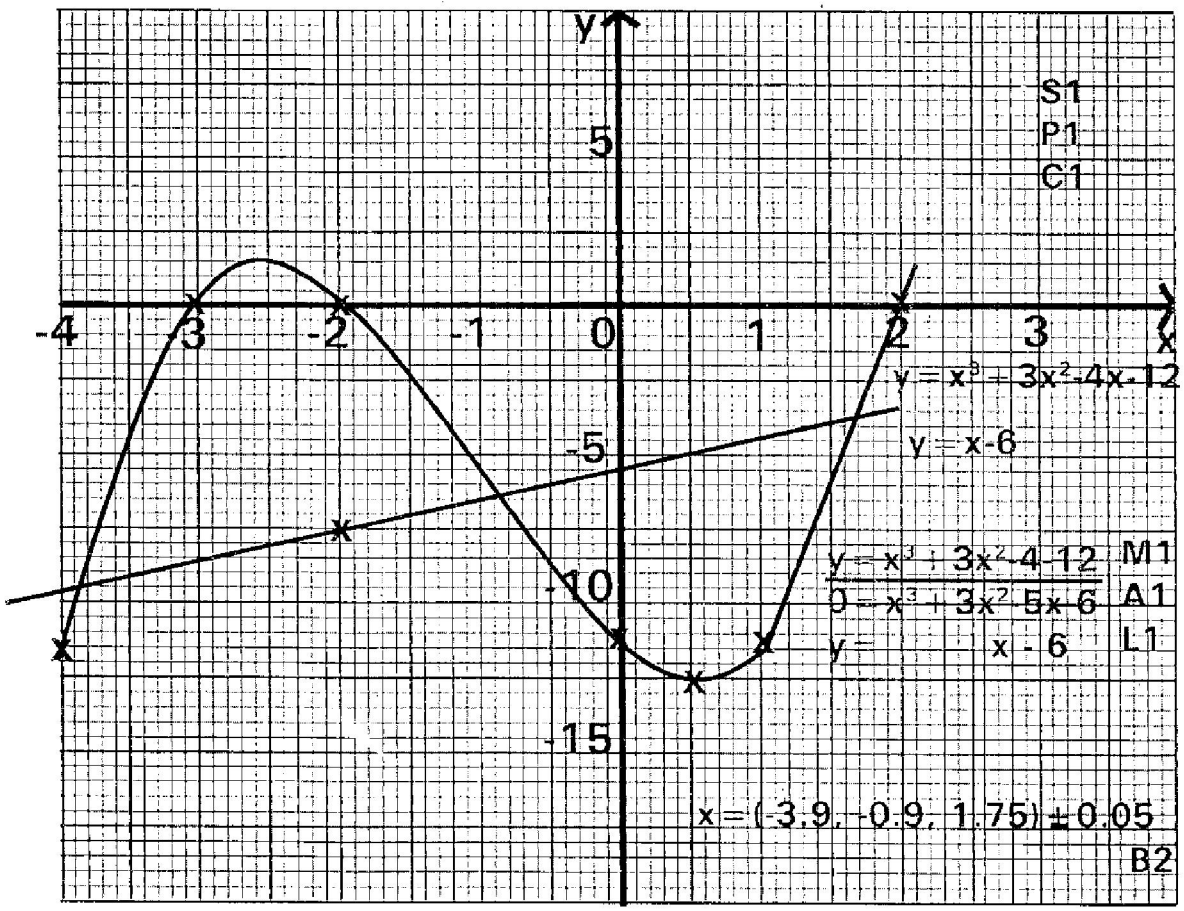
22. Cf: 2 7 13 23 37 48 57 60



23. (a) Interest $= 109375 \times {}^{8}/_{100} \times 2$ $= 17500$ Amount $= 109375 + 17500$ $=$ Sh.126875	M1 M1 A1 M1	
(b) (i) Ist year value $= \frac{96}{100} \times 126875$ $=$ sh. 121800 (ii) 4th year value $= 121800\left(1 + \frac{6}{100}\right)9$ $= 205779$	A1 M1 B1 A1	
(c) %gain $= \frac{205779 - 126875}{126875} \times 100$ $= 62.19\%$	M1 A1 10 marks	

24.

x	-4	-3	-2	-1	0	1	2
y	-12	0	0	-6	-12	-12	0



2009 MARKING SCHEME

PAPER 1

1. $\frac{\sqrt{5184}}{6X-18\div 9+(5-3)}$

$=\frac{\sqrt{2^6X3^4}}{6X-18\div 9+8}$

$=\frac{2^3X3^2}{6X-2+8}$

$=\frac{72}{-4}$

$=-18$

2. $\frac{2\frac{1}{4}+\frac{3}{5}\div\frac{5}{6}of\,2\frac{2}{5}}{1\frac{7}{10}}$

$=\frac{2\frac{1}{4}+\frac{3}{5}x\frac{6}{5}x\frac{5}{12}}{1\frac{7}{10}}$

$=\frac{2\frac{1}{4}+\frac{3}{5}x\frac{1}{2}}{1\frac{7}{10}}$

$=\frac{2\frac{1}{4}+\frac{3}{10}}{1\frac{7}{10}}$

$=\frac{51}{20}x\frac{10}{17}$

$=\frac{3}{2}$ or $1\frac{1}{2}$ or 1.5

3. X:y = 2:3 $\Rightarrow\frac{x}{y}=\frac{2k}{3k}$

$\frac{5x-2y}{x+y}=\frac{3}{3}$

(15x – 6y) = 2x + 2y

13x = 8y

$\frac{x}{y}=\frac{8}{13}$

x: y = 8 : 13

4. Distance covered by bus

=63x(10.45 – 8.15)

63x2.5

=157.5

Speed of car

$=\frac{157.5}{1.75}$

$=90km\,h^{-1}$

5. $=\frac{64^{-\frac{1}{2}}x\,27000^{\frac{2}{3}}}{2^{-4}x\,3^0x\,5^2}$

$=\frac{1}{\frac{1}{2}}x\,27000^{\frac{2}{3}}=\frac{64}{2^4x\,3^0x\,5^2}$

$=\frac{\frac{1}{\sqrt{64}}x(\sqrt[3]{2700})^2}{\frac{1}{16}x3^0x25}$

$=\frac{1}{8}x\frac{900x16}{25}$

$=72$

6. $AC=\sqrt{85^2-75^2}=\sqrt{1600}=40$

Area of quad ABCD

= ½

x40x75 +

$\sqrt{75(75-60)(75-50)(75-40)}$

$=1500+\sqrt{984375}$

$=1500+992$

$=2492m^2=\frac{2492}{1000}=0.2492$

=0.25 ha.

7. Time between Monday 0545 h and Friday 1945 h

=4x24 + 14

=110h

Time lost = 0.5 x 110

=55 min

∴time shown in 12 – hour system

1945 - 55 – 1850h

=6.50 pm

8. $\frac{12x^2+ax-6a^2}{9x^2-4a^2}$

$=\frac{(4x+3a)(3x-2a)}{(3x+2a)(3x-2a)}$

$=\frac{4x+3a}{3x+2a}$

9. $Y=\frac{-2}{5}x+2$

∴gradient $=\frac{-2}{5}$

$\frac{k-5}{3--2}=\frac{-2}{5}$

K – 5 = -2

⇒k=3

10. Let exterior < (=< at centre) be x°

∴6.5x + x = 180

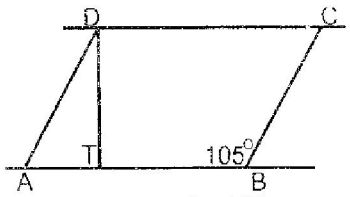
7.5x = 180

X = 24°

∴no of sides $=\frac{360}{24}$

=15 sides

11.



(a)– construction of 105°
- Fixing point c and construction of line parallel to AB through C.
- Completion of trapezium ABCD

(b) Location of point T

12. Let angle between ground and wire be 0°

$\therefore \theta + \frac{1}{3}\theta = 90°$

$\Rightarrow 0 = 90x\frac{3}{4} = 67.5$

Let length of wire be x cm.

$\therefore \cos 67.5 = \frac{6}{x}$

$X = \frac{6}{\cos 67.5} \Rightarrow \frac{6}{0.382683432}$

$= 15.68m$ or $1568cm$

Or 15m 68cm

13. $\sin(3x+30) = \sin 60°$

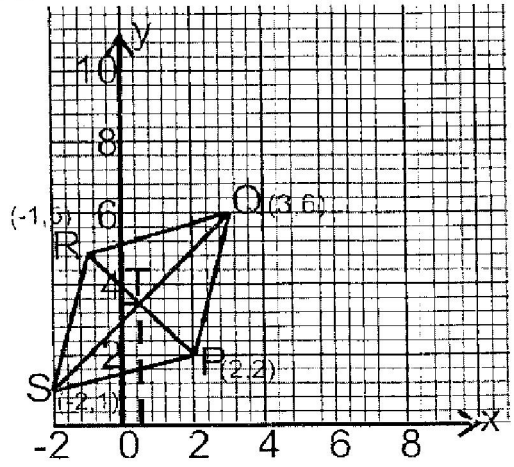
$\sin(3x+30) = \sin 120°$

$3x + 30 = 60°$

$3x + 30 = 120°$

$\therefore x = 10°, \quad x = 30°$

14.



(a)Rhombus PQRS drawn

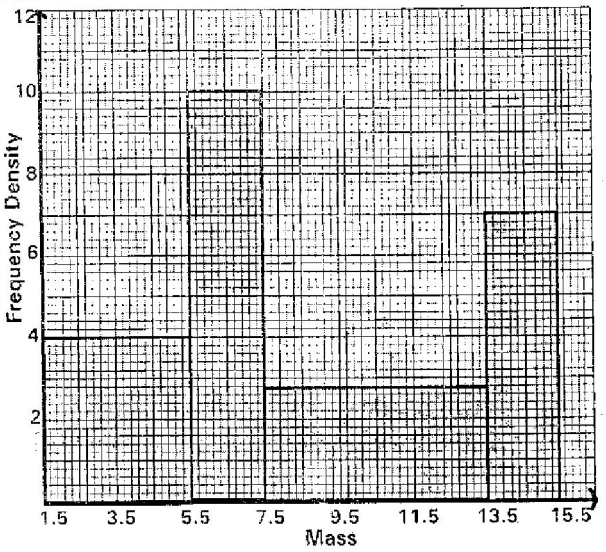
(b) Coordinates of T(0.5, 3.5)

15. Commission earned

(1.2 x 3800) 0.225

$= 1026$

16.



1.5 – 5.5 bar

5.5 – 7.5 bar

7.5 – 13.5 bar

17. (a) $BC^2 = 6^2 + 8^2 - 2 \times 6 \times 8 \cos 50$

$= 100 - 61.71$

$BC = \sqrt{38.2912} = 6.19$

(b) Let <ABC be B°

$\frac{\sin B}{6} = \frac{\sin 50^0}{6.19}$

$\sin B = \frac{6 \sin 50}{6.19}$

$B = 47.95$

(c) Let <CAD be $\propto$°

$2.82^2 = 7^2 + 6^2 - 2x7x6 \cos \propto$

$\cos \propto = \frac{49+36-7.9524}{84}$

$\therefore \propto = 23.48°$

(d) Area Δ ACD

$= \frac{1}{2} \times 7 \times 6 \sin 23.48°$

$= 8.37cm^2$

18. (a) (i) Modal class = 60 – 69

(ii) Class where median mark lies of 1, 3, 7, 14, 24, 40, 60, 66, 69, 70

Class 50 – 59

(b)

Class centres (x)	fd	D=x - A
4.5	- 49.9	- 49.9
14.5	- 79.8	- 39.9
24.5	- 119.6	- 29.9
34.5	- 139.3	- 19.9
44.5	- 99.0	- 9.9
54.5	1.6	0.1
64.5	20.2	10.1
74.5	120.6	20.1
84.5	90.3	30.1
94.5	40.1	40.1

$\sum f = 70$

$\sum fd = -33$

$\therefore$ mean $= 54.4 + \frac{-33}{70}$

$= \underline{53.93}$

19. (a) (i) Original price $= \frac{16200}{x}$

(ii) Price after discount

$= \frac{16200}{x+3}$

(b) (i) $\frac{16200}{x} - 60 = \frac{16200}{x+3}$

$\Rightarrow \frac{16200-60x}{x} = \frac{16200}{x+3}$

$\Rightarrow (16200 - 60x)(x+3) = 16200x$

$16200x + 16200x3 - 60x^2 - 180x = 16200x$

$60x^2 + 180x - 48600 = 0$

$x^2 + 3x - 810 = 0$

$(x + 30)(x - 27) = 0$

$x = -30$ or $x = 27$

no. of calculators bought = 30

(c) Initial cost of calculators $\frac{16200}{27} = 600$

Discount offered as a percentage

$\frac{\frac{16200}{27} - \frac{16200}{30}}{600} \times 100 = 10\%$

20. (a) (i) $\underline{ON} = \frac{1}{2}\begin{pmatrix} -8 \\ 5 \end{pmatrix} = \begin{pmatrix} 4 \\ -2\frac{1}{2} \end{pmatrix}$

