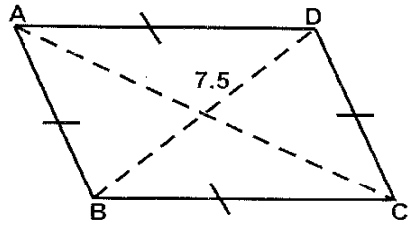
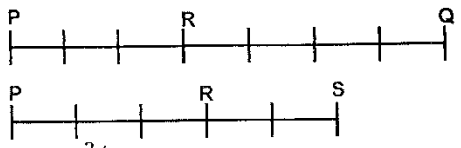
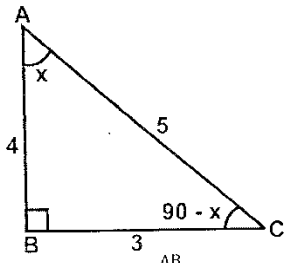
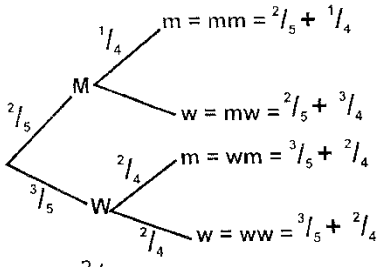
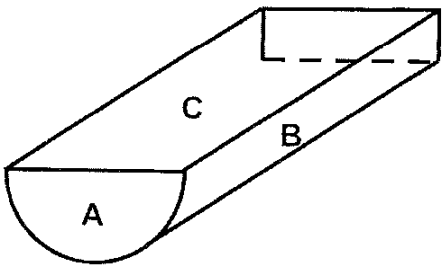
MATHEMATICS

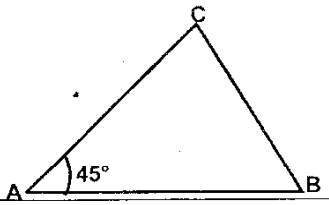
K.C.S.E PAPER 121/ 1 2005

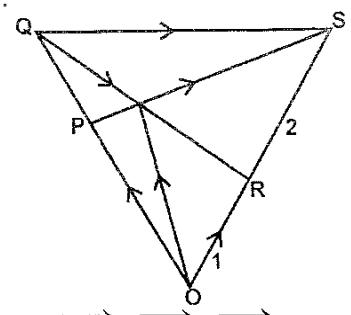
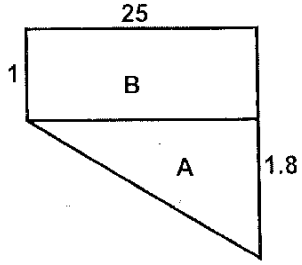
MARKING SCHEME

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 = $\frac{A.E}{A.M} \times 100$ = $\frac{2.5}{12} \times 100 = 20\,^{5}/_{6}\%$	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 $7y = -30$ $y = {}^{-30}/_{7} = -4\,^{2}/_{7}$ The coordinates are $(0, -4\,^{2}/_{7})$	B1 M1 A1 3 marks	
12.  Area A = Πr^2 = $^{22}/_{7}$ x 4.2 x 4.4 = 55.44cm² Area B = $2\Pi rh \times ½$ = $^{22}/_{7}$ x 4.2 x 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 = $^{2}/_{2}\pi rh + \pi r^2 + 2rh$ = $^{22}/_{7}$ x 4.2 x 150 + $^{22}/_{7}$ x 4.2 x 4.2 + 2 x 4.2 x 150 = 3295.44cm²

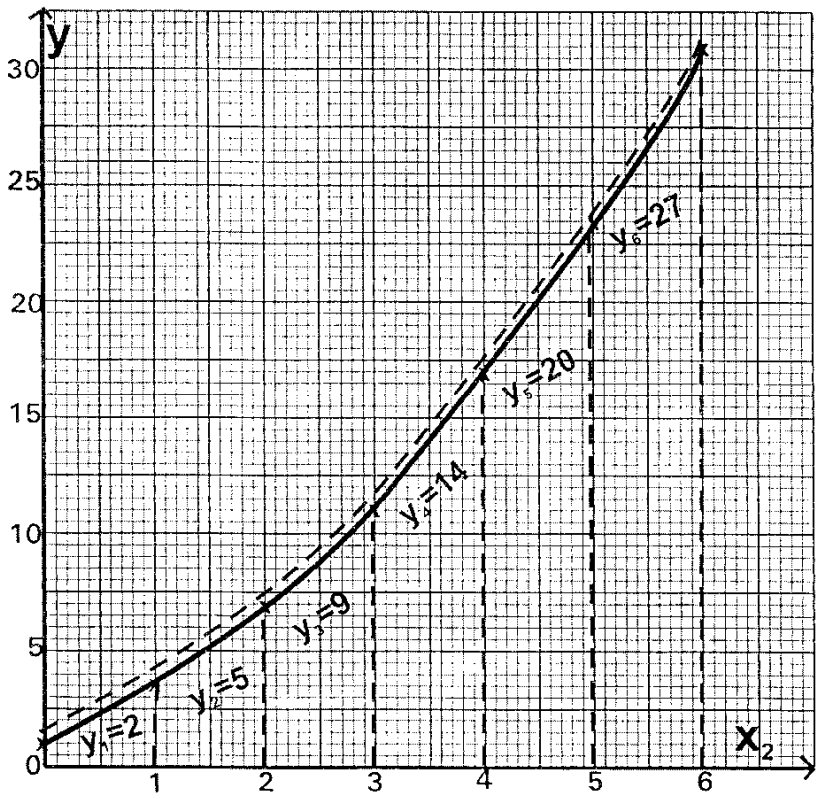
SOLUTION	MARKS	ALTERNATIVE
13. $A = \begin{bmatrix}1\\-1\\1\end{bmatrix}$, $B\begin{bmatrix}x\\y\\z\end{bmatrix}$ and $T = \begin{bmatrix}2\\0\\1.5\end{bmatrix}$ Midpoint – AB = T = $\left[\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}, \frac{z_1+z_2}{2}\right]$ $\left[\frac{1+x}{2}, \frac{y-1}{2}, \frac{1+z}{2}\right] \equiv (2, 0, 1.5)$ $x = 3$, $y = 1$ 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) $\overrightarrow{PS} = \overrightarrow{PO} + \overrightarrow{OS}$ $= -2p + 3r$ $= 3r - 2p$ $\overrightarrow{OT} = {}^1/_7\,OS + {}^6/_7\,OP$ $= {}^1/_7 \times 3\underline{r} + {}^6/_7 \times 2p$ $= {}^3/_7 r + {}^{12}/_7 \underline{p}$ $QT = QP + PT$ $= -{}^7/_6(3\underline{p}) + {}^7/_6(3\underline{r} - 2p)$ $= {}^3/_7 r - {}^9/_7 \underline{p}$ (b) $\overrightarrow{QT} = {}^7/_6\underline{r} - {}^9/_7\underline{p}$ $QR = \underline{r} - 3\underline{p}$ $QR \uparrow\uparrow QT$ if $QR = KQT$ $\underline{r} - 3\underline{p} = K({}^3/_7\underline{r} - {}^9/_7\underline{p})$ $r = {}^3/_7 kr$ $k = {}^7/_3$ Also $-3\underline{p} = {}^{-9}/_7 pk$ $k = {}^7/_3$	M1 A1 A1 M1 4 marks	Hence QR ↑↑ QT Q is common point Hence Q, T, R are Collinear A1 (b) (ii) $\overrightarrow{QT} : \overrightarrow{TR}$ $\overrightarrow{QT} = {}^3/_7\underline{r} - {}^9/_7\underline{p}$ $\overrightarrow{TR} = \overrightarrow{OT} + \overrightarrow{OR}$ B1 $= {}^{-3}/_7\underline{r} - {}^{12}/_9\underline{p} + \underline{r}$ $= {}^4/_7\underline{r} - {}^{12}/_7\underline{p}$ Hence $\overrightarrow{QT} : \overrightarrow{TR}$ ${}^3/_7\underline{r} - {}^9/_7\underline{p} : {}^{4r}/_7 - {}^{12}/_7\underline{p}$ $\Rightarrow {}^3/_7\underline{r} : {}^4/_7\underline{r}$ 3 : 4 or ${}^{-9}/_7\underline{p} : {}^{-12}/_7 p$ 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 $x = \frac{3}{4}$