N is $(-4, 2\frac{1}{2})$

$M = \frac{-8+12}{2}, \frac{5+5}{2}$

M is (2, 0)

(ii) $\underline{NM} = \begin{pmatrix} 6 \\ -2\frac{1}{2} \end{pmatrix}$

$NM = \sqrt{6^2 + (-2\frac{1}{2})^2}$

$= 6.5$

(b) $\underline{OB} = \begin{pmatrix} 12 \\ -5 \end{pmatrix}$, $\underline{NM} = \begin{pmatrix} 6 \\ -2\frac{1}{2} \end{pmatrix}$

$\therefore \underline{NM} = \frac{1}{2}\underline{OB}$

(c) $\underline{OP} = \begin{pmatrix} 2 \\ 0 \end{pmatrix} + 2\begin{pmatrix} -6 \\ 2\frac{1}{2} \end{pmatrix}$

$= \begin{pmatrix} -10 \\ 5 \end{pmatrix}$

$OP^1 = \begin{pmatrix} -10 \\ 5 \end{pmatrix} + \begin{pmatrix} -5 \\ 8 \end{pmatrix} = \begin{pmatrix} -15 \\ 13 \end{pmatrix}$

$\therefore P^1 + s(-15, 13)$

21. (a) Volume of water

$\frac{6}{9+x} = \frac{2}{x} \Rightarrow x = 4.5$

$\therefore$ volume $= \frac{1}{3}$x3.142$(6^2$x13.5-2^2x4.5$)$

$= 490.152$

(b) (i) Volume of sphere

$\frac{r}{14.5} = \frac{2}{4.5} = \frac{6}{13.5} \Rightarrow r = 6.444$ (top of radius)

$vol = \frac{1}{3}$x3.142$(6.444^2$x14.5-6^2x13.5$)$

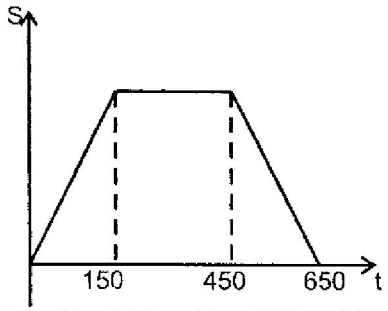
$= 121.6$

(ii) $\frac{4\pi r^3}{3} = 121.6$

$r^3 = 121.6 \times \frac{3}{4\pi}$

R = 3.073

22.



(a) ½ x 150h + ½ x 200h + 300h

= 10450

475h = 10450

H = 22m/s

Max speed $= \frac{22X60X60}{1000}$

= 79.2km/h

(b) Acceleration $= \frac{22m/s}{150s}$

$= \frac{11}{75} m/s^2$

(c) ½ x100x11

= 550

(d) Time for half of journey

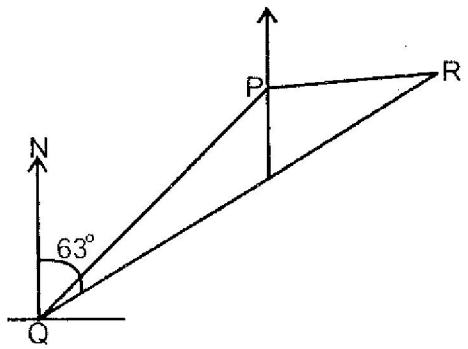
½ x22(150+t+t)= ½ x10450

T = 162.5

Total time = 150+162.5

= 312.5

23.



(a) Direction and distance of Q from P
Direction and distance of R from P

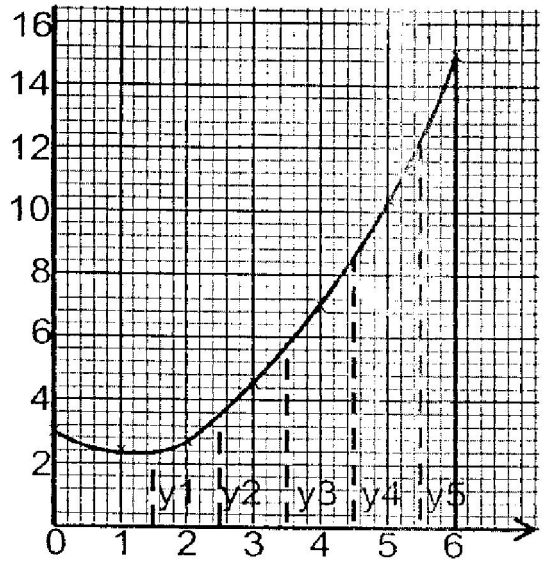
(b) (i) distance conversion
8.5x40=340
(ii)North line at Q
Bearing 063° stated

(c) Distance from top of post at Q to top of post at P
$X=\frac{240}{\cos 9^\circ}$ or $x \cos 9^\circ = 240$
=143m

(ii) speed of bird
$=\frac{243X60X60}{100X18}$
=48.6km h^{-1}

24.(a)

x	0	1	2	3	4	5	6
$y = \frac{1}{2}x^2 - x + 3$	3	2½	3	4½	7	10½	15



(b) $y1 = \frac{1}{2} \times 1.5^2 - 1.5 + 3 = 2.625$
$y2 = \frac{1}{2} \times 2.5^2 - 2.5 + 3 = 3.625$
$y3 = \frac{1}{2} 3.5^2 - 3.5 + 3 = 5.625$
$y4 = \frac{1}{2} \times 4.5^2 - 4.5 + 3 = 8.625$
$y5 = \frac{1}{2} \times 5.5^2 - 5.5 + 3 = 12.625$
approximate area
$= 1(2.625 + 3.625 + 5.625 + 8.625 + 12.625)$
= 33.125 sq units

(c) area $= \int_1^6 (\frac{1}{2}x^2 - x + 3)dx = \left[\frac{x^3}{6} - \frac{x^2}{2} + 3x\right]_1^6$
$= \left[\frac{6^3}{6} - \frac{6^2}{2} + 3X6\right] - \left[\frac{1^3}{6} - \frac{1^2}{2} + 3\right] = 33.3$

% error $= \frac{33.3 - 33.125}{33.3} X100$
=0.625%

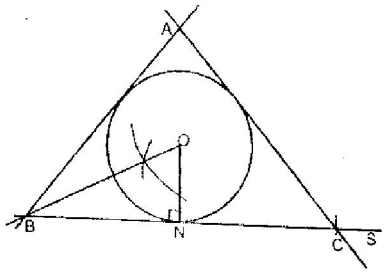
PAPER 2 ANSWERS

1. 1 cow feeds on $\frac{480}{2 \times 4}$kg in 1 day.
= 60kg
No of cows fo feed on 20160kg
$\frac{20160}{60X42}$
In 6 weeks $= \frac{20160}{60 \times 6 \times 7} = 8$

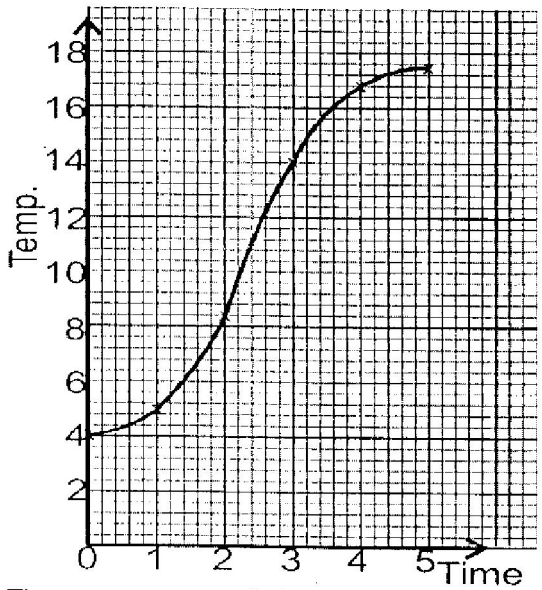
2. $x-(1.5+2\sqrt{2})(x-5-\sqrt{2})$
b = -3 or c = 0.25
$(x-1.5-\sqrt{2})(x-1.5+\sqrt{2}) = 0$
$x^2 - 1.5x + x\sqrt{2} - 1.5x + 2.25 - 1.5\sqrt{2}$
$-x\sqrt{2} + 1.5\sqrt{2} - 2 = 0$
$x^2 - 3x + 0.25 = 0$
$4x^2 - 12x + 1 = 0$

3. $m = c + kt^2$
$40 = c + 4k$
$65 = c + 9k$
$25 = 5k$, $k = 5$
$40 = c + 4x5$
$C = 20$
When $t = 4$, $m = 20 + 5x16$
= 100g

4. Check 60° at 0
120 at 0



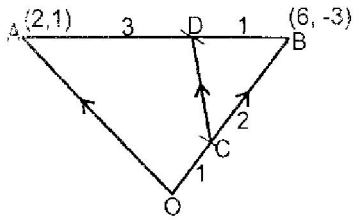
5.



The average rate of change

$=\frac{15.5-7.6}{3.4-1.8}$
$=4.9375°c/min$

6.



$\underline{CO}=\frac{-1}{3}\begin{pmatrix}6\\-3\end{pmatrix}=\begin{pmatrix}-2\\1\end{pmatrix}$ or $\underline{OC}=\begin{pmatrix}2\\-1\end{pmatrix}$
$\underline{AD}=\frac{3}{4}\begin{pmatrix}4\\-4\end{pmatrix}=\begin{pmatrix}3\\-3\end{pmatrix}$
$\underline{CD}=\underline{CO}+\underline{OA}+\underline{AD}$
$=\begin{pmatrix}-2\\1\end{pmatrix}+\begin{pmatrix}2\\1\end{pmatrix}+\begin{pmatrix}3\\-3\end{pmatrix}$ addition of 3 vector
$=\begin{pmatrix}3\\-1\end{pmatrix}$

7. The LCM of 3 and 5 = 15
In 15 minutes, 8 customers will be served
$\therefore$ total time $=\frac{200}{8}\times 15$
$=6¼$ hrs

8. $(2-x)^7=2^7-7.2^6.x+21.2^5.x^2-35.2^4.x^3+$
(a) $35.2^3.x^4-21.2^2x^5+7.2^1.x^6-x^7$
$=128-448x+672x^2-560x^3+280x^4-84x^5+14x^6-x^7$

(b) $(1.97)^7=(2-0.03)^7$
$=128-448x0.03+672x(0.03)^2-560x(0.03)^3$
$=128-13.44+0.6048-0.01512$
$=115.14968$
$=115.1497$

9. Image area $=[(4X2)-(5X1]X21$
$=63$ sq cm

10. $\frac{\sqrt{3}}{\sqrt{3}-\sqrt{2}}=\frac{\sqrt{3}(\sqrt{3}+\sqrt{2})}{(\sqrt{3}-\sqrt{2})(\sqrt{3}+\sqrt{2})}$
$=\frac{3+\sqrt{3}.\sqrt{2}}{3-2}$
$=3+\sqrt{6}$

11. $(2-1)^2+(5-k)^2=10$
$k^2-10k+16=0$
$(k-2)(k-8)=0$
$k=2$ or $k=8$
Centre at (1, 2) (1, 8)

12. $\left(\frac{1}{7}X\frac{2}{5}\right)+\left(\frac{6}{7}X\frac{1}{6}\right)$
$=\frac{7}{35}$

13. Longitude difference $=45°+60°=105°$
Distance in km
$=\frac{105}{360}$ x 2 x 3.142 x 6370 cos 40°
$=8943.7$km
$=8946.12$km when $\frac{22}{7}$ is used for π

14. $4-4\cos^2\propto=4\sin\propto-1$
$4-4(1-\sin^2\propto)=4\sin\propto-1$
$4\sin^2\propto-4\sin\propto+1=0$
$(2\sin\propto-1)(2\sin\propto-1)=0$
$\sin\propto=½$
$\therefore\propto=30°, 150°$

15. $AT^2=9$ x 4
$=36$
$\therefore$ AT = 6cm

16. $\int(3t^2-6t-9)dt=t^3-3t^2-9t+c$
$[t^3-3t^2-qt]_1^3=[3^3-3(3^2)-9(3)]-[1^3-3(1)^2-(1)^2-9(1)]=-16$
$[t^3-3t^2-9t]_3^4$
$=[4^3-3(4)^2-9(4)]-[3^3-3(3^2)-9(3)]$
$=7$
Distance travelled = 16 + 7 = 23

17. (a) Total rate of flow in litres = 120 + 150 = 270 L/min
Time taken $=\frac{18900}{270}$
$=70$ min (1 hr 10 min)

(b) (i) Part of tank filled after 25 min $=270x25$
$=6750$
Time taken to fill remaining part
$=\frac{18900-6750}{270-20}$
$=48.6$ min
Total time to fill tank $=25+48.6=73.6$ min

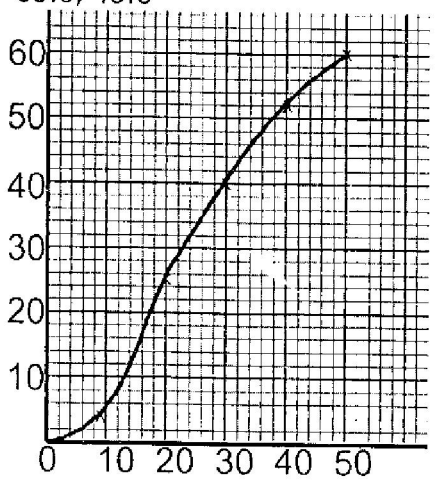
(ii) Total inflow into tank $=270$ x 73.6
$=19872$
Water wasted
$=19872-(542$ x 25 + 6300) = 22L

18. (a) value after 9 yrs $= 1240000(1+\frac{12}{100})^a$
$= 3438617.659$
$= 3438618$

(b) (i) $1240000(1.12)^n = 2741245$
$n \log 1.12 = \log\left(\frac{2741245}{1240000}\right)$
$n = \frac{\log 2.210681452}{\log 1.12}$
$n = 7$

(ii) $1240000(1+\frac{r}{100})^7 = 2917231$
$1+\frac{r}{100} = \sqrt[7]{\left(\frac{2917231}{1240000}\right)}$
$1+\frac{r}{100} = 1.130000011$
$r = 13\%$

19. (a) 2, 16, 40, 52, 60, 9.5, 19.5, 29.5, 39.5, 49.5



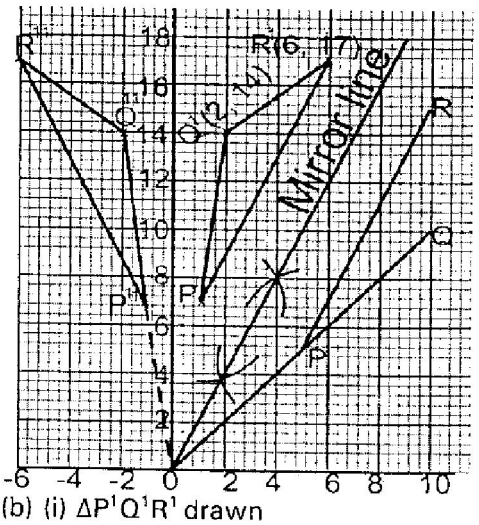
(b) (i) Median goals = 25.5

(ii) number of matches in which scores were between or -37 = 49

(iii) $Q1 = 19 \pm 0.5$
$Q3 = 33 \pm 0.5$
Inter quartile range 33 – 19 = 14

20. (a) $\begin{pmatrix}-0.6 & 0.8\\ 0.8 & 0.6\end{pmatrix}\begin{pmatrix}5 & 10 & 10\\ 5 & 10 & 15\end{pmatrix} = \begin{pmatrix}1 & 2 & 6\\ 7 & 14 & 17\end{pmatrix}$

$P^1(1, 7)$ $Q^1(2, 14)$, $R^1(6, 17)$



(b) (i) $\Delta P^1Q^1R^1$ drawn
Mirror line drawn through (3, 6), (7, 14)

(ii) mirror line equation $= y = 2x$

(c) (i) $\Delta P^{11}Q^{11}R^{11}$ √ly drawn

(ii) $\begin{pmatrix}a & b\\ c & d\end{pmatrix}\begin{pmatrix}P & Q & R\\ 5 & 10 & 10\\ 5 & 10 & 15\end{pmatrix} = \begin{pmatrix}P^{11} & Q^{11} & R^{11}\\ -1 & -2 & -6\\ 7 & 14 & 17\end{pmatrix}$
$\begin{pmatrix}a & b\\ c & d\end{pmatrix} = \begin{pmatrix}0.6 & -0.8\\ 0.8 & 0.6\end{pmatrix}$

(i) Rotation about (0, 0) through angle $53° \pm 1$

21. Tax on 1st $9680 = 9680 \times \frac{10}{100}$
Tax on ksh(1880-9680) $= 9120 \times \frac{5}{100}$
$= 1368$
Tax on ksh(24200 – 18800)
$= 5400 \times \frac{20}{100}$
Total tax = ksh(968 + 1368 + 1080)
= ksh3416

(b) Tax paid = 3416 – (1056 $+ 2400 \times \frac{15}{100}$
= ksh2000

(c) Increase in tax paid = ksh2000 $\times \frac{36.3}{100}$
= ksh726
∴ increase in earnings = ksh726 $\times \frac{100}{20}$
= ksh3630
% increase $= \frac{3630}{24200} \times 100\%$
$= 15\%$

22. (a) $AC = \sqrt{(15\sqrt{2})^2 + (15\sqrt{2})^2} = 30CN$

(b) Identification of Q (<CAG)

$\tan\theta = \frac{8}{30}$ or equivalent

$\theta = 14.93°$

(c) Pyramid height $= \sqrt{(17\sqrt{2})^2 - 15^2}$

$= 18.79cm$

$VO = 18.79 + 8$

$= 26.79cm$

(d) Identification of $\propto$

$\tan\propto = \frac{18.79}{7.5\sqrt{2}}$

$\propto = 60.55°$ or 60.56

23. (a) (i) $\frac{8}{2}\{2x2 + (8 - 1)d\} = 156$

$d = 5$

(ii) $\frac{n}{2}\{2x2 + (n-1)5\} = 1 + 16$

$5n^2 - n = 832$

$5n^2 - n - 832 = 0$

$(5n + 64)(n - 13) = 0$

$n = 13$

(b) (i) 1st three terms of the G.P, $a + 2d$, $a + 4d$, $a + 7d$

These terms are; $a + 6$, $a + 12$ and $a + 21$

$r = \frac{a+12}{a+6} = \frac{a+21}{a+12}$

$(a + 12)^2 = (a + 6)(a + 21)$

$a^2 + 24a + 144 = a^2 + 27a + 126$

$a = 6$

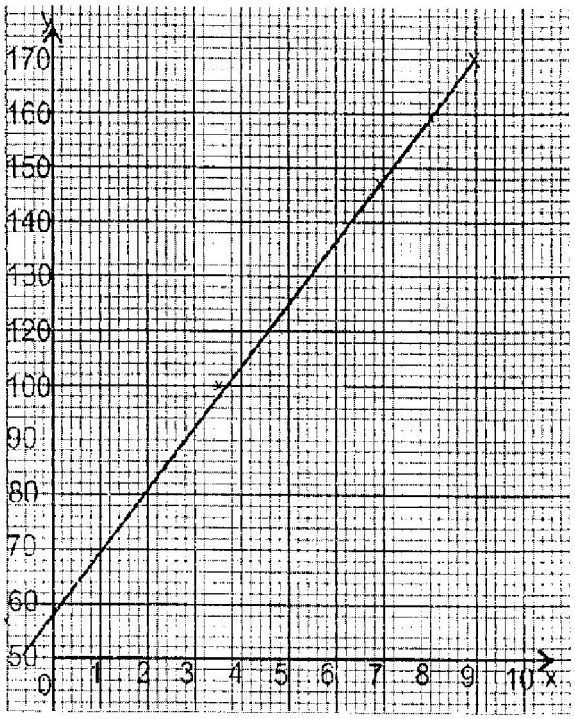
$\therefore$ 1st term of GP $= 6 + 6 = 12$

$r = \frac{6+12}{6+6} = \frac{3}{2}$

$Sq = 12\left(\frac{\frac{3}{2}^9 - 1}{\frac{3}{2} - 1}\right)$

$= 898.6$ (to 4 sf)

24.



(a) (i) scale

(ii) Plotting

(b) (i) average volume of ball bearing

$= \frac{133 - 108}{6 - 4}$

$= 12.5$

(ii) $\frac{y - 133}{x - 6} = 12.5$

$Y = 12.5x + 58$

(c) Volume of water in cylinder is the value of y when $x = 0$;

$Y = 12.5 \times 0 + 58$

$= 58$

2010 MARKING SCHEME

PAPER 1

1. $= \frac{-2(5+3)-9\div 3+5}{-3\times -5+(-2)\times 4} = \frac{-14}{7}$

$= -2$

2. Total fraction:

$\frac{3}{8}+\frac{2}{5}=\frac{31}{40}$

Remaining fraction $= 1-\frac{31}{40}=\frac{9}{40}$

$original\ amount = sh.12330\times\frac{40}{9}$

= sh.54800

$Tatu's\ fees = sh\frac{2}{5}\times 54800$

= sh.21920

3. Gradient (perpendicular) $= -\frac{1}{2}$

$\frac{y+2}{x-3}=-\frac{1}{2}$

$y=-\frac{1}{2}x-\frac{1}{2}$

4. let the distance be d km

$\frac{d}{75}\ and\ \frac{d}{95}$

$\therefore \frac{d}{75}-\frac{d}{95}=\frac{20}{60}$

d = 118.75km

5. Let odd integers be:

x, (x + 2), (x + 2 + 2)

x + (x + 2) + (x + 2 + 2) > 219

3x > 213

X = 71

The numbers are 73, 75, 77

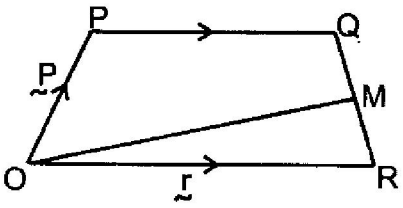
6. (a) sh.77.24 x 100,000

= sh.7,724,000

(b) $\frac{sh.77.24\times 10000}{122.27}$

= shs. 63172

7.



$\underset{\sim}{RQ} = -\underset{\sim}{r}+\underset{\sim}{p}+\frac{1}{3}\underset{\sim}{r}$

$= \underset{\sim}{P}-\frac{2}{3}\underset{\sim}{r}$

$\underset{\sim}{OM} = \underset{\sim}{r}+\frac{1}{2}(\underset{\sim}{P}-\frac{2}{3}\underset{\sim}{r})$

$= \frac{2}{3}\underset{\sim}{r}+\frac{1}{2}\underset{\sim}{P}$

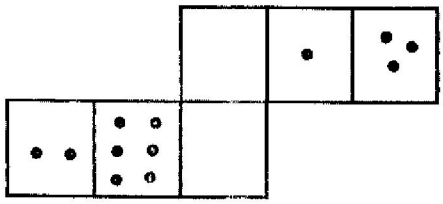
8. $27^{\frac{2}{3}}\times\left(\frac{81}{16}\right)^{-\frac{1}{4}} = \left(3^3\right)^{\frac{2}{3}}\times\left(\frac{3^4}{2^4}\right)^{-\frac{1}{4}}$

$= 3^2\times\left(\frac{3}{2}\right)^{-1}$

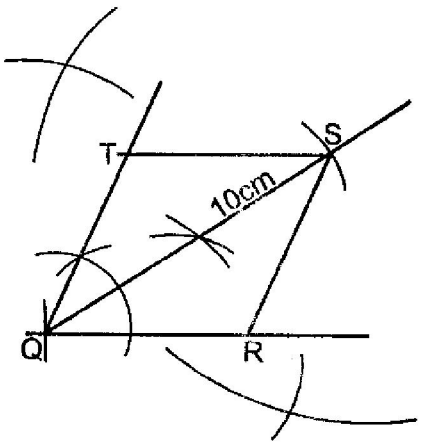
$= = 3^2\times\frac{2}{3}$

= 6

9.



10.