and $y = \frac{-1}{8}$ — B2

$= (4x - 3)dx$

$y = 2x^2 - 3x + c$ 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

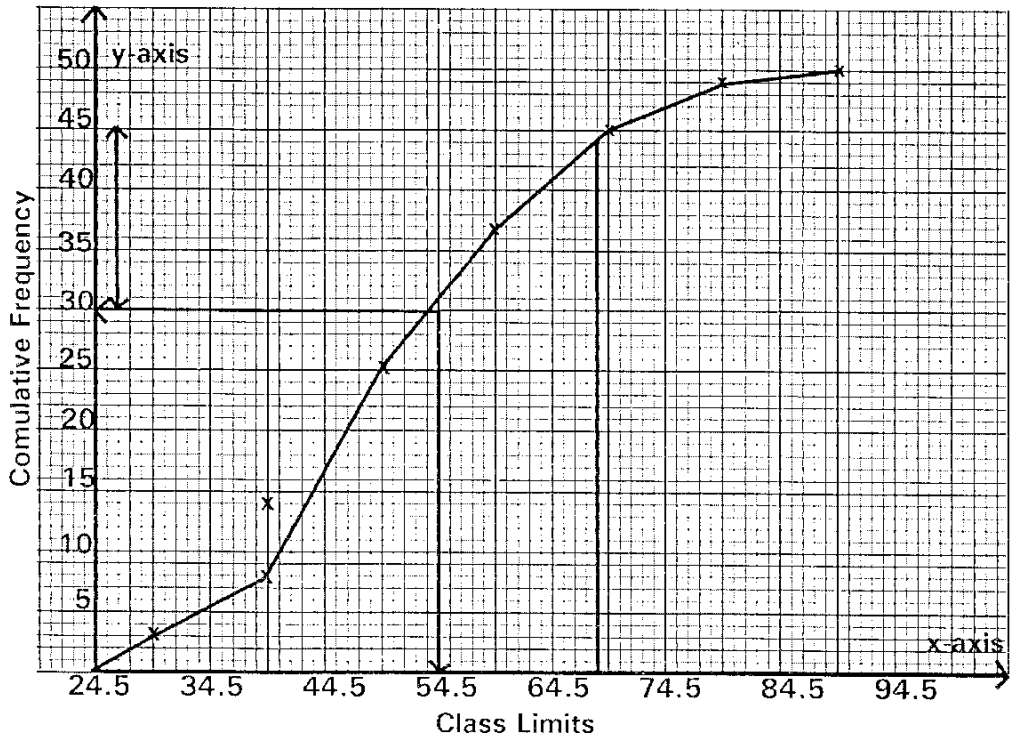
Subst, for x

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



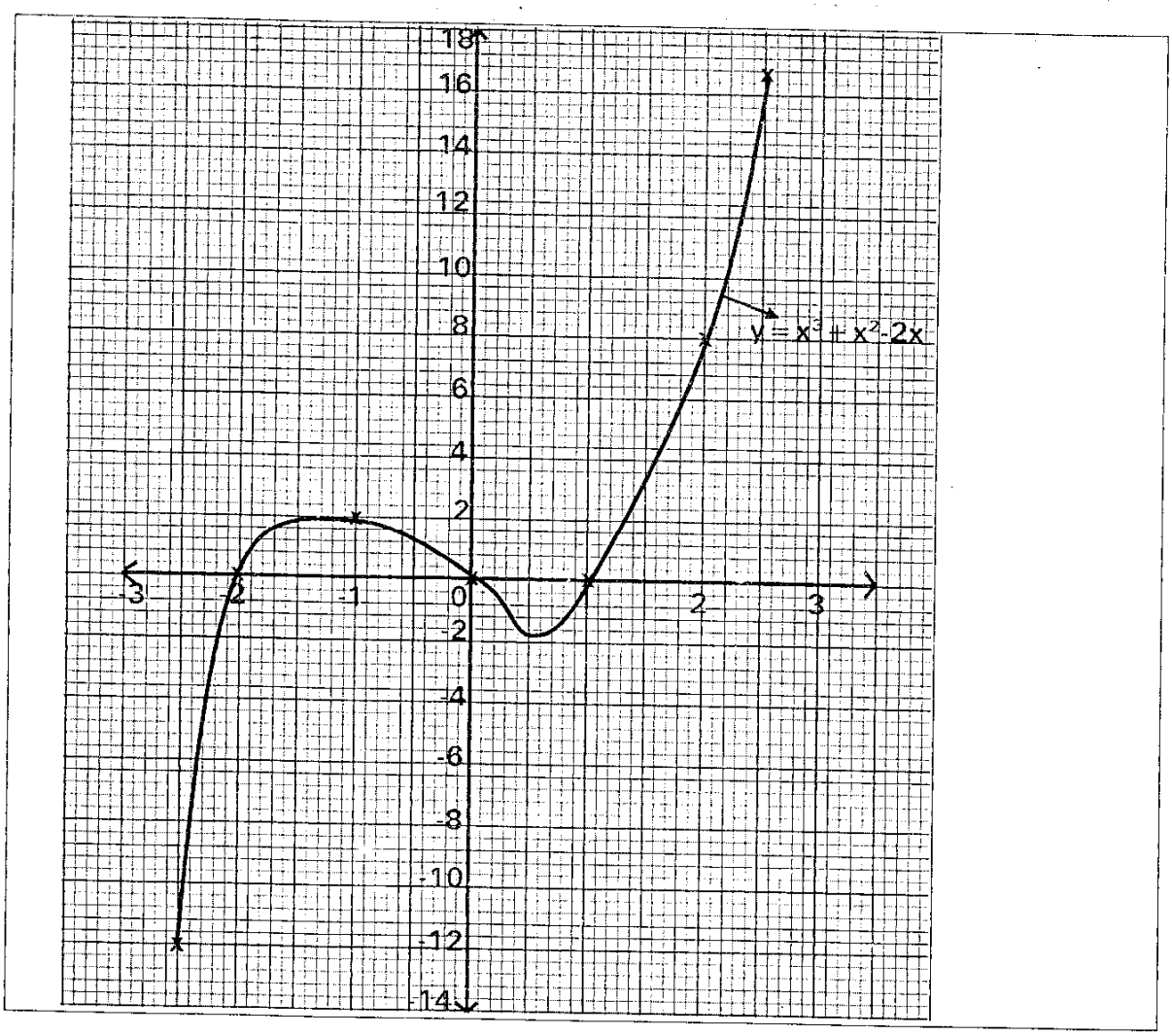
23. OUT OF SYLLABUS

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)

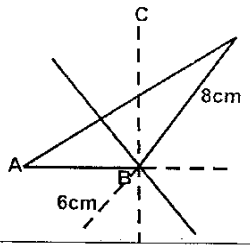
(iii) $x < -2$

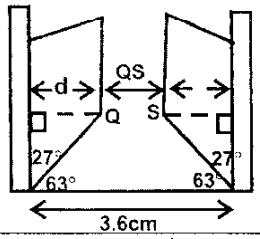
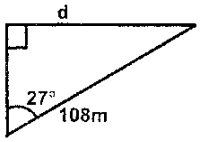
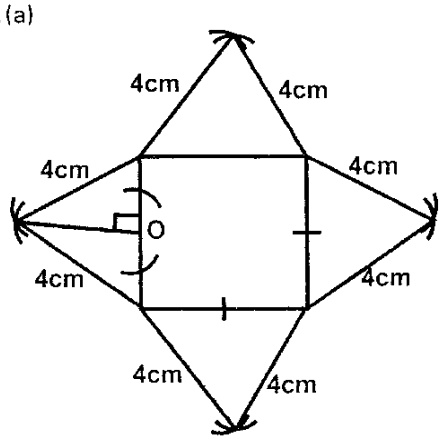

18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-3
-2
-1
2
3
$y = x^3 + x^2 - 2x$

MATHEMATICS

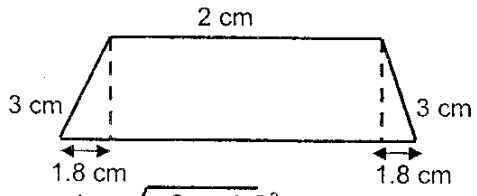
K.C.S.E PAPER 121/ 1 2006

MARKING SCHEME

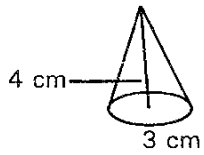
SOLUTION	MARKS	ALTERNATIVE METHOD
1. $\frac{3\sqrt{675 \times 135}}{\sqrt{2025}} = \frac{3\sqrt{3^3 \times 5^2 \times 5}}{\sqrt{3^4 \times 5^2}} = \frac{3^2 \times 5}{3^2 \times 5} = 1$	M1 A1 2 marks	$3\sqrt{91125} = 45$ Working must be shown $x^3 = 3\sqrt{\frac{675 \times 135}{45}} = \frac{675 \times 135}{45 \times 45 \times 45}$ $x = 1$
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) $m\begin{bmatrix} -2 \\ 3 \end{bmatrix} - n\begin{bmatrix} 1 \\ 3 \end{bmatrix} = \begin{bmatrix} -12 \\ 9 \end{bmatrix}$ $-2m - n = 12$ $\frac{3m-3n=9}{m=n+3}$ $2(n + 3) + n = 12$ $3n = 6 \quad m = 5 \quad n = 2$	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 $\frac{1}{2}(0.4)\times(2+0)+2(1.96+1.83+1.60+1.20)$ $= 3.036cm^2$ = 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 $= \frac{125}{100} \times 12000$ = sh. 15,000 New No. of sets $= \frac{90}{100} \times 240 = 216$ Amount from sale = 216 x 15,000 = Sh. 3,240,000 Increase = 3,240,000 – 2,880,000 = 360,000 % increase $= \frac{360,240,000}{2,880,000} \times 100 = 12.5\%$ (ii) $\frac{16}{15} \times 15,000 = Sh.\ 16,000$ (c) Let the No. of sets sold in 2003 be x 16000 x = 2,880,000 $x = \frac{2,880,000}{16,000}$ $\therefore x = 180$ $p\% = \frac{240 - 180}{240} \times 100 = 25\%$ $\therefore p = 25$	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 $\frac{240+80}{240} \times 100$ ..... M1 M1 $\frac{100-p \times 240}{100} \times 26000$ = 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	

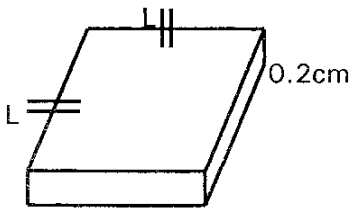
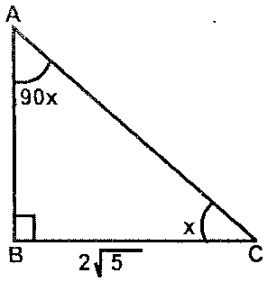
SOLUTION	MARKS	ALTERNATIVE METHOD
21.(a) (i) Length At = 100 tan 30° = 100 x 0.5774 = 57.74	M1 A1	 x tan 60° - 100
(ii) Length AD AC $=\sqrt{57.74^2 + 57.74^2}$ = 81.66 OR 81.65 $AD^2 = 51.66 + 80^2$ = 2 x 8166 x 80Cos 100° = 6668 + 6400 – 2 x 81.66 x 80 x(-0.1736) $AD = \sqrt{15336}$ = 123.8	M1 A1 M1	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	A1 M1	477.1 in case 123.84 is used
Rolls to be bought $\frac{(616.4-3 \text{ x } 2.8)\text{x } 5}{480}$ = 6.33 = 7 rolls	M1 A2 10 marks	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) $\underline{OT} = \frac{7}{6}\underline{OM}$ $= \frac{7}{6}\begin{bmatrix}6\\12\end{bmatrix}$ $= \begin{bmatrix}7\\14\end{bmatrix}$	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	

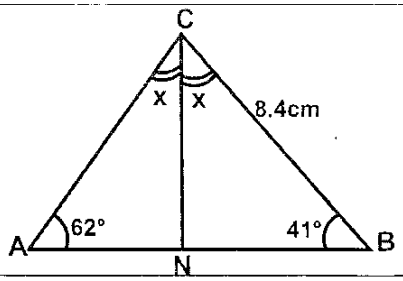
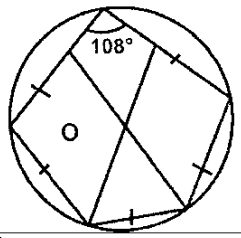
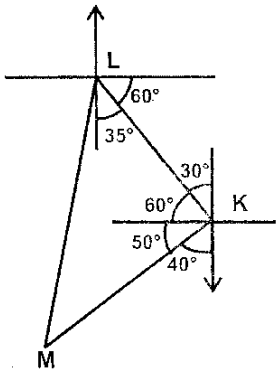
SOLUTION	MARKS	ALTERNATIVE METHOD
23.(a) $L = \sqrt{4^2 + 3^2}$ $L = \sqrt{25} = 5cm$  $A_c = \prod rl$ $= 3.142 \times 3 \times 5$ $= 47.13\ cm^2$ $A_{cs} = \prod Dh$ $= 3.142 \times 6 \times 8$ $= 150.82\ cm^2$ $A_s = \frac{1}{2}\ 4\prod r^2 = 2\prod r^2$ $= 2 \times 3.142 \times 9$ $= 56.56\ cm^2$ 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) $a = \frac{dv}{dt}$ $= 6t - 10$ $= 6(2) - 10$ $= 2ms^{-2}$		