<TQR = 60°; QS = 10cm and bisects <TQR

Mediator (⊥ or bisector) of QS drawn or

<RSQ = <QST = <RQS = 30°

✓ Rhombus completed

11. No of oranges for Friday
1948 – (750 + 750 + 240) = 208
No of oranges for Saturday
208 + 560 = 768
∴ Amount = sh.8 × 768
= sh.6144

12. $\frac{x^2+x-4xy-4y}{(x+1)(4y^2-xy)} = \frac{x(x+1)-4y(x+1)}{(x+1)(y)(4y-x)}$

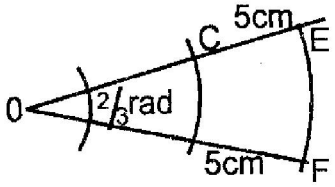
$= \frac{(x-4y)(x+1)}{(x+1)(-y)(x-4y)}$

$= -\frac{1}{y}$

13. Sin 3θ = cos 2 θ
∴ sin 3θ = sin (90° - 2θ)
∴ 3θ = 90° - 2θ
5 θ = 90
θ = 18°

14. $2\pi r^2 + 2\pi rh = 154$
r = h
$2\pi r^2 + 2\pi r^2 = 154$
$4\pi r^2 = 154$
$r = \sqrt{\frac{154}{4\times 3.142}}$
r = 3.500
∴ diameter = 2r = 3.500 × 2
= 7.00(2dp)

15.



Let OC = r
$\therefore CD = \frac{2}{3}r \text{ and } EF = \frac{2}{3}(r+5)$
$\frac{2}{3}r + \frac{2}{3}(r+5) + 5 + 5 = 24$
$\frac{4}{3}r = 10\frac{2}{3}$
r = 8

16. Total number of seedlings
(5×1)+(10×3) + (15×1)+(20×4)+(30×1)+(10×2)
= 5 + 30 + 15 + 80 + 30 + 20 = 180
% of height (h) : $23 \le h < 27$

$= \left(\frac{30+15}{180}\right) \times 100$
= 25%

17. (a) Total sales = sh.360 ×500 = sh.180,000
Commission = sh(180,000 – 100,000) × $^2/_3$
= sh.1600
Total earnings = sh.(12,000 + 1600)
= 13600

(b) (i) New salary = sh.(12000 + 12000×$^{10}/_{100}$)
= sh. 13200
Commission paid = sh(17,600 – 13,200)
= sh.4400
Commission is paid on sh.4400 × $^{100}/_2$
= 220,000
Total sales = sh.220,000 + 100,000
= 320,000/=

(ii) *No of handbags sold* = $\frac{320,000}{500}$
= 640

18. (a) (i) Internal volume of box = 150×80×40cm^3
= 480,000cm^3
External volume of bos = 152× 82 × 42cm^3
= 523488cm^3
∴ Volume of wood = (523488– 480,000)cm^3
= 43488cm^3

(ii) *Mass of box* = $\frac{43488\times 0.6}{1000}$
= 26092.8
= 26.1kg

(b) (i) *No of tins* = $\frac{150}{10}\times\frac{80}{10}\times\frac{40}{10}$
= 240

(ii) *Total mass* = $26.1 + \left(\frac{240\times 120}{1000}\right)$
= 54.9kg

19. (a) Det $\begin{vmatrix} 5 & -4 \\ 2 & 1 \end{vmatrix}$ = 3

Inverse $A^{-1} = \frac{1}{3}\begin{pmatrix} 9 & -6 \\ -7 & 5 \end{pmatrix}$

(b) (i)
$\begin{bmatrix} 5 & 6 \\ 6 & 9 \end{bmatrix}\begin{bmatrix} x \\ 6 \end{bmatrix} = \begin{bmatrix} 2440 \\ 3560 \end{bmatrix}$

(ii)
$\frac{1}{3}\begin{bmatrix} 9 & -6 \\ -7 & 5 \end{bmatrix}\begin{bmatrix} 5 & 6 \\ 6 & 9 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 & -2 \\ -7 & 5 \\ \hline 3 & 3 \end{bmatrix}\begin{bmatrix} 2440 \\ 3560 \end{bmatrix}$

$$\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}\begin{bmatrix}x\\ y\end{bmatrix}=\begin{bmatrix}3\times 2440-2\times 3560\\ \frac{-7}{3}\times 2440+\frac{5}{3}\times 3560\end{bmatrix}$$

$$\begin{bmatrix}x\\ y\end{bmatrix}=\begin{bmatrix}200\\ 240\end{bmatrix}=$$

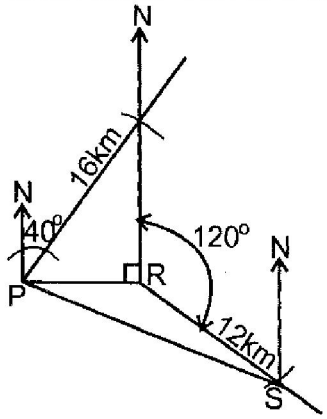
$\therefore x=200 \;;\; y=240$

(c) Total cost of books
$=(36\times200)+(50\times240)$
$=19200$

Total cost with discount
$\frac{36\times200\times95}{100}+\frac{50\times240\times92}{100}=17880$

% discount $=\frac{19200-17880}{19200}\times100=6.875\%$

20. Given scale: 1cm to 2 km



(b) (i) Distance of P from S $=10.8\pm0.1$cm
$=21.6$km

(ii) $<$ PSN $=74\pm1°$
Bearing of P from S $=286\pm1°$

(c) Area of Δ PQR $=\frac{1}{2}\times10.2\times12.2$
$=62.22\text{km}^2$

Area of Δ PRS $=\frac{1}{2}\times10.2\times12\sin150°$
$=30.6\text{km}^2$
Area of ranch PQRS
$=62.22+30.6$
$=92.82\text{km}^2$

21. (a) (i) *A takes* $\frac{180}{x+10}$

(ii) *B takes* $\frac{180}{x}$

(b) $\frac{180}{x}-\frac{180}{x+10}=\frac{3}{2}$

$180(x+10)-180x=\frac{3}{2}x(x+10)$

$360x+3600-360x=3x^2+30x$

$X^2+10x-1200=0$
$(x-30)(x+40)=0$
$X=30$ or $x=-40$
Speed of A $=30+10=40$

(c) Time taken by A $=\frac{48}{40}\times60=72$min

Time taken by B $=\frac{48}{30}\times60=96$min

Time for B $=96-10=86$ min
$86-72=14$min

22. (a) (i) Reflection in the line PR or ER Or PER

(ii) Enlargement centre E
Scale factor -1

(iii) Rotation about pt R
Through 90°
Clockwise

(a) R $\longrightarrow$ S
C $\longrightarrow$ A

(ii) R $\longrightarrow$ Q
C $\longrightarrow$ E

23. Modal frequency $=8$

(b)

No of kg of meat	Fre. (f)	Mid pts (x)	fx	cf
1 - 5	2	3	6	2
6 – 10	3	8	24	5
11 – 15	6	13	78	11
16 - 20	8	18	144	19
21 – 25	3	23	69	22
26 – 30	2	28	56	24
31 – 35	1	33	33	25
	$\Sigma f=25$		$\Sigma fx=410$	

Mean $=\frac{410}{25}=16.4$

(b) 2, 5, 11, 19, 22, 24,25

Median $=15.5+\frac{12.5-11}{8}\times5$

$=15.5+\frac{1.5}{8}\times5$

$=16.4375$

24. (a) (i) Area of base x^2
Or Area of sides = 4xh
$X^2 + 4xh = 432$
$h = \frac{432 - x^2}{4x}$

(ii) Volume = x^2h
$= x^2(432 - x^2)$

(a)(i) Volume (v) = $108x - \frac{1}{4}x^3$
$\frac{dv}{dx} = 108 - \frac{3}{4}x^2$
$108 - \frac{3}{4}x^2 = 0$
$x = 12$

(ii) Vol = $108x - \frac{1}{4}x^3$
$= (108 \times 2) - \frac{1}{4} \times 12^3$
$= 864cm^3$

PAPER 2 MARKING SCHEME

1. $\frac{7.55 \times 5.25 - 7.45 \times 5.15}{2}$
$\frac{0.635}{7.5 \times 5.2} \times 100\%$
$\left(\frac{0.05}{7.5} + \frac{0.05}{5.2}\right) \times 100$
$= 1.628\%$

2. $\frac{4(\sqrt{5} - \sqrt{2}) - 3(\sqrt{5} + \sqrt{2})}{(\sqrt{5} + \sqrt{2})(\sqrt{5} - \sqrt{2})}$
$\frac{4\sqrt{5} - 4\sqrt{2} - 3\sqrt{5} - 3\sqrt{2}}{5 - 2}$
$= \frac{\sqrt{5} - 7\sqrt{2}}{3}$

3. $\angle OCT = 36°$
$\angle OTC = 36°$ OR $\angle COT = 108°$
$\angle CTB = 54°$

4. Let the ratio be x : y
$\frac{68x + 53y}{x + y} = 62$
$\Leftrightarrow 6x = 9y$
$\Rightarrow x : y = 3 : 2$

5. Let the width be x
Area = $(2x - 2)x = 60$
$\Leftrightarrow x^2 - x - 30 = 0$
$(x - 6)(x + 5) = 0$
$X = 6$
Length = $(6 \times 2 - 2) = 10m$

6. $\frac{6}{3} \times \frac{21}{15} \times 5$
$= 14$ people

7. $3800 = \frac{40000 \times R \times 5}{100}$
$R = 1.9$
$3420 = \frac{P \times 1.9 \times 7.5}{100}$
$P = sh.24000$

8. Cf: 9, 25, 44, 70, 90, 100
Lower quartile = $19.5 + \frac{16}{16} \times 10 = 29.5$
Upper quartile = $49.5 + \frac{5}{20} \times 10 = 52$
Quartile deviation = $\frac{52 - 29.5}{2}$
$= 11.25cm$

9. P(WW) = $\frac{2}{5} \times \frac{1}{4} = \frac{1}{10}$

10.(a) $= \begin{pmatrix} 1 & K \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 3 + 2K \\ 2 \end{pmatrix}$

X – coordinate = 3 + 2k

(b) Δ ⊥ed at A
$3 + 2K = 4 \Rightarrow K = \frac{1}{2}$
Δ ⊥ed at O
$3 + 2K = 0 \Rightarrow K = -1.5$

11.(a) $S = \frac{3}{2}t^2 - \frac{1}{3}t^3 + C$

(b) When t = 0, S = 0 $\Rightarrow$ C =
$S = \frac{3}{2}t^2 - \frac{1}{3}t^3 = 0$
$t^2(\frac{3}{2} - \frac{1}{3}t) = 0$
$T = 4.5s$

12. (a)

$(2-x)^5 = 2^5 - 5(2)^4x + 10(2)^3x^2 - 10(2)^2x^3 + 5(2)x^4 - (x^5)$

$= 32 - 80x + 80x^2 - 40x^3 + 10x^4 - x^5$

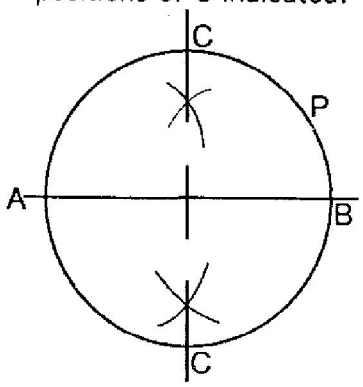
(b) $(2-0.2)^5 \sim 32 - 80(0.2) + 80(0.2)^2 - 40(0.2)^3$

$= 18.88$

13. Locus of P drawn

⊥ bisector of AB constructed.

✓ positions of C indicated.