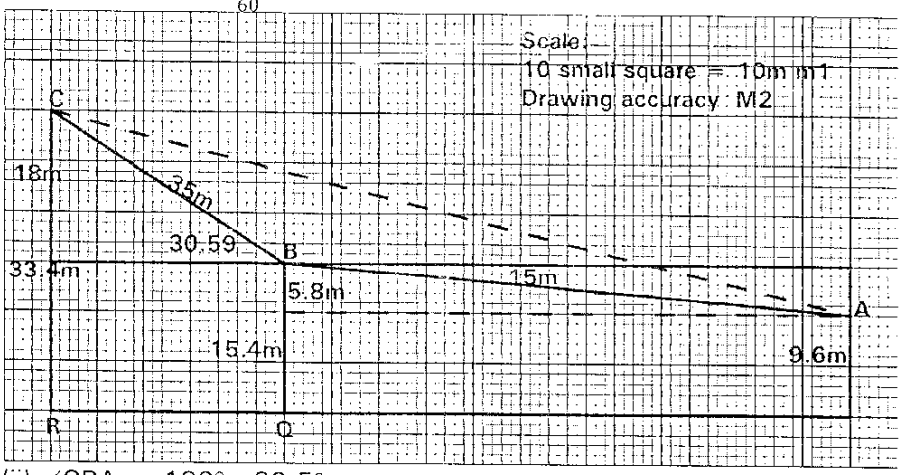
MATHEMATICS

K.C.S.E PAPER 121/ 1 2007

QUESTIONS

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 $= \sqrt{5^2 - (2\sqrt{5})^2} = \sqrt{5}$ Tan(90° - x) $= \frac{2\sqrt{5}}{\sqrt{5}} = 2$  	M1 A1
9. X = Area $= \Pi DL$ $= 3.142 \times 10 \times 12$ $= 377.04cm^2$ 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) $\frac{5.8}{\sin 5.5°} = \frac{x}{\sin 84.5°}$ $x = \frac{5.8 \sin 84.5°}{\sin 5.5°} = 60.2$m $\frac{105.8}{\sin 149.5°} = \frac{60.2}{\sin C}$ $\sin C = \frac{60.2 \sin 149.5}{105.8} = 0.2888$ (b) (i) 60mm $=$ 33.4m $\therefore$ 190mm $= \frac{190 \times 33.4}{60} = 105.77$m  (ii) $\angle CBA = 180° - 30.5°$ $\therefore \angle BCA = 16.8°$	M1 A1 M1 M1 M2 M1 A1 8 marks
19. (i)	

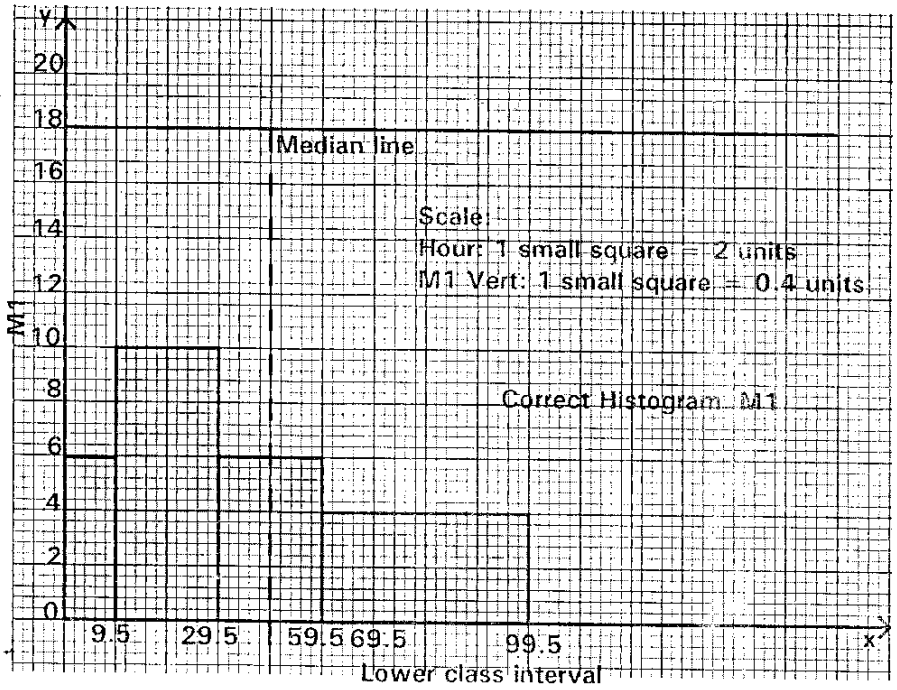
Marks	0 - 10	10 - 30	30 - 60	60 - 70	70 - 100
Frequency	12	40	36	8	24
Area of rectangle	60	200		40	120
Height of rectangle	6	10		4	4

M1

A1

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

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



2 marks

M1

M1

(b) Median mark = 30 - 60 — M1

Or 29.5 – 59.6

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

$= 37.5$ — A1

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

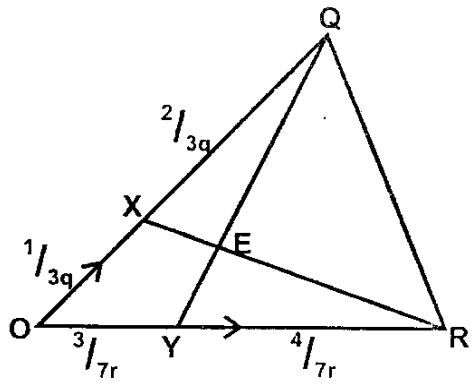
(b) Remaining computers = 50 – 2 = 48 — M1

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

= Kshs. 270,000 — A1

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

10 marks

21.(a) (i) $XR = -OX + OR$ $r - {}^{1}/_{3}q$ (ii) $YQ = q - {}^{3}/_{7r}$ (b) (i) $XE = m(r - {}^{1}/_{3q})$ (ii) $YE = n(q - {}^{1}/_{3r})$ (c) (i) $OE = OX + XE$ $= {}^{1}/_{3q} + m(r - {}^{1}/_{3}q)$ $= \frac{(1-m)}{3}q + mr$ (ii) Also $OE = OY + YE$ $\frac{3}{7}r - \frac{3}{7}nr + nq$ $= \frac{1-m}{3}n$ ..... (i) $M = 1 - 3n$ ..... (ii) Subst. and solving $n = {}^{2}/_{9}$ and $m = {}^{1}/_{3}$  	M1 M1 M1 M1 A1 M1 A1 A1 A1 10 marks
22.(a) (A.S.F)½ = (L.S.F) L.S.F = $\left[\frac{45}{20}\right]$½ = 1.5 $(L.S.F)^3 = (V.S.F)$ $\therefore V.S.F = (1.5)^3 = 3.375$ $= \frac{0.945}{y} = 3.375$ $\therefore y = \frac{0.945}{3.375} = 0.28$ litres (b) From A.S.F $A = {}^{3}/_{2}B$ $\therefore {}^{3}/_{2}B(13 - h) = Bh$ $2 \times {}^{3}/_{2}(13 - h) = h \times 2$ $39 - 3h = 2h$ $5h = 39$ $h = {}^{39}/_{5} = 7.8$cm (c) Volume in larger Cylinder $= {}^{3}/_{2}Bh$ $= {}^{3}/_{2} \times 7.8B$ $= 11.7Bcm^3$ ${}^{1}/_{5}$ of $11.7B = 2.34Bcm^3$ Total volume of juice in smaller container $= 2.34B + Bh$ $= 2.34B + 7.8B$ $= 101.14B$	M1 M1 M1 A1 B1 M1 A1 M1 A1 M1 A1 12 marks
23. (a) $\begin{bmatrix} 9 & 8 \\ 7 & 6 \end{bmatrix}$ det. $= (9 \times 6) - (8 \times 7)$ $= 54 - 56 = -2$ $A^{-1} = \begin{bmatrix} 6 & -8 \\ -7 & 9 \end{bmatrix} - {}^{1}/_{2} = \begin{bmatrix} -3 & 4 \\ 3.5 & -4.5 \end{bmatrix}$ (b) Let price of bicycle be x and radio be y Bicycle Radio $A = \begin{bmatrix} 36 & 32 \\ 28 & 24 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 227,280 \\ 174,960 \end{bmatrix}$ Det $= (36 \times 24) - (32 \times 28) = 864 - 896 = -32$ $A^{-1} = {}^{-1}/_{32}\begin{bmatrix} 24 & 32 \\ -28 & 36 \end{bmatrix} = \begin{bmatrix} -0.75 & +1 \\ +0.875 & -1.125 \end{bmatrix}$	M1 A1 M1 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 $\begin{bmatrix} 259,200 \\ 125,664 \end{bmatrix}$

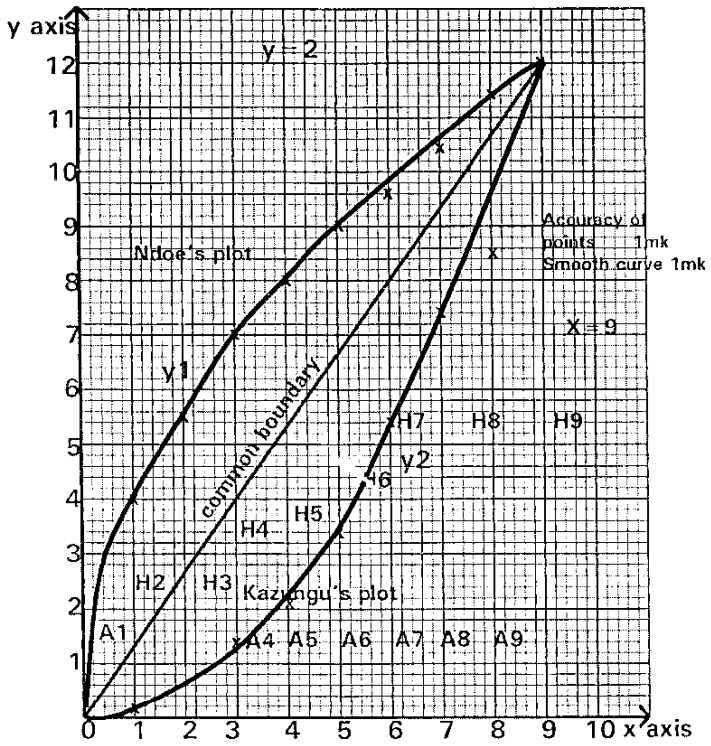
Total for Radios

M1

A1

8 marks

24.



2 marks

(b) (i) $A_1 = \frac{1}{2}(1 \times 0.2) + \frac{1}{2}(0.2 + 0.6)1 + \frac{1}{2}(0.6 + 1.3) + \frac{1}{2}(1.3 + 2.4) +$ M1

$\frac{1}{2}(2.4 + 3.7) + \frac{1}{2}(3.7 + 5.3) + \frac{1}{2}(5.3 + 7.3) + \frac{1}{2}(7.3 + 9.5) + \frac{1}{2}(9.5 + 12)$ A1

$= 36.30$sq units

$A_2 = (\frac{1}{2} \times 4 \times 1) + \frac{1}{2}(4 + 5.7) + \frac{1}{2}(5.7 + 6.9) + \frac{1}{2}(6.9 + 8) + \frac{1}{2}(8 + 9) +$ M1

$\frac{1}{2}(9 + 9.8 + \frac{1}{2}(9.8 + 1.06) + \frac{1}{2}(10.6 + 11.3) + \frac{1}{2}(11.3 + 2)$ M1

$= 59.65$sq units A1

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

M1

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

1 unit $= 20m$

$\therefore 1 \times 1$ unit squared $= 20 \times 20m^2$ M1

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

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

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

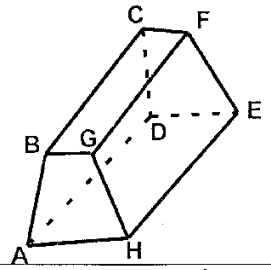
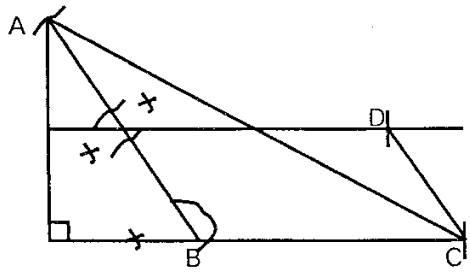
$= 0.934$ hactares A1

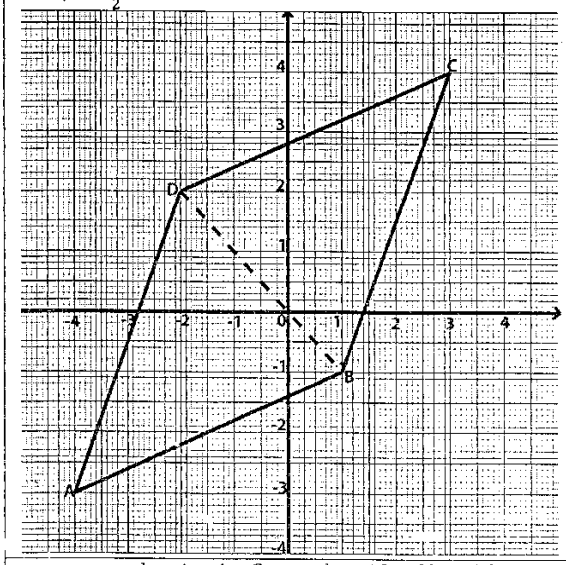
10 marks

MATHEMATICS

K.C.S.E PAPER 121/ 1 2008

MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE METHOD
1. $\frac{-8+(-5)x(-8)-(-6)}{-3+(-8)\div 2 x 4} = \frac{-8+40+6}{-3+-4x4}$ $= \frac{38}{-19} = -2$	M1 A1 2 marks	
2. $\frac{(3^3)^{2/3} \div 2^4}{(2^5)^{-3/5}} = \frac{3^2 \div 2^4}{2^{-3}}$ $= \frac{3^2}{2^4 x 2^{-3}}$ $= {}^{9}/_{2} = 4\,{}^{1}/_{2}$ 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 – ${}^{1}/_{3}$ x 900 000 Diesel – ${}^{2}/_{3}$ x 900 000 Profit: $\frac{1}{3} x \frac{900000}{1000} x 520 + {}^{2}/_{3} x \frac{900000}{1000} x 480$ = 156000 + 288000 = 444 000	M1 M1 A1 3 marks	
7. Volume of liquid = $\frac{384}{0.6}$ Height of liquid = $\frac{640}{\pi x 3.2^2}$ = 19.89 2dp	M1 M1 A1 3 marks	
8.  	B1 B1 B1 B1 4 marks	< 120° 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. 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 $L_2 = \frac{0+4}{-5-5} = \frac{4}{10} = \frac{-2}{5}$ $\frac{5}{2} \times \frac{-2}{5} = -1$ $\therefore L_1$ 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

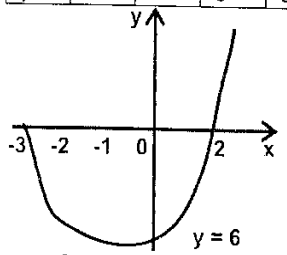
$\text{Arc} = \frac{1}{2} \times [(11+11) + 2(7+5+5+7)]$
$= \frac{1}{2}(22 + 48)$
$= 35$
$\text{Arc} = 11 \times 5 = 55$
$= 55 - 35$
$= 20$ square units
(b) Mid - ordinates

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

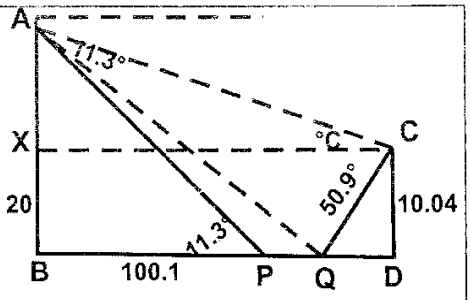
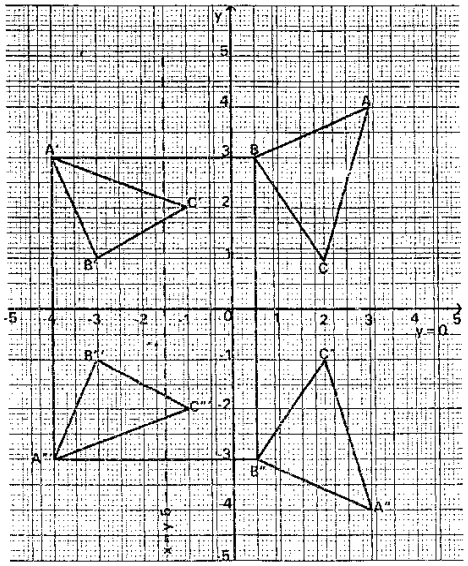
19. (a) (i) $\underline{BD} = \underline{q} - \underline{p}$
(ii) $\underline{BC} = \frac{2}{3}(\underline{q} - \underline{P})$
(iii) $\underline{CD} = \frac{1}{3}(\underline{q} - \underline{P})$
(iv) $\underline{AC} = \underline{P} + \frac{2}{3}\underline{q} - \frac{2}{3}\underline{P}$
$= \frac{1}{3}\underline{q}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

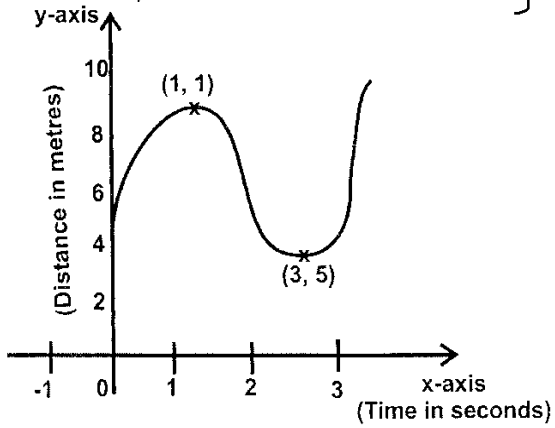
B1
B1
B1
M1
A1
M1
A1
M1
A1
B1
10 marks

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) $\text{Tan } 11.3° = {}^{20}/_{x} \rightarrow x = \frac{20}{\tan 11.3°}$ $= \frac{20}{0.1998197} = 100.09022$ $\sim$ 100.1m (b) PQ $= \frac{36 \times 1000}{60 \times 60} \times 5 = 50$m BQ = 100.1 + 50 = 150.1m $\text{Tan } \theta = \frac{20}{150.1} = 0.1332445$ $\theta = 7.5896426$ $\theta = 7.59°$ (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 $\text{Tan } \alpha = \frac{9.96}{200} = 0.0498$ $\alpha = 2.8509745$ $\alpha = 3°$	M1 A1 M1 M1 A1 M1 A1 M1 M1 A1 10 marks	
21. (a) $\Delta A'B'C'$ ✓ly drawn (b) $\Delta A''B''C''$ ✓ly drawn (c) $\Delta A'''B'''C'''$ ✓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) $\frac{1}{3} \times \frac{22}{7} \times 25.2 \times 5.2 \times 36 = 23950.08$ $= 23950.08 - 13860 = 10090.08 \text{cm}^3$ (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 $\Pi = 3.142$ 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	

MATHEMATICS

K.C.S.E PAPER 121/ 1 2009

MARKING SCHEME

2009 MARKING SCHEME

PAPER 1

1. $\frac{\sqrt{5184}}{6X-18\div9+(5-3)}$

$=\frac{\sqrt{2^6X3^4}}{6X-18\div9+8}$

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

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

$=-18$

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

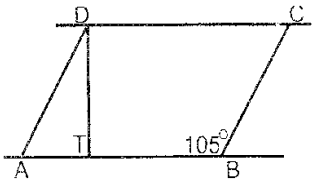
7.5x = 180

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°

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

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

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. $\sin (3x + 30) = \sin 60°$

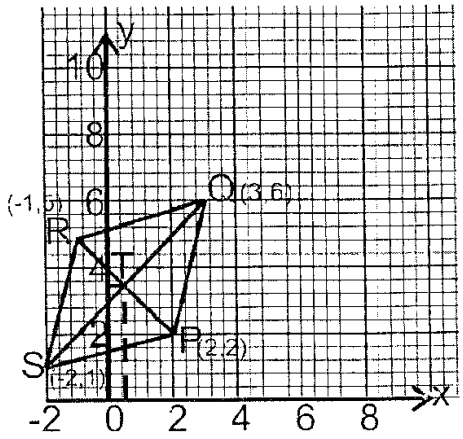
$\sin (3x + 30) = \sin 120°$

$3x + 30 = 60°$

$3x + 30 = 120°$

$\therefore x = 10°, \quad x = 30°$

14.



(a)Rhombus PQRS drawn

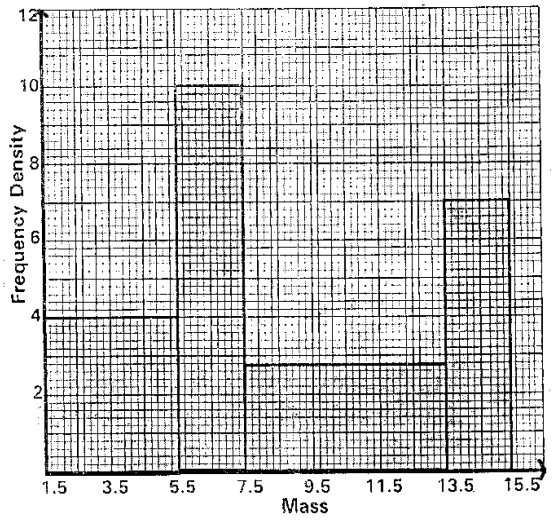
(b) Coordinates of T(0.5, 3.5)

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°

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

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

$B = 47.95$

(c) Let <CAD be $\propto°$

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

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

$\therefore \propto = 23.48°$

(d) Area Δ ACD

$= ½ \times 7 \times 6 \sin 23.48°$

$= 8.37cm^2$

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 + $\frac{-33}{70}$

=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) ON= ½ $\begin{pmatrix} -8 \\ 5 \end{pmatrix} = \begin{pmatrix} 4 \\ -2\frac{1}{2} \end{pmatrix}$

N is(-4, 2 ½)

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

M is (2, 0)

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

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

=6.5

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

$\therefore$NM= ½ OB

(c) 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^{2}x4.5)