14. $2y(q + \frac{1}{x}) = P$

$q + \frac{1}{x} = \frac{P}{2y}$

$\frac{1}{x} = \frac{P}{2y} - q$

$x = \frac{2y}{P - 2yq}$ or $\frac{-2y}{2yq - p}$

15. $Log\left(\frac{15-5x}{10}\right) = \log(3x-2)$

$\frac{15-5x}{10} = 3x - 2$

$x = 1$

16. (a) co-ordinates of centre: (1, - 1)

$r = \sqrt{1^2 + 3^2} = 3.162$

(b) Equation: $(x-1)^2 + (y+1)^2 = (\sqrt{10})^2$

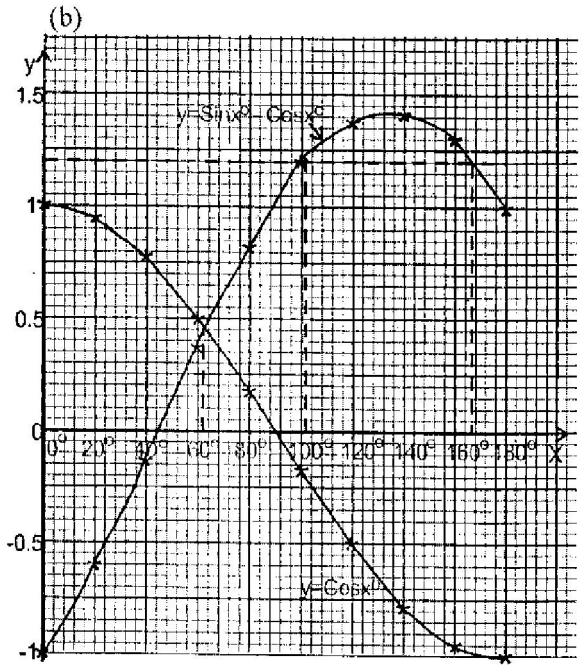
$\Leftrightarrow x^2 - 2x + 1 + y^2 + 2y + 1 = 10$

$\Leftrightarrow x^2 + y^2 - 2x + 2y = 8$

17. (a)

x°	40°	60°	80°	100°	120°	140°	160°
cosx°			0.17		-0.50		-0.[illegible]
sinx°-cosx°	-0.13 (2)			-0.15(6)		1.41	

(b)



18. (a) $\underset{\sim}{QB} = \underset{\sim}{3P} + \underset{\sim}{3r}$

$\underset{\sim}{AJ} = \underset{\sim}{2P} - \underset{\sim}{2r}$

(b)(i) $\underset{\sim}{QX} = m\underset{\sim}{QB} = m(\underset{\sim}{3P} + \underset{\sim}{3r})$

$= 3m\underset{\sim}{P} + 3\underset{\sim}{m}r$

(ii) $\underset{\sim}{QX} = 2\underset{\sim}{r} + \underset{\sim}{P} + n(\underset{\sim}{2P} - \underset{\sim}{2r})$

$= (2n+1)\underset{\sim}{P} + (2 - 2n)\underset{\sim}{r}$

(iii) $3m\underset{\sim}{P} + 3\underset{\sim}{m}r = (2n+1)\underset{\sim}{P} + (2-2n)\underset{\sim}{r}$

$3m = 2n + 1$

$3m = 2 - 2n$

$2n + 1 = 2 - 2n$

$\Rightarrow n = \frac{1}{4}$

$m = \frac{1}{3}(2 \times \frac{1}{4} + 1) = \frac{1}{2}$

$\underset{\sim}{AX} = n\underset{\sim}{AJ} = \frac{1}{4}\underset{\sim}{AJ}$

division ratio = 1:3

19. (a) (i) Longitude difference = 40°

Arc AB = (60 × cos 34°)×40

≃ 1990nm

(ii) Latitude difference = 60°

Arc AC = 60 × 60 = 3600nm

(b)(i) Local time at B = $1330 + \frac{40}{15}hr$ = 1610hr

(ii) Time taken $= \frac{1990\ nm}{40\ knots}$

=49h 45min

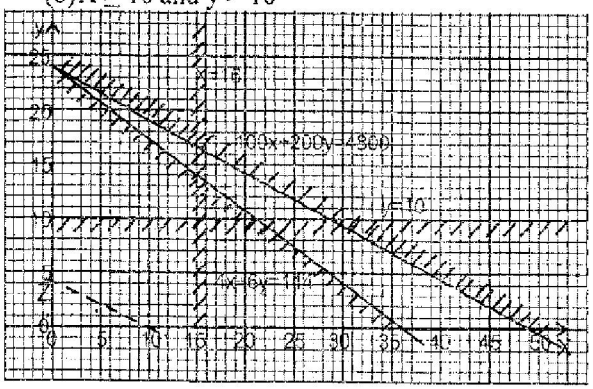
Arrival time = Wed. 1610 + 1hr 45 min

=Wed. 1755h

20. (a) $4x + 6y \geq 144$

$100x + 200y \leq 4800$

(b) $X \geq 16$ and $y > 10$



(c) $Z = 40x + 100y$ drawn OR 2 feasible pts inspected

Profit = $40\times16 + 100\times16$

= sh.2240

21. Let number of lows be r and persons be P.

(a) $pr = 600$

$(r + 5)(P - 6) = 600$

$(r + 5)\left(\frac{600}{r} - 6\right) = 600$

$\Leftrightarrow 600r - 6r^2 + 3000 - 30r = 600r$

$\Leftrightarrow r^2 + 5r - 500 = 0$

$(r+25)(r - 20) = 0$

$r = 20$

(b) New no. of rows = 20 + 5 = 25

No of empty chairs = 600 – 450

= 150

Empty chairs/row $= \frac{150}{25}$

= 6 chairs

22. (a) $T_6 = P + 5c$ and $T_5\ P + 4d$

$P + 5c = P + 4d$

$d = \frac{5}{4}C$

(b) $(P + 3d) - (P + 3c) = 1\frac{1}{2}$

$3d - 3c = 1\frac{1}{2}$

$3(\frac{5}{4}c) - 3c = 1\frac{1}{2}$

$C = 2$

$d = \frac{5}{4}(2) = 2\frac{1}{2}$

(c) $S_6 = \frac{6}{2}(2P + 5\times2)$

$S_5 = \frac{5}{2}(2p + 4\times2\frac{1}{2})$

$(6P + 30) = (5P + 25) + 10$

$P = 5$

23. (a) $S = at + bt^2$

$80 = 2a + 4b$ and $135 = 3a + 9b$

$270 = 6a + 18b$

$-240 = 6a + 12b$

$30 = 6b$

$b = 5$

$a = \frac{(80 - 4\times5)}{2} = 30$

$s = 30t + 5t^2$

(b) (i) at t = 5, $S = 30(5) + 5(5^2)$

= 275m

(ii) $560 = 30t + 5t^2$

$(t + 14)(t - 8) = 0$

$t = 8$ sec

24. (a) (i) $\angle OSR = 40°$ OR $\angle SOR = 100°$

$\angle ORS = 40°$

(ii) $\angle OSP = 80°$

(iii) $\angle PSR = 50° \Rightarrow \angle PQR = 130°$

(b) (i) $(PR + 7) \times 7 = 9^2$

$PR = 4.57$ cm

(ii) $\frac{4.57}{Sin50°} = 2r$

$r = \frac{4.57}{2\sin50°}$

= 2.98cm

MATHS 2011 MARKING SCHEMES

1. $\dfrac{2\frac{1}{5}+\frac{2}{3}\times\frac{15}{4}-4\frac{1}{6}}{1\frac{1}{4}-\frac{12}{5}\times\frac{3}{4}+3\frac{3}{4}} = \dfrac{\frac{8}{15}}{3\frac{1}{3}}$ — M1 Numerator for operation

M1 denominator

$\frac{8}{15}\times\frac{5}{16} = \frac{1}{6}$ — A1

3

2. $\sqrt{11.25^2-6.75^2} = 9$ — B1

Perimeter $= 2(9+6.75)$

$= 31.5$ — B1

2

3. Let d be distance covered

$\frac{3d}{5}-\frac{d}{2} = \frac{d}{10}$ — M1

% change

$= \dfrac{\frac{d}{10}}{\frac{d}{2}}\times 100\%$ — M1

$= \frac{d}{10}\times\frac{2}{d}\times 100$

$= 20\%$ — A1 If -20%

3

Time ratio $= 1\frac{2}{3} : 2 = 5:6$

Speed ratio $= 6:5$

% change $= \frac{1}{5}\times 100\%$

$= 20\%$

$-1-$

4	$60 = 2^2 \times 3 \times 5$ $42 = 2 \times 3 \times 7$ Side of pavement LCM $= 2^2 \times 3 \times 5 \times 7 = 420cm$ least Area $= 4.2 \times 4.2m = 17.64m^2$	M1 A1 B1 3	Prime factors
5	$\sin(x+60^\circ) = \cos 2x$ $x + 60 + 2x = 90^\circ$ $3x = 30$ $x = 10^\circ$ $\tan(x+60)^\circ = \tan 70^\circ$ $= 2.7475$ from tables 45.f 2.7475	M1 M1 A1 3	2.747 from calculator
6	$\frac{4x - 9x^3}{3x^2 - 4x - 4} = \frac{x(2-3x)(2+3x)}{(3x+2)(x-2)}$ $= \frac{x(2-3x)}{x-2}$	M1 M1 A1 OR 3	Factorizing Numerator Factorizing denominator $\frac{2x - 3x^2}{x-2}$
7	Internal Dimensions: 40, 20 and 15 Volume unoccupied $= 40 \times 20 \times 15 - 8000$ $= 4000$ Height of unoccupied $= \frac{4000}{40 \times 20}$ $= 5cm$	B1 M1 M1 A1	OR EQUIVALENTS

8 $2x^2y^2 - 5xy - 12$

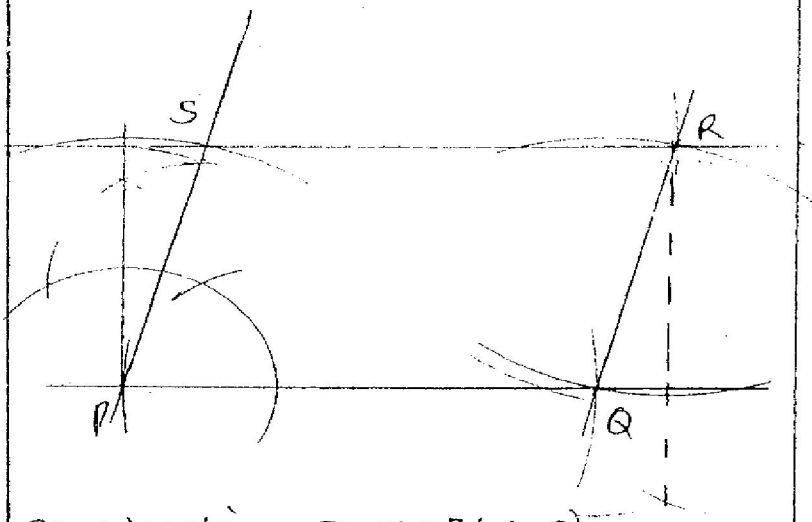
$= 2x^2y^2 - 8xy + 3xy - 12$ — M1

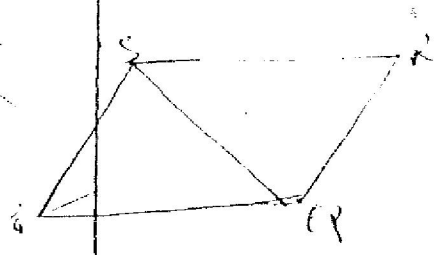
$= 2xy(xy-4) + 3(xy-4)$

$= (2xy+3)(xy-4)$ — A1

2

9.





Construction of 75° (at P) — B1

Construction of 2 adjacent sides — B1 — PS & PQ

Completion of ∥gram — B1 — Mark seen arcs except when transferring angles.

height = 3.9 ± 0.1 cm. — B1

4

10. Mid points:

42, 47, 52, 57, 62, 67, 72

fx = 42, 94, 624, 570, 124, 134, 72 — M1 for fx or f seen

$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{1660}{30} = 55\frac{1}{3}$ kg — M1 A1

55.33 ---

3

11. $\frac{98}{100} \times = 5880$ → M1

Sh $\frac{5880}{98} \times 100$

$= 6000$

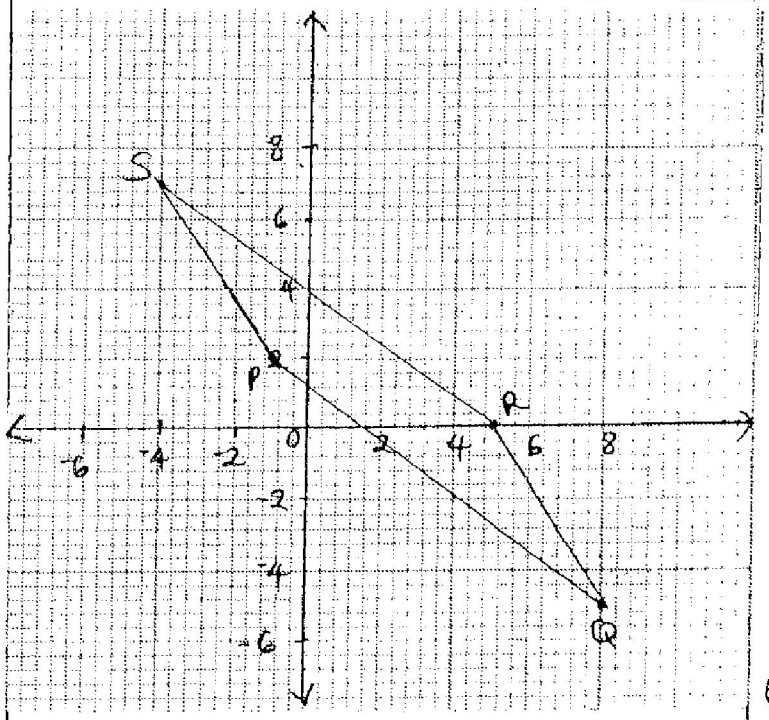
$\frac{120}{100} y = 6,000$ → M1

Sh $\frac{6000}{120} \times 100$

$=$ Sh 5000 A1

3

12.