= 490.152

(b) (i) Volume of sphere

$\frac{r}{14.5} = \frac{2}{4.5} = \frac{6}{13.5} \Rightarrow$ r=6.444

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

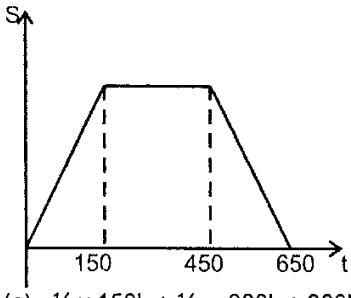
= 121.6

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

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

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

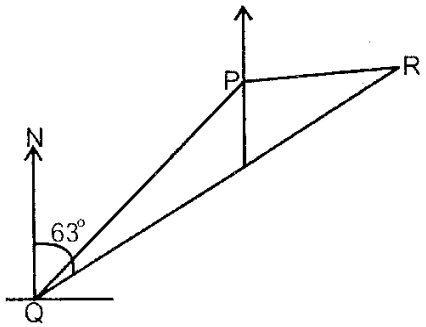
½ x22(150+t+t)= ½ x10450

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

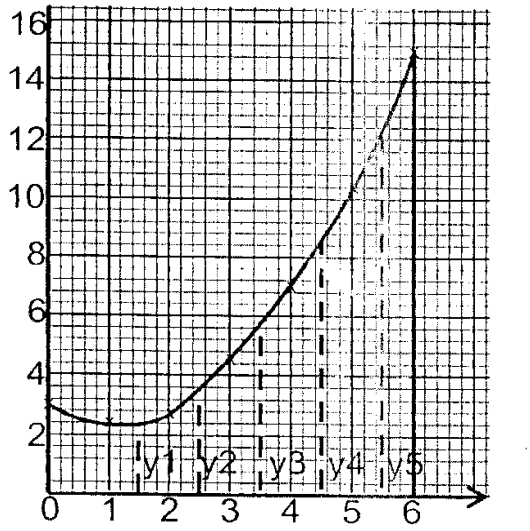
(b) (i) distance conversion
8.5x40=340
(ii)North line at Q
Bearing 063° stated

(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 = ½ x 1.5^2 - 1.5 +3 = 2.625
y2 = ½ x2.5^2-2.5+3 = 3.625
y3 = ½ 3.5^2 – 3.5+3 = 5.625
y4 = ½ x4.5^2 – 4.5 +3 = 8.625
y5 = ½ x5.5^2-5.5+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%

MATHEMATICS

K.C.S.E PAPER 121/ 1 2010

QUESTIONS

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

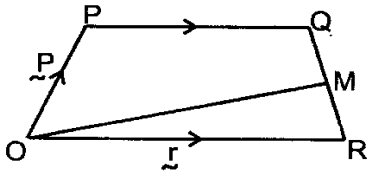
   The numbers are 73, 75, 77

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

   = sh.7,724,000

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

   = shs. 63172

7. 

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

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

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

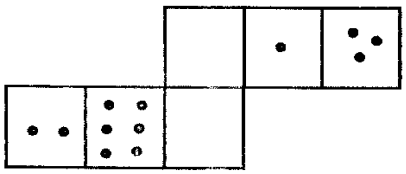
   $= \frac{2}{3}\underset{\sim}{r}+\frac{1}{2}\underset{\sim}{p}$

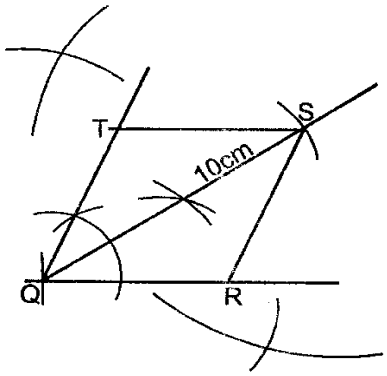
8. $27^{\frac{2}{3}}\times\left(\frac{81}{16}\right)^{-\frac{1}{4}} = (3^3)^{\frac{2}{3}}\times\left(\frac{3^4}{2^4}\right)^{-\frac{1}{4}}$

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

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

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

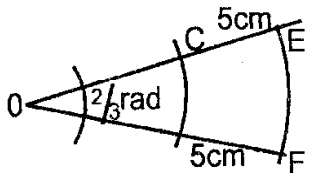
$= \frac{(x-4y)(x+1)}{(x+1)(-y)(x-4y)}$

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

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 $\begin{vmatrix} 45 & 42 \\ 1 & 3 \end{vmatrix}$ = 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)
$\frac{1}{3}\begin{bmatrix} 9 & -6 \\ -7 & 5 \end{bmatrix}\begin{bmatrix} 5 & 6 \\ 6 & 9 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 & -2 \\ -7 & 5 \\ \hline 3 & 3 \end{bmatrix}\begin{bmatrix} 2440 \\ 3560 \end{bmatrix}$

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

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

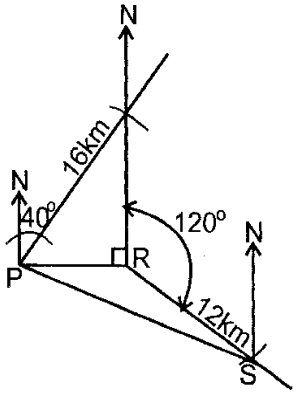
$\therefore x=200 \;;\; y=240$

(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 $=$ ½ × 10.2 × 12.2
$=62.22$km^2

Area of Δ PRS $=$ ½ ×10.2×12 sin 150°
$=30.6$km^2
Area of ranch PQRS
$=62.22+30.6$
$=92.82$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 ⟶ S
C ⟶ A

(ii) R ⟶ Q
C ⟶ 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 = $108x - \frac{1}{4}x^3$

$= (108 \times 2) - \frac{1}{4} \times 12^3$

$= 864cm^3$

MATHEMATICS

K.C.S.E PAPER 121/ 1 2011

MARKING SCHEME

1.	$\frac{2\frac{1}{5}+\frac{2}{3}\times\frac{15}{4}-4\frac{1}{6}}{1\frac{1}{4}-\frac{12}{5}\times\frac{3}{4}+3\frac{3}{4}} = \frac{\frac{8}{15}}{3\frac{1}{3}}$ $\frac{8}{15}\times\frac{5}{16} = \frac{1}{6}$	M1 M1 A1 3	Numerator for operation denominator
2	$\sqrt{11.25^2-6.75^2} = 9$ Perimeter $= 2(9+6.75)$ $= 31.5$	B1 B1 2	
3.	Let d be distance covered $\frac{3d}{5}-\frac{d}{2} = \frac{d}{10}$ % change $= \frac{\frac{d}{10}}{\frac{d}{2}}\times 100\%$ $= \frac{d}{10}\times\frac{2}{d}\times 100$ $= 20\%$	M1 M1 A1 3	If -20%
	Time ratio $= 1\frac{2}{3} : 2 = 5:6$ Speed ratio $= 6:5$ % change $= \frac{1}{5}\times 100\%$ $= 20\%$		

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	$\sin(x+60^\circ) = \cos 2x$ $x + 60 + 2x = 90^\circ$ $3x = 30$ $x = 10^\circ$ $\tan(x+60)^\circ = \tan 70^\circ$ $= 2.7448$ from tables $= 2.7475$	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 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 $2x^2y^2 - 5xy - 12$

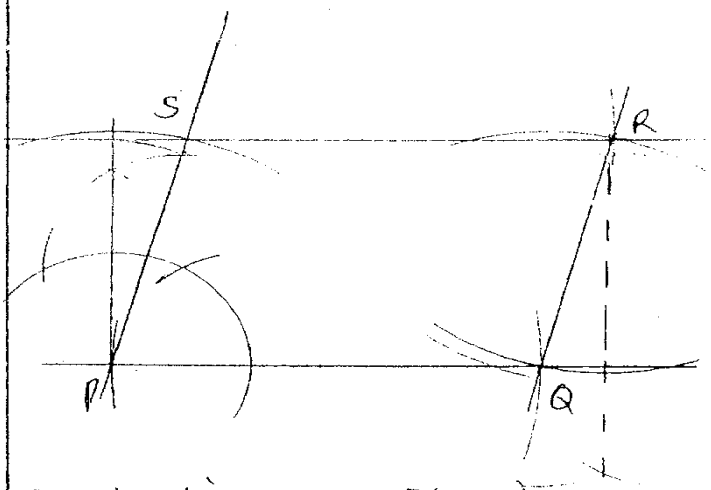
$= 2x^2y^2 - 8xy + 3xy - 12$ M1

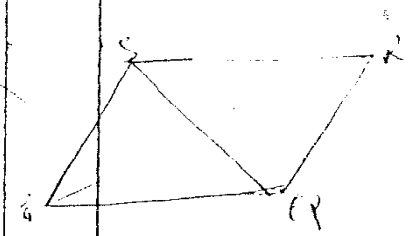
$= 2xy(xy-4) + 3(xy-4)$

$= (2xy+3)(xy-4)$ 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 $\frac{5880}{98} \times 100$

$= 6000$

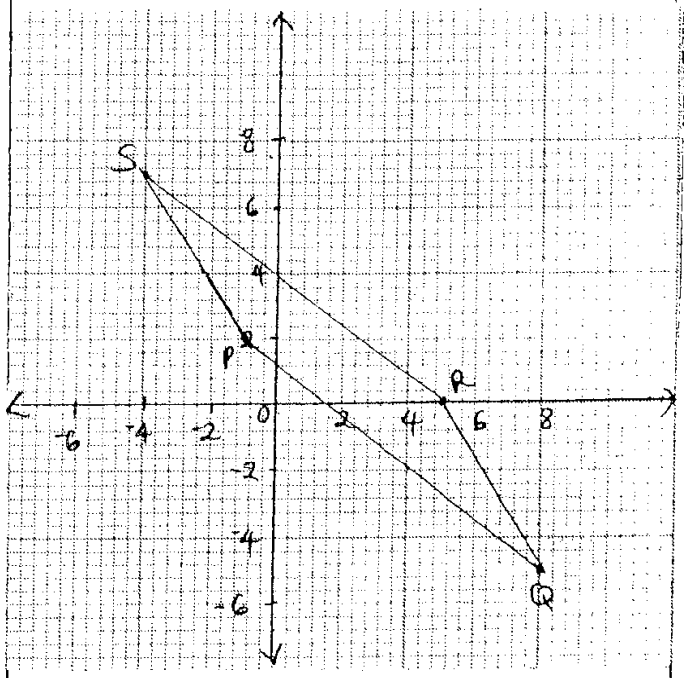
$\frac{120}{100} y = 6,000$ → M1

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

$= 16.97 \quad = 12\sqrt{2}$ A0 A1

3

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

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

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

$5x + 6y = 444600$

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

$5x + 6y = 444600$

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

$4x = 180\,000$

$x = 45000$

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 $P = 2 \times 3^2 \times 7^2$

$= 882$

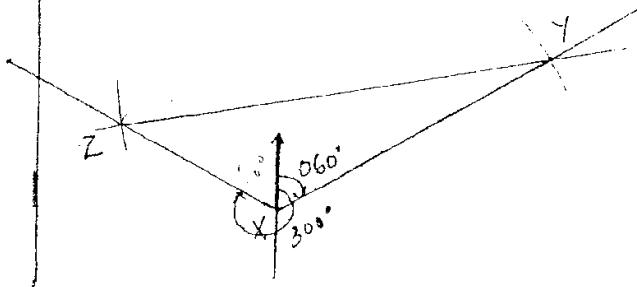
B1

M1

A1

3

15



distance XZ

$= 3 \times 10 = 30$km

3cm ± 1mm

✓ Position of X determined and 060° at X

B1 ✓ Line drawn from angle X

B1 ✓ Correct position of Z determined

B1 Completion of △

B1 ⇒ may be 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

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

$r^2 = \frac{3 \times 160}{11 \, h}$

$r = 4.370$

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

$R = 13.11$ (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

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

$= 414.69$

(ii) height of cone:

$= \sqrt{100 - 36} = 8$ (seen)

∴ volume of solid

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

$= 753.98 \text{ cm}^3$

b) mass of solid in kg

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

$= 0.98$ kg (condone).

0.9802 kg to 4 s.f.

follow Th

M1 two appropriate sections

M1 addition

A1

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

S A = 414.3

If 3.142 us.d

S.A = 414.

B1

M1 correct expressions

M1 addition

A1

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

Volume = 754.

If 3.142 used

Volume 754.6

M1 mass expression in g

M1 → conversion to kg

A1

$\frac{22}{7}$ used ⇒ 0.980

3.142 used ⇒ 0.980

10

Time taken by bus = t

" " " train = $11-t$

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

$t = 6$

Distance by bus = 75×6 M1

$= 450\text{km}$ 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

∴ time by train $= \frac{700-b}{50}$

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

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

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

$2100 - b = 11 \times 150$ Removal of denominators

$b = 2100 - 1650$

$= 450$ A1

(ii) time taken by train

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

$= 5h$

total time before departure of bus

$= 5h + 30$ mins

∴ Departure time for bus:

$8.00 - 5h\ 30$ mins

$= 1.30$ pm. M1

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

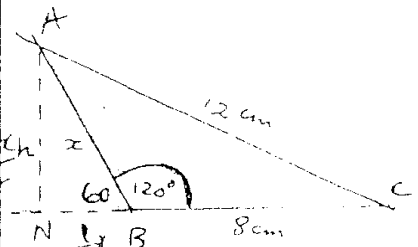
a) $12^2 = x^2 + 8^2 - 2 \times 8 \times x \cos 120^\circ$ M1

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

$= 20.0 m^2$ A1 accept 20 or 20.1

(iii) size of $\angle ACB$

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

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

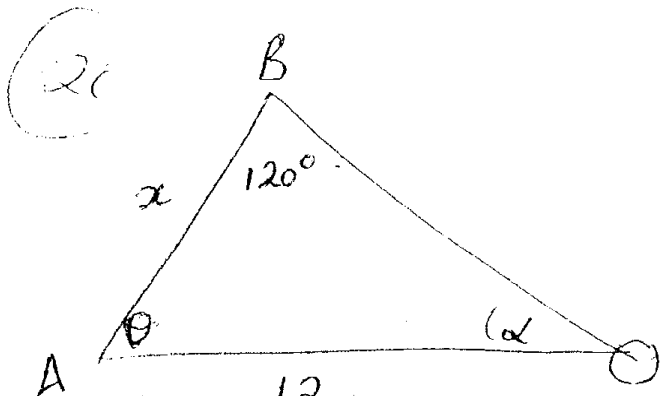
$\angle C = 24.7^\circ$ A1

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

21. a) ordinates

$x = 0 \quad y_1 = 1$

$x = 1 \quad y_2 = 6$

$x = 2 \quad y_3 = 9$

$x = 3 \quad y_4 = 10$

$x = 4 \quad y_5 = 9$

$x = 5 \quad y_6 = 6$

$x = 6 \quad y_7 = 1$

B3 all values ✓ allow B2 for 5 ✓ and B1 for 3 ✓

$\text{Area} = \frac{1}{2} \times 1 \times \{1+1+2(6+9+10+9+6)\}$ 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	$(6t-4)(t-1)=0$ (1m)
	$t = \frac{2}{3}$ or $t = 1$	A1	
	c) $t = \frac{2}{3}$; $s = 2\left(\frac{2}{3}\right)^3 - 5\left(\frac{2}{3}\right)^2 + 4\left(\frac{2}{3}\right) + 2$		
	$= 3.037 m$	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 for $\underset{\sim}{AC}$
A1

(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 eqn in one unknown

$3k = 1$

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

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

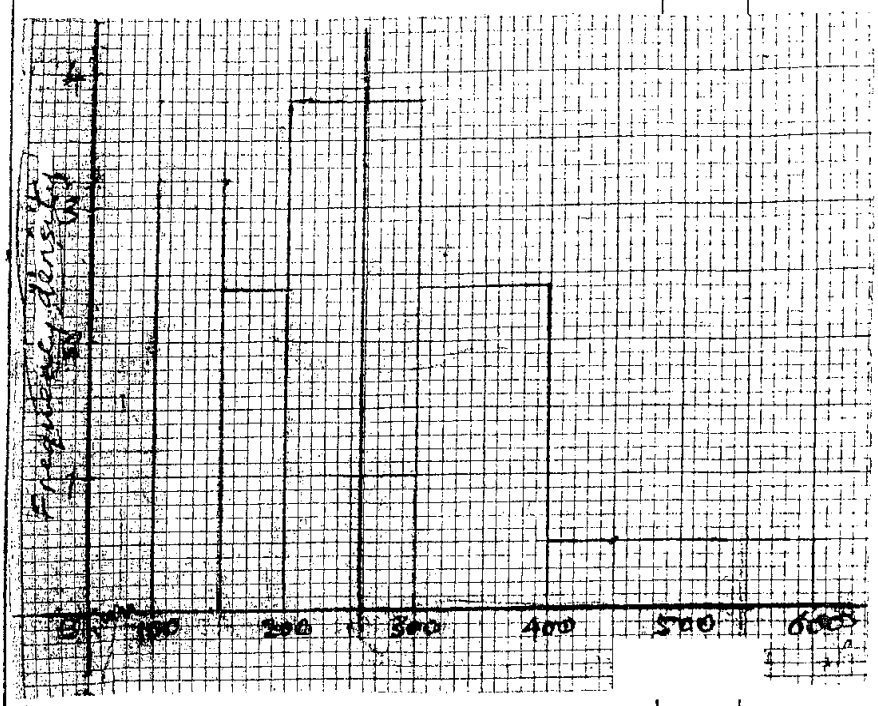
$= \frac{2}{3}$ B1

10

c) (i) $\underset{\sim}{AX} = \underset{\sim}{AD} + \underset{\sim}{DX} = h\underset{\sim}{a} + (h-1)\underset{\sim}{d}$ M1A1

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

24.



B1 for

a)

b) (i) median class: 200 – 300

(ii) median line:

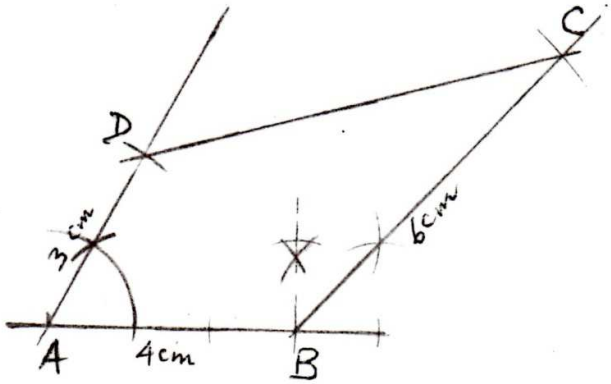
c) $900 + 50 \times 0.5$

$= 925$

B1	vertical scale
B1	horizontal scale
B	all bars drawn
B1	Allow B1 for any 3
B1	vertical line drawn
M1	for 25 or 75
M1	
A1	
10	

MATHEMATICS
K.C.S.E PAPER 121/ 1 2012
QUESTIONS

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

6.	LCM of 9, 15 and 21 $3^2 \times 5 \times 7 = 315$ minutes Last time of ringing together 11:00 5:15 5:45 p.m.	 B1 M1 A1 3	 For 315 minutes For subtraction
7.	$\frac{x}{8} = \frac{x}{20} + \frac{1}{4}$ $\frac{x}{8} - \frac{x}{20} = \frac{1}{4}$ $\Rightarrow \frac{3x}{40} = \frac{1}{4}$ $x = 3\frac{1}{3}$ Distance to shopping centre $12 - 3\frac{1}{3} = 8\frac{2}{3}$ km	M1 A1 B1 3	
8.	 Construction of 135^0 angle between lines AB = 4 cm and BC = 6 cm Construction of 60^0 angle between lines AB = 4 cm and AD = 3 cm Completion of quadrilateral ABCD $\angle BCD = 31^\circ \pm 1^\circ$	 B1 B1 B1 B1 4	

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

13.	$2y = 4x + 5 \Rightarrow y = 2x + \frac{5}{2}$ gradient, M_1 of line = 2 gradient, M_2, of perpendicular is given by $2M_2 = -1 \Longrightarrow M_2 = -\frac{1}{2}$ equation of line L $\frac{y-1}{x-3} = -\frac{1}{2}$ $y = -\frac{1}{2}x + \frac{5}{2}$	B1 M1 A1 3	
14. (a)	195250 Chinese Yuan into Kenya Shillings $= 195250 \times 12.34 = 2409385$	B1	
(b)	Balance: $= 2409385 - 1258000$ $= 1151385$ Balance in S.A. Rand $= \frac{1151385}{11.37}$ $= 101265$	M1 M1 A1 4	