B1 // gram PQRS (
with S at (-4,

$QS = \sqrt{12^2 + 12^2}$ M1

$= 16.97 \quad = 12\sqrt{2}$ Ao A1

3

let Mambo's salary be x and simba's y

13.

$\frac{1}{6}x + \frac{1}{5}y = 14\,820$

$\frac{1}{8}x + \frac{1}{12}y = 8675$

$5x + 6y = 444600$

$3x + 2y = 208\,200$

$5x + 6y = 444600$

$9x + 6y = 624\,600$

$4x = 180000$

$x = 45000$

M1 Forming two equations

M1 Attempt to Eliminate one unknown.

M1 Solving

A1

4

14

a) $10500 = 2^2 \times 3 \times 5^3 \times 7$

b) $P \times 10500 = 2^3 \times 3^3 \times 5^3 \times 7^3$

Smallest value of $P = 2 \times 3^2 \times 7^2$

$= 882$

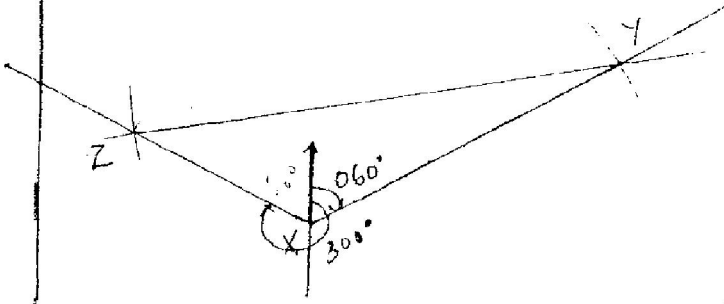
B1

M1

A1

3

15



distance XZ

$= 3 \times 10 = 30$km

B1 Position of Y determined and 60° at X

B1 Line drawn making angle

B1 Correct position of Z determined

B1 Completion of Δ

B1 ⇒ maybe calculated by use of trigonometry (Sine rule)

4

16	L.S.F = 8 : 24 = 1 : 3	
	V.S.F = 1 : 27 ------	B1
	volume of frustum	
	= 160 × 27 − 160	M1
	= 4160 cm³	A1
		3

ALT

$V = \frac{1}{3}\pi r^2 h$

$r^2 = \frac{3 \times 160}{\pi h}$

$r = 4.370$

$\frac{r}{8} = \frac{R}{24}$

$R = 13.11$ (B1)

$V = \frac{1}{3} \times \frac{22}{7} \times 13.11^2 \times 24$

$= 4320.177$

$V_f = 4320.177 - 160$ (M1)

$= 4160.177$ (A1)

SECTION II

17. a) (i) Surface area of solid

$\pi \times 6 \times 10 + \frac{4}{2} \times \pi \times 6^2$ — M1

$= 414.69$ — A1

(ii) Height of cone:

$= \sqrt{100 - 36} = 8$ (seen) — B1

∴ volume of solid

$\frac{1}{3} \times \pi \times 6^2 \times 8 + \frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3$ — M1 M1

$= 753.98 \text{ cm}^3$ — A1

b) mass of solid in kg

$= \frac{1.3 \times 753.98}{1000}$ — M1 M1

$= 0.98$ kg (condone) — A1

0.9802 kg to 4 s.f. — 10

follow th

M1 ... $\pi = \frac{22}{7}$ giv

M1 ... S.A = 414.

A1 ... If 3.142 used S.A = 414.

M1 ... $\pi = \frac{22}{7}$ gives

M1 ... Volume = 754.

A1 ... If 3.142 used Volume 754.6

M1 ... mass expression in kg

M1 ... → conversion to kg

A1 ... $\frac{22}{7}$ used ⇒ 0.980

3.142 used ⇒ 0.980

Time taken by bus = t

" " " train = $11-t$

$75t + 5(11-t) = 700$ M1M1

$t = 6$

Distance by bus = 75×6 M1

$= 450km$ A1

OR

$x + y = 700$ M1 — The two equation

$\frac{x}{75} + \frac{y}{50} = 11$ M1 Denominators removed

$x = 450$ A1.

18. a) (i) Let distance covered by bus be b km

$\therefore$ time by train $= \frac{700-b}{50}$

time by bus $= \frac{b}{75}$ } M1

$\therefore \frac{700-b}{50} + \frac{b}{75} = 11\frac{1}{2} - \frac{1}{2}$ M1

$\frac{2100-3b+2b}{150} = 11$ M1 Simplification. Removal of denominator

$2100 - b = 11 \times 150$

$b = 2100 - 1650$

$= 450$ A1

(ii) time taken by train

$= \frac{700-450}{50}$ M1

$= 5h$

total time before departure of bus

$= 5h + 30min$

$\therefore$ Departure time for bus:

$8:00 + 5h\ 30min$ M1

$= 1.30\ pm.$ A1 or 1330 hrs

b) time bus took before puncture:

$\frac{187.5}{75}$ M1

$= 2\frac{1}{2}h$

time needed to cover remaining part of journey

$= 11\frac{1}{2} - (5\frac{1}{2} + 2\frac{1}{2})$ M1

$= 3\frac{1}{2}h = 3\frac{1}{2}$ hrs A1

10

19

a) $\begin{pmatrix} 0 & 1 \\ 2 & p \end{pmatrix}\begin{pmatrix} -1.5 & -0.5 \\ p & p-2 \end{pmatrix}$

$= \begin{pmatrix} p & p-2 \\ -3+p^2 & -1+p^2-2p \end{pmatrix}$ B1

$-p + p^3 - 2p^2 = p^3 - 2p^2 - 3p + 6$ M1

$-p = -3p + 6$

$2p = 6$

$p = 3.$ A1

b) (i) $x + 30y = 50\,000$ B1

$x + 40y = 56\,000$ B1

(ii) $\begin{pmatrix} 1 & 30 \\ 1 & 40 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 50\,000 \\ 56\,000 \end{pmatrix}$

$\frac{1}{10}\begin{pmatrix} 40 & -30 \\ -1 & 1 \end{pmatrix}\begin{pmatrix} 1 & 30 \\ 1 & 40 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{10}\begin{pmatrix} 40 & -30 \\ -1 & 1 \end{pmatrix}\begin{pmatrix} 50\,000 \\ 56\,000 \end{pmatrix}$ M1

$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{10}\begin{pmatrix} 320\,000 \\ 6\,000 \end{pmatrix}$ M1

$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 32\,000 \\ 600 \end{pmatrix}$

$x = 32\,000$

$y = 600$ A1

(iii) $32\,000 + 600 = 68\,000$

$\frac{68\,000 - 32\,000}{600}$ M1

$= 60$ A1

10

X

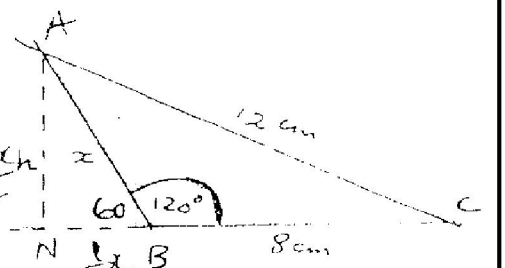
a) $12^2 = x^2 + 8^2 - 2 \times 8 \times x \cos 120^\circ$ M1

$x^2 + 8x - 80 = 0$ M1

$x = \frac{-8 \pm \sqrt{64 - 4 \times 1 \times -80}}{2 \times 1}$ M1

$= 5.8$ or -13.8

$\therefore x = 5.8$ A1



M1 for use of Pythagoras theorem
M1 for parallel steps
A1 5.8.

b) (i) $h = 5.8 \sin 60$ M1

$= 5.0$ cm A1

(ii) area of ΔABC

$= \frac{1}{2} \times 8 \times 5.0$ M1

$= 20$ cm^2 A1 accept 20 or 20.1

(iii) size of $\angle ACB$

$\frac{\sin C}{5.8} = \frac{\sin 120}{12}$ ⟶ M1

$\angle C = \sin^{-1} \frac{5.8 \times 0.866}{12}$

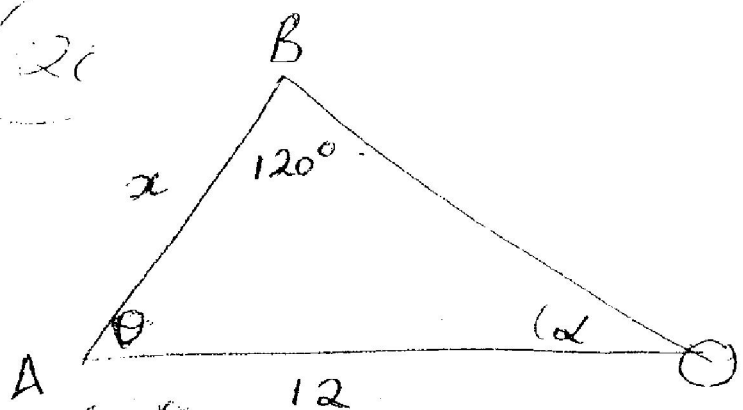
$\angle C = 24.7^\circ$ A1

10

$\left(\frac{\sqrt{3}}{2}x\right)^2 + \left(\frac{1}{2} \times 8\right)^2 = 12^2$ M1

$x^2 + 8x - 80 = 0$ M1

(a) ALT 1



$\frac{\sin\theta}{8} = \frac{\sin 120}{12}$ → (M1

$\sin\theta = \frac{8\sin 120^\circ}{12}$

$\theta = 35.26$

$\alpha = 24.74^\circ$

$180 - (120^\circ + 35.26^\circ)$ M1

$\frac{x}{\sin 24.74^\circ} = \frac{12}{\sin 120^\circ}$ (M1)

$x = 5.799$

$= 5.8$ (1 d.p) (A1

(b) (i) $\frac{1}{2} \times 8 \times h = \frac{1}{2} \times 12 \times 5.799 \sin 35.26$ M1

$h = 5.022$

$= 5.0$ (1 d.p) A1

(ii) Area $= \frac{1}{2} \times 12 \times 5.799 \sin 35.26$ M1

$= 20.09$

$= 20.1$ (1 d.p) A1

(iii) $\alpha = 180 - (120^\circ + 35.26^\circ)$ M1

21. a) ordinates

$x = 0$	$y_1 = 1$	B3 all values ✓ allow B2 for 5 ✓ and B1 for 3 ✓
$x = 1$	$y_2 = 6$	
$x = 2$	$y_3 = 9$	
$x = 3$	$y_4 = 10$	
$x = 4$	$y_5 = 9$	
$x = 5$	$y_6 = 6$	
$x = 6$	$y_7 = 1$	

Area $= \frac{1}{2} \times 1 \times \{1+1+2(6+9+10+9+6)\}$ M1

$= \frac{1}{2}\{2+2(40)\}$

$= \frac{1}{2}(82) = 41$ A1

b) (i) $\int_0^6 -x^2+6x+1 = \left[-\frac{1}{3}x^3+\frac{6}{2}x^2+x\right]_0^6$ M1 ✓ Integration and limits

$= -72+108+6$ M1 ✓ substitution

$= 114-72 = 42$ A1

(ii) $\frac{42-41}{42} \times 100\%$ M1

$= 2.38\%$ A1

10

22	a) $V = \frac{ds}{dt} = 6t^2 - 10t + 4$	B1	
	when $t = 3$,		
	$V = 6(9) - 10(3) + 4$	M1	
	$= 28 m/s$	A1	
	b) $V = 0 \Rightarrow 6t^2 - 10t + 4 = 0$	M1	
	$3t^2 - 5t + 2 = 0$		
	$(3t - 2)(t - 1) = 0$	M1	$(6t-4)(t-1)=0$ (1)
	$t = \frac{2}{3}$ or $t = 1$	A1	
	c) $t = \frac{2}{3}$: $s = 2(\frac{2}{3})^3 - 5(\frac{2}{3})^2 + 4(\frac{2}{3}) + 2$		
	$= 3.037 m$	B1	$3\frac{1}{27}$
	$t = 1$; $s = 2(1)^3 - 5(1)^2 + 4(1) + 2$		
	$= 3 m$	B1	
	d) $a = \frac{dv}{dt} = 12t - 10$	B1	
	$t = 3$; $a = 12(3) - 10$		
	$= 26$	B1	
		10	

23

a) $\underset{\sim}{BC} = \underset{\sim}{BD} + \underset{\sim}{DC}$

$= -\underset{\sim}{d} - \underset{\sim}{a} + 2\underset{\sim}{a}$ M1

$= \underset{\sim}{a} - \underset{\sim}{d}$ A1

(ii) $\underset{\sim}{AX} = k\underset{\sim}{AC} \Rightarrow \underset{\sim}{AX} = k(2\underset{\sim}{a} - \underset{\sim}{d})$ M1 A1 for $\underset{\sim}{AC}$

(iii) $\underset{\sim}{DX} = h\underset{\sim}{DB} \Rightarrow \underset{\sim}{DX} = h(\underset{\sim}{d} + \underset{\sim}{a})$ B1

b) $\underset{\sim}{AX} = -\underset{\sim}{d} + h\underset{\sim}{d} + h\underset{\sim}{a}$

$\Rightarrow \underset{\sim}{AX} = \underset{\sim}{d}(h-1) + h\underset{\sim}{a}$ M1 or equivalent

Also $\underset{\sim}{AX} = 2k\underset{\sim}{a} - k\underset{\sim}{d}$

$\therefore \underset{\sim}{d}(h-1) + h\underset{\sim}{a} = 2k\underset{\sim}{a} - k\underset{\sim}{d}$ M1 equating

$\Rightarrow h = 2k$ and $h - 1 = -k$

$h = -k + 1 \Rightarrow 2k = -k + 1$ M1 for equations and solving

$3k = 1$

$k = \frac{1}{3}$ A1

$h = 2k \Rightarrow h = 2 \times \frac{1}{3}$

$= \frac{2}{3}$ B1

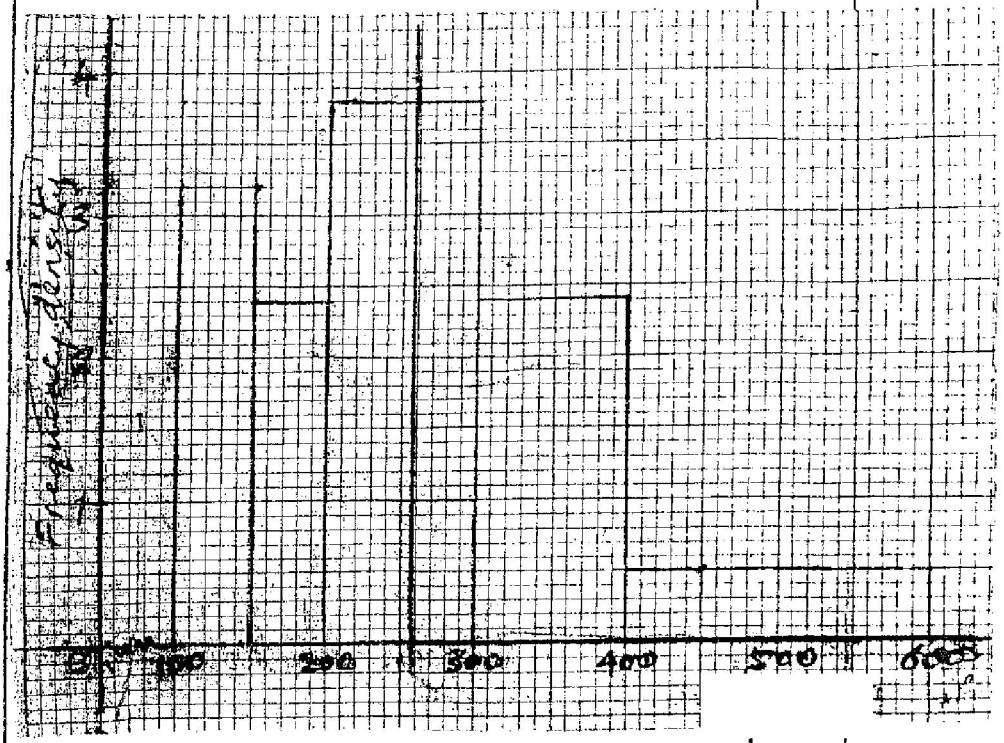
10

c) (i) $\underset{\sim}{AX} = \underset{\sim}{AD} + \underset{\sim}{DX} = h\underset{\sim}{a} + (h-1)\underset{\sim}{d}$ M1 A1

(ii) $\underset{\sim}{DX} = 2k\underset{\sim}{a} + (1-k)\underset{\sim}{d}$ B1

follow th

24.



B1 for

a)	B1	vertical scale
	B1	horizontal scale
	B	all bars drawn
		All B1 for each 3½
b) (i) median class: 200 – 300	B1	
(ii) median line:	B1	vertical line drawn
c) $900 + \frac{50 \times 0.5}{}$	M1	for 25 or 75
$= 925$	M1	
	A1	
	10	

2011 MARKING SCHEMES

1	No log $83.46 \longrightarrow 1.9215$ + $0.0054 \longrightarrow \underline{3.7324}$ $\bar{1}.6539$ $1.56^2 \longrightarrow 0.1931 \times 2 = \underline{0.3862}$ $\bar{1}.2677$ $\bar{1}.2677 \div 3 = \frac{\bar{3} + 2.2677}{3}$ $0.5700^{(1)} \longleftarrow \bar{1}.7559$	M1 M1 M1 A1 4	ALT ✓ logs ✓ operations (+, ×2, −) ✓ attempt to divide by 3 Accept 0.57 Accept std form 5.7×10^{-1}
a)	$1\text{ kg} \rightarrow \frac{120\times3 + 90\times4 + 60\times5}{12}$ $= \text{Sh. } 85$	M1 A1	
b)	$5\text{ kg Mixture} \rightarrow \frac{108}{100} \times 85 \times 5$ $= \text{sh } 459$	M1 A1 4	
3	$w^3 = \frac{s+t}{s}$ $w^3 s - s = t$ $s = \frac{t}{w^3 - 1}$	M1 M1 A1 3	removing the cube root collecting terms in s or equivalent
a)	$2x - 5 > -11$ $\Rightarrow x > -3$ $3 + 2x \leq 13$ $\Rightarrow x \leq 5$ Combined: $-3 < x \leq 5$	B1 B1 B1	
b)	$-2, -1, 0, 1, 2, 3, 4, 5$	B1 4	
	$\angle BAD = 30° + 40° = 70°$ $\angle BCD = 110°$	B1 B1 2	Reflex $\angle BOD = 220°$

6 a)

+	7	8	9	10	11
4	11	12	13	14	15
5	12	13	14	15	16
6	13	14	15	16	17
7	14	15	16	17	18
8	15	16	17	18	19

B1 ✓probability space (C.A.O)

b) P(Sum of ages at least 17) $= \frac{6}{25}$ B1

2

7 (a) $\underset{\sim}{T} = \begin{pmatrix} 6 \\ -2 \end{pmatrix} - \begin{pmatrix} 4 \\ 1 \end{pmatrix} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$ B1

(b) $\underset{\sim}{OA'} = \begin{pmatrix} 1 \\ 2 \end{pmatrix} + \begin{pmatrix} 2 \\ -3 \end{pmatrix} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$

$A'(3, -1)$ B1

$\underset{\sim}{OB'} = \begin{pmatrix} 3 \\ 5 \end{pmatrix} + \begin{pmatrix} 2 \\ -3 \end{pmatrix} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$

$B'(5, 2)$ B1

3

8 $\sin 45° = \frac{1}{\sqrt{2}}$ B1

$\frac{\sqrt{8}}{1 + \sin 45°} = \frac{\sqrt{8}(1 - \frac{1}{\sqrt{2}})}{(1 + \frac{1}{\sqrt{2}})(1 - \frac{1}{\sqrt{2}})}$

$= \frac{\sqrt{8} - \frac{\sqrt{8}}{\sqrt{2}}}{1 - \frac{1}{2}}$ M1 Rational denominator with the numerator expanded

$= 2\sqrt{8} - 4$ A1 accept other forms $\frac{4\sqrt{2} - 4}{4(\sqrt{2} - 1)}$

3

$Max_A = 4\pi(7.5)^2$ & $Min_A = 4\pi(6.5)^2$ M1 $\frac{0.5}{7}$ ---M1---R.E.

Absolute error $= \frac{4\pi(7.5^2 - 6.5^2)}{2}$ M1 $\frac{0.5}{7} \times 2$ ---M1 Absolute Error

% Error $= \frac{28\pi}{4\pi \times 7^2} \times 100\%$ M1 $\frac{0.5}{7} \times 2 \times 100$---M1 allow for use of {Max − Min, Max − Actual, Actual − min}

$= 14.29\%$ A1 14.29% A1

4

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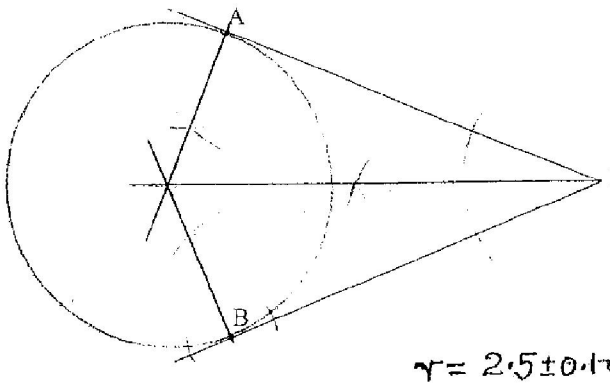
(a)



(b) $r = 2.5 \pm 0.1$ cm

B1 ✓location of centre by construction
- ⊥ bisector of A or B
- by ⊥ bisector angle ANB and one ⊥ of A or B

B1 Circle drawn
Use of ⊥ bisector

B1

3

11

$(a+\frac{1}{2})^4 = a^4 + 4a^3(\frac{1}{2}) + 6a^2(\frac{1}{2})^2 + 4a(\frac{1}{2})^3 + (\frac{1}{2})^4$ M1

$= a^4 + 2a^3 + \frac{3}{2}a^2 + \frac{1}{2}a + \frac{1}{16}$

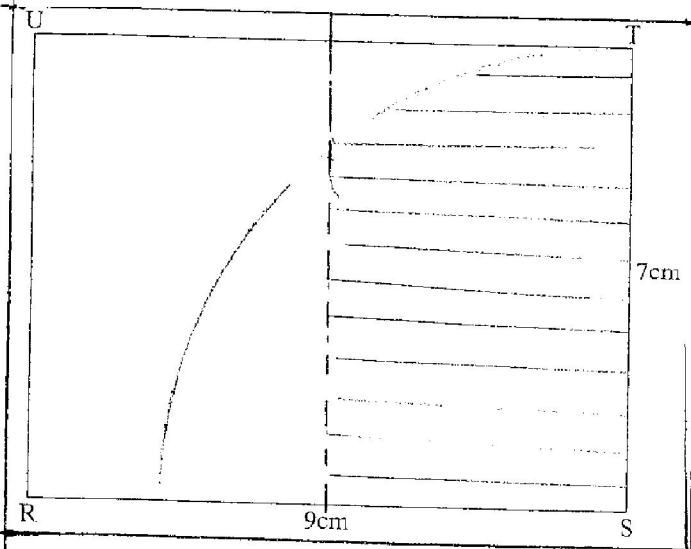
$(a-\frac{1}{2})^4 = a^4 + 4a^3(-\frac{1}{2}) + 6a^2(-\frac{1}{2})^2 + 4a(-\frac{1}{2})^3 + (-\frac{1}{2})^4$ M1

$= a^4 - 2a^3 + \frac{3}{2}a^2 - \frac{1}{2}a + \frac{1}{16}$

$(a+\frac{1}{2})^4 + (a-\frac{1}{2})^4 = 2a^4 + 3a^2 + \frac{1}{8}$ A1

3

12



B1 ⊥ bisector of TU drawn
Continuous or dotted.

B1 Arc radius 7 centre S drawn
Continuous or dotted.