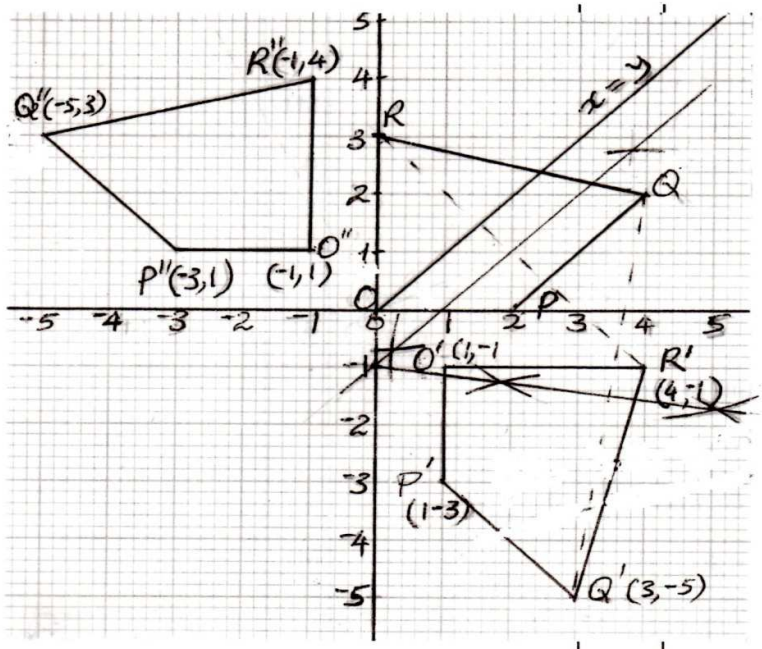
15.	Volume of solid $= \frac{1}{3} \times \frac{22}{7} \times 10.5^2 \times 15 - \frac{22}{7} \times 3.5^2 \times 8$ $= 1732.5 - 308$ $= 1424.5\ cm^3$	M1 M1 A1 3	
16.	$4(A-2) = B+2$ $2(A+10) = B+10$ $4A - B = 10 \ldots (i)$ $\mp 2A \pm B = \pm 10 \ldots (ii)$ $2A = 20$ $\Longrightarrow A = 10$ Substitute A = 10 in (i) $4 \times 10 - B = 10$ $\Longrightarrow B = 30$	M1 M1 A1 3	for both values of A and B
17. (a) (b)	modal class 40 - 44 (i) mid points: 22, 27, 32, 37, 42, 47, 52, 57 $\frac{22 \times 2 + 27 \times 15 + 32 \times 18 + 37 \times 25 + 42 \times 30 + 47 \times 6 + 52 \times 3 + 57 \times 2}{101}$ $= 37.25$	B1 B1 M1 M1 A1	fx for $\frac{\Sigma fx}{\Sigma f}$

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

19. (a)	*Ratio*: *copper*: *zinc*: *tin* copper zinc tin 3 $\frac{2}{3}$ 5 9 6 10 Copper : zinc : tin = 9 : 6 : 10	M1 A1	
(b) (i)	mass of tin $= 250 \times \frac{10}{25}$ $= 100kg$	M1 A1	
(ii)	mass of zinc and tin in alloy B: mass of copper $= \frac{70}{100} \times 90$ $= 63$ ∴ mass of zinc and tin: $= 250 - 63$ $= 187$	M1 M1 A1	
(c)	amount of tin in alloy A than B: mass of tin in alloy B $= \frac{8}{11} \times 187$ $= 136$ difference: $136 - 100$ $= 36$	M1 M1 A1	
		10	

20. (a)	$\frac{1}{x-2} - \frac{2}{x+5} = \frac{3}{x+1}$		
	$\frac{x+5-2(x-2)}{(x-2)(x+5)} = \frac{3}{x+1}$		
	$\frac{-x+9}{x^2+3x-10} = \frac{3}{x+1}$	M1	
	$4x^2 + x - 39 = 0$	A1	
	$(4x+13)(x-3) = 0$	M1	
	$x = 3 \text{ or } x = -3\frac{1}{4}$	A1	
(b)	mean for second set of tests $= \frac{147}{y+2}$	B1	
	$\frac{120}{y} - \frac{147}{y+2} = 3$	M1	
	$\frac{120y + 240 - 147y}{y(y+2)} = 3$		
	$-27y + 240 = 3y^2 + 6y$	M1	elimination of denominator
	$-9y + 80 = y^2 + 2y$		
	$y^2 + 11y - 80 = 0$	A1	
	$(y-5)(y+16) = 0$	M1	factorization
	$y = 5 \text{ or } -16$		
	No. of tests: $5 + 2 = 7$	A1	
		10	

21.



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

22. (a) (i) x - intercepts

when y= 0

$x^2(2x + 3) = 0$ M1

$x = 0$ *and* $x = -\frac{3}{2}$ A1

(ii) y - intercept

when x = 0, y = 0 B1

(b) (i) stationary points of curve

$\frac{dy}{dx} = 6x^2 + 6x$

stationery points when $\frac{dy}{dx} = 0$

i.e. $6x^2 + 6x = 0$ M1

$6x(x + 1) = 0$

$x = 0$ *or* $x = -1$ A1

$\therefore$ stationary points are:

$(0,0)$ and $(-1,1)$ B1

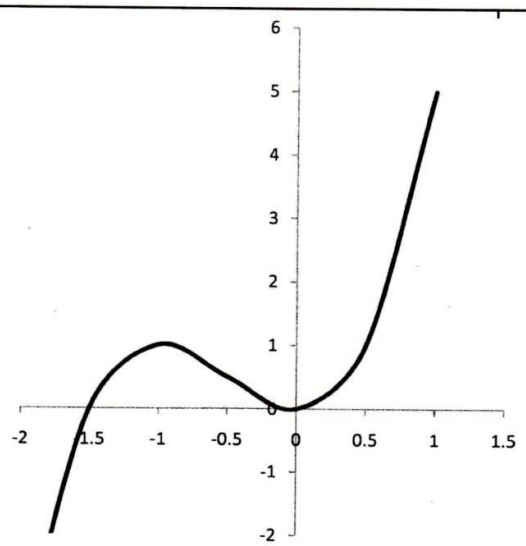
(ii)

x	-2	$-1\frac{1}{2}$	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1
$\frac{dy}{dx}$	12	$4\frac{1}{2}$	0	$-1\frac{1}{2}$	0	$4\frac{1}{2}$	12

B1 checking points

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

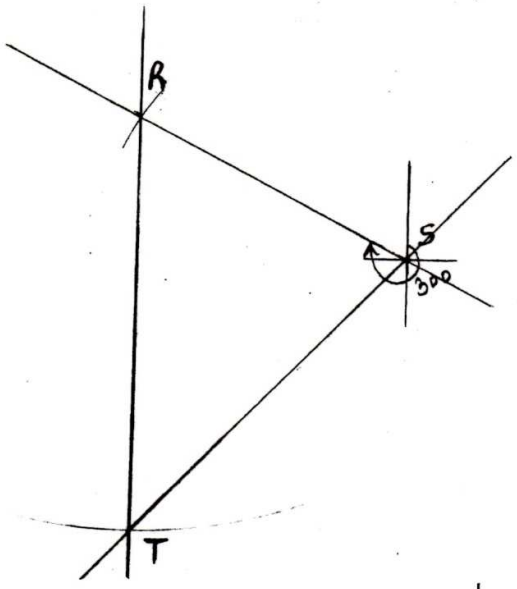
(c)



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

smooth curve B1

10

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

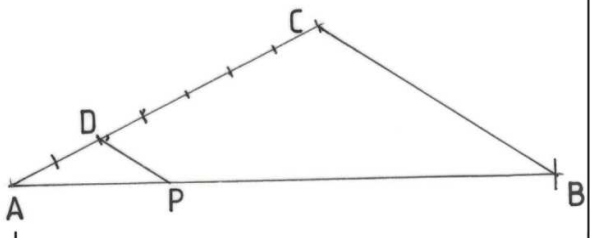
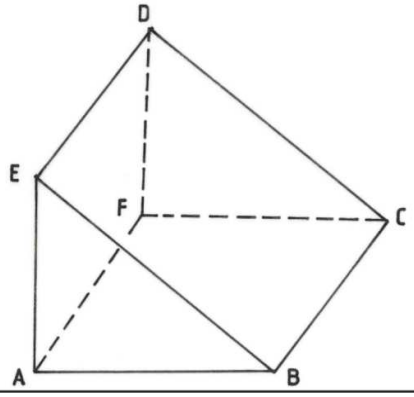
24. (a)	length of RT:		
	$= \frac{3}{5} \times 10$	M1	
	$= 6$ cm	A1	
(b) (i)	Perpendicular distance between PQ & RS		
	$= 10 \sin 40$	M1	
	$= 6.4$ cm	A1	
(ii)	$\frac{TS}{\sin 40} = \frac{6}{\sin 60}$		
	$TS = \frac{6 \times \sin 40}{\sin 60}$	M1	
	$= 4.5$ cm	A1	
(c)	length RS using cosine rule		
	$RS^2 = 6^2 + 4.5^2 - 2 \times 4.5 \times 6Cos\, 80$	M1	
	$= 46.87299841$		
	RS = 6.8	A1	
(d)	area of ΔRST		
	$= \frac{1}{2} \times 6 \times 4.5 \sin 80$	M1	
	=13.3	A1	
		10	

MATHEMATICS

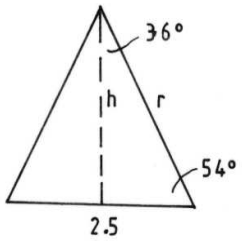
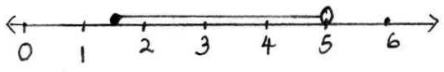
K.C.S.E PAPER 121/ 1 2013

MARKING SCHEME

1.	$\frac{36}{-12} - \frac{-108}{-27}$ $= -3 - 4$ $= -7$	 M1 A1 2	
2.	(a) Mode $= 22$ (b) Median 15, 15, 16, 19, 19, 20, 20, 21, 22, 22, 22, 26, 27, 28 median $= \frac{20 + 21}{2}$ $= 20.5$	 B1 M1 A1 3	
3.	<table><tr><th>No.</th><th>Log</th></tr><tr><td>1.794 0.038 1.243</td><td>0.2538 $\bar{2}.5798$ $\bar{2}.8336$ 0.0945</td></tr><tr><td>0.3799</td><td>$\bar{2}.7391 \div 3$ $\bar{1}.5797$</td></tr></table>	 M1 M1 M1 A1 4	 all log √ + and - operations √ ÷3 √
4.	$\frac{(4m + 3n)(4m - 3n)}{(4m + 3n)(m - n)}$ $= \frac{4m - 3n}{m - n}$	M1 M1 A1 3	factorizing numerator √ factorizing denominator √
5.	Retailer 130% ⟶ 1560 100% ⟶ $\frac{1560 \times 100}{130}$ $= 1200$ Wholesaler 120% ⟶ 1200 100% ⟶ $\frac{1200 \times 100}{120}$ $= 1000$	 M1 M1 A1 3	

6.		B1 B1 B1 3	construction of equal parts on AC draw DP//CB such that AP= $\frac{2}{7}$ AB locating point P
7.	From 0700 h Monday to 1900 h Wednesday $= 24 \times 2 + 12$ h $= 60$ h Time lost $= 60 \times 15 = 900$ sec $= 15$ min Time shown on clock: 1900 h − 15 min = 1845 h	M1 M1 A1 3	
8.	$x + 20 = 230°$ or $x + 20 = 310°$ $x = 210°$ or $x = 290°$	B1 B1 B1 3	for 230° or 310°
9.	(a) 2357_ 941 1416 (b) $1416 = 2^3 \times 3 \times 59$	B1 B1 B1 3	for 2357 and 941 √ for 1416
10.		B1 B1 B1 3	lines AF, ED equal and parallel to BC lines AB, FC equal and parrallel or lines AE and FD equal and parallel or lines CD, EB equal and parallel. completing the solid showing dotted lines.