B1 ✓Region shaded with bisector dotted and arc full line

3

13

$\underset{\sim}{PQ} = -(6i+j) + (-2i+5j)$ M1

$= -8i + 4j$

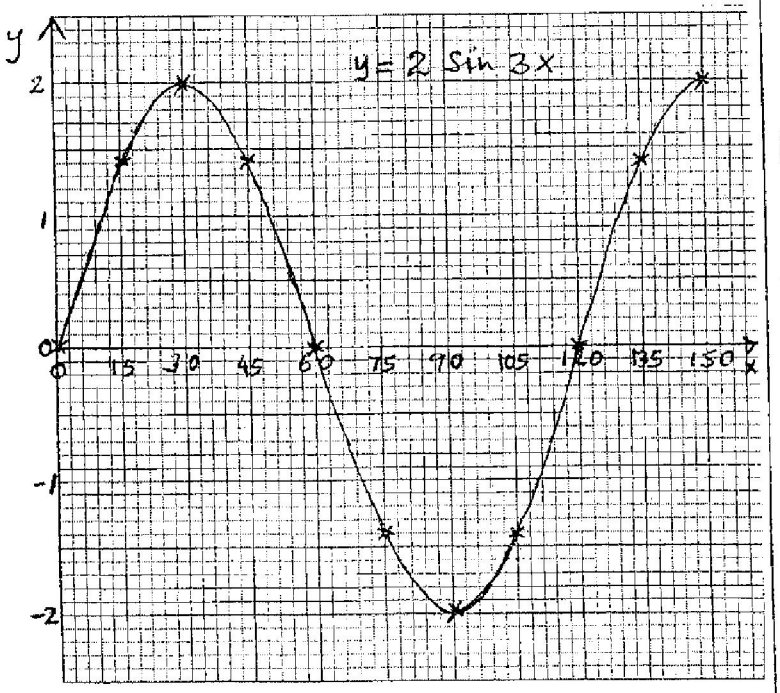
$\underset{\sim}{PN} = \frac{3}{4}(-8i+4j)$ M1

$= -6i + 3j$ A1

$\underset{\sim}{ON} = \frac{3}{4}(-2i+5j) + \frac{1}{4}(6i+j)$

$= 4j$

$\underset{\sim}{PN} = -(6i+j) + 4j$

14 (a)	Let longitude difference be θ $\theta \times 60\cos 60^\circ = 630$ $\theta = \frac{630}{60\cos 60^\circ}$ $= 21^\circ$	M1 A1	Case where unit is in Km: follow through.
(b)	21° East of longitude $18^\circ E$ is $39^\circ E$ $N(60^\circ N, 39^\circ E)$	B1 3	
15	$x^2 - 6x + 9 + y^2 - 10y + 25 = -30 + 9 + 25$ $\pm 2a = \pm 6$ or $(x-3)^2 = (x-a)^2$ $\pm 2b = \pm 10$ or $(y-5)^2 = (y-b)^2$ $a = 3$ and $b = 5$	B1 B1 B1 3	allow for $(x-3)^2$ seen allow for $(y-5)^2$ seen Allow if (3, 5)
Q16 (a)		P1 C1	✓ plotting Smooth Sine Curve.
(b)	Period $= 120^\circ$	B1 3	If curve shown $\frac{360}{3} = 120^\circ$ Allow

17(a) (i) Ike cost = Ksh (7500 + 11 × 6000) M1
= Ksh 73500 A1

(ii) Ike % increase = $\frac{73500 - 60000}{60000} \times 100$ M1
= 22.5 % A1

(b) Ike amount paid = Ksh 60000 × 25 × 0.95 M1
= Ksh 1425000 A1

(c) Institution X; Ksh 73500 × 25 M1
= Ksh 1837500
Institution Y; Ksh $60000 \times 25 \times \left(1 + \frac{12}{100}\right)^2$ M1
= Ksh 1881600
Difference = Ksh (1881600 − 1837500) M1
= Ksh 44100 A1
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18(a) (i) $r = \frac{64+4d}{64}$, $r = \frac{64+6d}{64+4d}$ B1B1 or equivalent $64 + 4d = 64r$, $64 + 6d = 64r^2$

(ii) $\frac{64+4d}{64} = \frac{64+6d}{64+4d}$ M1 or equivalent. $64r^2 = 64 + 6(16r - 16)$

$16d^2 + 128d = 0$
$16d(d + 8) = 0$ M1 $2r^2 - 3r + 1 = 0$
$d = -8$ $(2r - 1)(r - 1) = 0$
A1 $\therefore r = \frac{1}{2}$ or $r = 1$.
$\therefore r = \frac{1}{2}$

$\therefore r = \frac{64 + 4 \times -8}{64}$
$= \frac{1}{2}$. B1 $d = \frac{32 - 64}{4} = -8$

(b) (i) $S_{10} = \frac{10}{2}\{2 \times 64 + 9 \times -8\}$ M1
$= 280$ A1

(ii) $S_{10} = \frac{64\left(1 - \left(\frac{1}{2}\right)^{10}\right)}{1 - \frac{1}{2}}$ M1 − Any substitute to the value for r

$= 127.875$. A1 Accept $127\frac{7}{8}$ and when rounded off to at least 4 s.f.
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19(a) Rectangle ABCD drawn B1

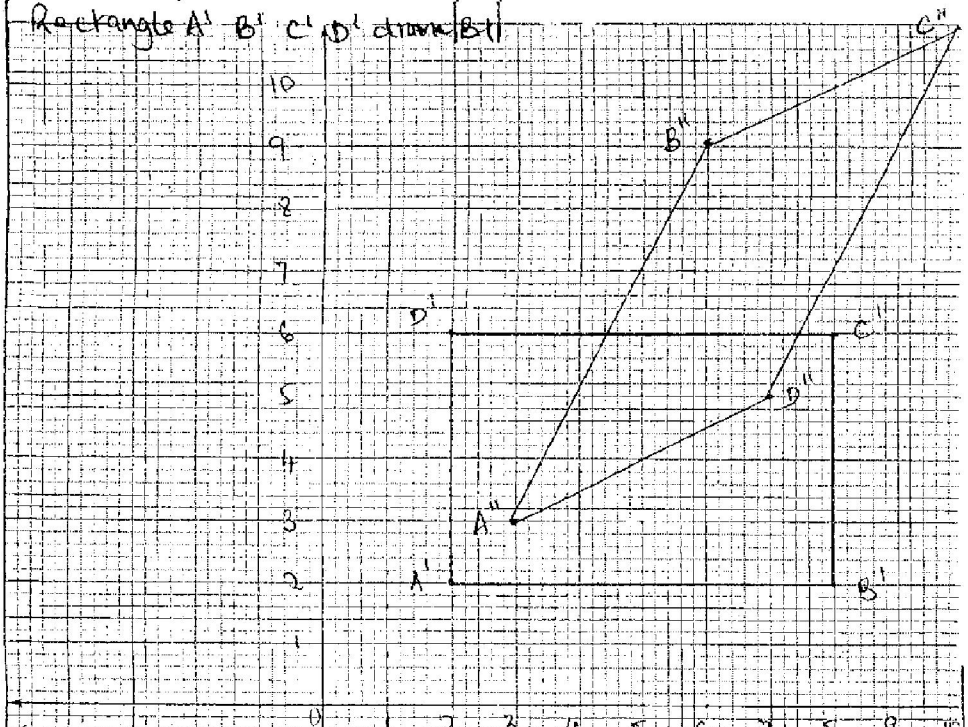
$\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}\begin{pmatrix} -1 & -4 & -4 & -1 \\ -1 & -1 & -3 & -3 \end{pmatrix}$ M1

$A'\ B'\ C'\ D'$

$= \begin{pmatrix} 2 & 8 & 8 & 2 \\ 2 & 2 & 6 & 6 \end{pmatrix}$ A1

May be implied in the diagram

Rectangle $A'B'C'D'$ drawn B1



(b) (i) $\begin{pmatrix} \frac{1}{2} & \frac{1}{2} \\ 1 & \frac{1}{2} \end{pmatrix}\begin{pmatrix} 2 & 8 & 8 & 2 \\ 2 & 2 & 6 & 6 \end{pmatrix} = \begin{pmatrix} 3 & 6 & 10 & 7 \\ 3 & 9 & 11 & 5 \end{pmatrix}$ M1 ✓ attempt to multiply

$A''(3,3),\ B''(6,9),\ C''(10,11),\ D''(7,5)$ A1 ✓ if A is correct is lost

Rectangle $A''B''C''D''$ drawn B1 ✓

(c) Det of $P = -\frac{3}{4}$ B1 or equivalent

Area $A''B''C''D'' = \frac{3}{4} \times 6 \times 4$ M1

$= 18$ sq units. A1

10

20(a) (i) $x - 5$ B1

(ii) $[x + (x-5)]\times 2$ B1

$= 4x - 10$

(b) (i) $(x+20),\ (x+15),\ (4x+10)$ B1

$(x+20)(x+15) = 15(4x+10)$ M1 allow when two ages are ✓

$x^2 - 25x + 150 = 0$

$(x-10)(x-15) = 0$ M1 for ✓ attempt to solve or equivalent

$x = 10$ or $x = 15$ A1

(ii) $4\times10 - 10$ or $4\times15 - 10$ M1

$= 30$ 50 A1 for both ages

(iii) $(10-5) + 20$ or $(15-5) + 20$ M1

$= 25$ 30 A1 for both ages.

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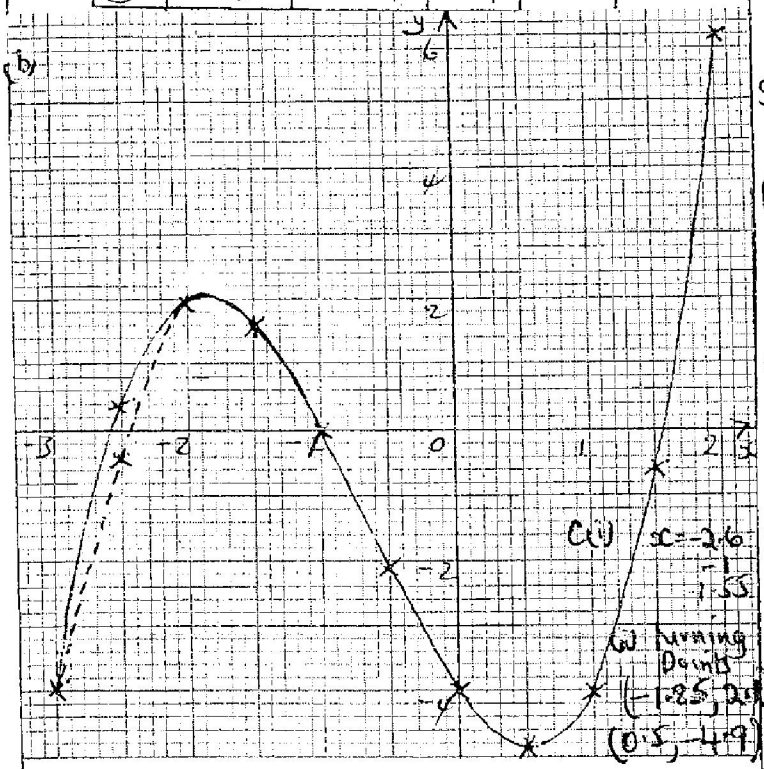
21 (a)

x	-2	-0.5	1	1.5
y	2	-2.1	-4	-0.6

B2 — B1 for 3 ✓



(b) S1 — for ✓ scale

P1 — for ✓ plotting

C1 — for ✓ smooth curve

(c) (i) $x = -2.6$ B1; -1 B1; 1.55 B1 — Accept -2.45 for use of -0.4

(ii) Turning Point $(-1.25, 2.9)$ B1; $(0.5, -4.9)$ B1 — Allow readings within 1 small square.

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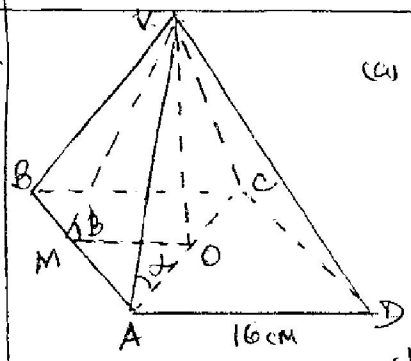
22.



(a) $AC^2 = 16^2 + 12^2 = 400$ M1 — or equivalent

$AC = \sqrt{400} = 20\text{cm}$

$AO = 10\text{cm}$.

$VO^2 = 26^2 - 10^2$ M1

$VO = \sqrt{576}$ M1

$= 24\text{cm}$. A1

(b) The angle between VA and ABCD is α B1

$\tan\alpha = \frac{24}{10}$ M1 — or equivalent

$\alpha = 67.38°$ A1

(2)

(c) The angle between the planes is β B1

$\tan\beta = \frac{24}{8}$ M1 — or equivalent

$\beta = 71.57°$ A1 — Accept 71.6

(5)

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