11.	$2x + \frac{1}{2}x + x + 40 + 110 + 135 + 160 + 2x + 10 + 185$ $= 1080$ $\frac{11}{2}x = 440 \Rightarrow x = 440 \times \frac{2}{11} = 80°$	M1 A1 2	
12.	(a) Gradient of line: $\frac{3-1}{6-{}^{-}2} = \frac{1}{4}$ $\therefore$ line equation: $\frac{y-3}{x-6} = \frac{1}{4}$ $y - 3 = \frac{1}{4}(x-6)$ $y = \frac{1}{4}x + 1\frac{1}{2}$ (b) Gradient of perpendicular line $\frac{1}{4}m' = -1$ $m' = -4$	M1 A1 B1 3	
13.	(a) $5^2 = 7^2 + 6^2 - 2 \times 6 \times 7 \cos C$ $\cos C = \frac{49 + 36 - 25}{84}$ $C = 44.42°$ (b) $h = 7 \sin 44.42$ $= 4.9$ cm	M1 A1 M1 A1 4	
14.	Volume of pipe material $\frac{22}{7}(1.75^2 - 1.05^2) \times 250$ cm $= 1540$ cm^3 $\therefore$ mass of pipe $= \frac{1540 \times 1.25}{1000}$ $= 1.925$ kg	M1 M1 M1 A1 4	

15.	$h = 2.5 \tan 54^\circ = 3.441\,\text{cm}$ Area of pentagonal faces $= 2\left(\frac{1}{2} \times 5 \times 3.441 \times 5\right)$ $= 86.025$ Total area $= 86.025 + 5(12 \times 5)$ $= 386.0$	B1 M1 M1 A1 4	
16.	(a) $x - 5 \leq 3x - 8$ $-2x \leq -3$ $x \geq 1.5$ $3x - 8 < 2x - 3$ $x < 5$ $\therefore 1.5 \leq x < 5$ (b) 	 B1 B1 B1 3	

17.	(a) Mass after decrease		
	$112 \times \frac{15}{16}$	M1	or equivalent
	$= 105$ kg		
	Total decrease		
	$(112 - 105) \times 540$	M1	
	$= 3780$ kg	A1	
	(b) (i) No. of 90 kg bags		
	$\frac{105 \times 540}{90}$	M1	
	$= 630$		
	Least number of trips		
	$\frac{630}{120}$	M1	
	$= 5.25$ $\Longrightarrow 6$ trips	A1	
	(ii) Expenses		
	buying price $= 1500 \times 630$ $= 945000$	M1	
	transport $= 2500 \times 6$ $= 15000$		
	Total $945000 + 15000$	M1	
	Selling price per bag:		
	$= \frac{960000 \times 1.26}{630}$	M1	
	$= 1920$	A1	
		10	

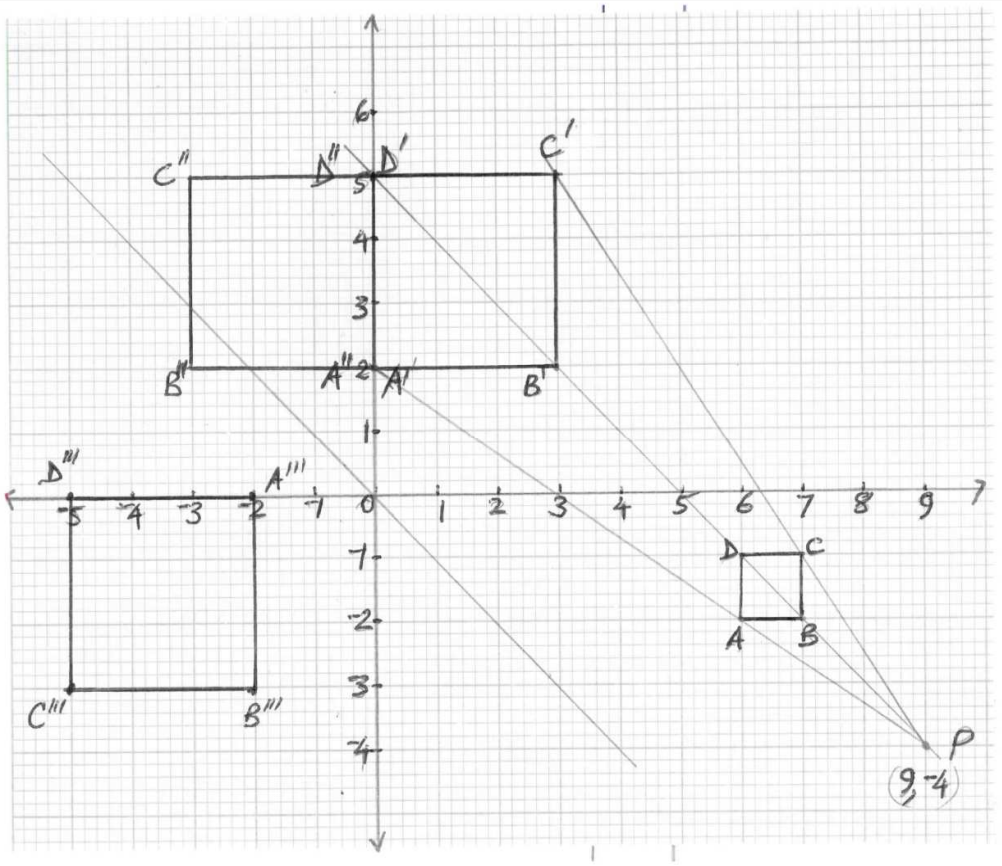
18.	(a) $(x+3)(x-2)=24$ $x^2+x-30=0$ $(x+6)(x-5)=0$ $x=-6 \text{ or } x=5$ (b) (i) $(x+9)x=136$ $x^2+9x-136=0$ $(x+17)(x-9)=0$ $x=-17 \text{ or } x=8$ $\because x=8$ perimeter $=2(8+17)=50$ m (ii) $2x \times x=136-64$ $2x^2=72$ $x^2=36$ $x=6\,m$	M1 M1 M1 A1 M1 M1 A1 B1 M1 A1 10	
19.	(a) $2c+9g=98200$ $3c+4g=96000$ (b) Det. of $\begin{pmatrix}2&9\\3&4\end{pmatrix}=-19$ $M'=-\frac{1}{19}\begin{pmatrix}4&-9\\-3&2\end{pmatrix}$ $-\frac{1}{19}\begin{pmatrix}4&-9\\-3&2\end{pmatrix}\begin{pmatrix}2&9\\3&4\end{pmatrix}\begin{pmatrix}c\\g\end{pmatrix}=-\frac{1}{19}\begin{pmatrix}4&-9\\-3&2\end{pmatrix}\begin{pmatrix}98200\\96000\end{pmatrix}$ $-\frac{1}{19}\begin{pmatrix}-19&0\\0&-19\end{pmatrix}\begin{pmatrix}c\\g\end{pmatrix}=-\frac{1}{19}\begin{pmatrix}-471200\\-102600\end{pmatrix}$ $\begin{pmatrix}c\\g\end{pmatrix}=\begin{pmatrix}24800\\5400\end{pmatrix}$ cost of cow = sh 24800 cost of goat = sh 5400 (c) (i) selling price of cows $=2\times24800\times1.3$ selling price of goats $=9\times5400\times1.4$ Total selling price $=2\times24800\times1.3+9\times5400\times1.4$ $=132520$ (ii) % profit $=\frac{132520-98200}{98200}\times100\%$ $=34.95\%$	B1 B1 B1 M1 M1 A1 M1 A1 M1 A1 10	

20.	(a) (i) Time taken by Juma $= \frac{x}{40}h$	B1	
	Time taken by Mutuku $= \frac{80-x}{60}$	B1	
	Let x km be distance from A		
	$\therefore \frac{x}{40} - \frac{80-x}{60} = \frac{1}{2}$	M1	
	$\frac{3x-2(80-x)}{120} = \frac{1}{2}$		
	$2(5x-160) = 120$	M1	
	$10x = 440$		
	$x = 44\ km$	A1	
	(ii) Time they met		
	$10.00\text{ am} + \frac{44}{40}\text{h}$		
	$= 10.00 + 1\text{ h } 6\text{ min}$	M1	
	$= 11.06\text{ am}$	A1	
	(b) Speed if Kamau delayed by 21 minutes		
	Kamau's time $= \left(\frac{44}{40} - \frac{21}{60}\right)\text{h}$	M1	
	$= \frac{3}{4}\text{h}$		
	$\therefore$ speed needed: $\frac{44}{\frac{3}{4}}$	M1	
	$= 58\frac{2}{3}$ km/h	A1	
		10	

21.	(a) Displacement, s, when t = 2		
	$2^3 - 5\times 2^2 + 3\times 2 + 10$	M1	
	$= 4$	A1	
	(b) (i) velocity when t = 5 seconds		
	$V = \frac{ds}{dt} = 3t^2 - 10t + 3$	B1	
	when t = 5, $V = 3\times 5^2 - 10\times 5 + 3$	M1	
	$= 28$	A1	
	(ii) $3t^2 - 10t + 3 = 0$	M1	
	$(3t-1)(t-3) = 0$	M1	
	$t = \frac{1}{3}, \quad t = 3$	A1	
	(c) time when velocity of particle is at its maximum		
	acceleration $= \frac{dv}{dt} = 6t - 10 = 0$	M1	
	$t = \frac{10}{6} = 1\frac{2}{3}\text{s}$	A1	
		10	

22.	(a) (i) $\underset{\sim}{OB} = \underset{\sim}{p} + \underset{\sim}{q}$	B1	
	(ii) $\underset{\sim}{AD} = -\underset{\sim}{p} + \frac{3}{5} \times 5\underset{\sim}{q}$	M1	
	$= -\underset{\sim}{p} + 3\underset{\sim}{q}$	A1	
	(iii) $\underset{\sim}{CB} = -5\underset{\sim}{q} + \underset{\sim}{p} + \underset{\sim}{q}$	M1	or equivalent
	$= -4\underset{\sim}{q} + \underset{\sim}{p}$	A1	
	(b) $\underset{\sim}{AX} = k(\underset{\sim}{AD})$		
	$= k(-\underset{\sim}{p} + 3\underset{\sim}{q})$	B1	
	$= -k\underset{\sim}{p} + 3k\underset{\sim}{q}$		
	also $\underset{\sim}{AX} = -\underset{\sim}{p} + r(\underset{\sim}{OB})$		
	$= -\underset{\sim}{p} + r(\underset{\sim}{p} + \underset{\sim}{q})$ $= \underset{\sim}{p}(r-1) + r\underset{\sim}{q}$	B1	
	$\underset{\sim}{p}(r-1) + r\underset{\sim}{q} = -k\underset{\sim}{p} + 3k\underset{\sim}{q}$	M1	
	$-k = r - 1$ *and* $r = 3k$ $-k = 3k - 1$ $-4k = -1 \Longrightarrow k = \frac{1}{4}$ *substitute* $r = 3 \times \frac{1}{4} = \frac{3}{4}$	M1 A1	
		10	

23.



(a) ABCD √ drawn	B1	
(b) (i) Centre identified and used √	B1	
	B1	AA', BB', CC' and DD' drawn √
	B1	completion of square A'B'C'D' and labelled
(ii) A"B"C"D"	B2	A"B"C"D" drawn √
(iii) A"'B"'C"'D"'	B2	A"'B"'C"'D"' drawn
(c) Reflection on line $y = -x$	B1	reflection
	B1	line $y = -x$
	10	

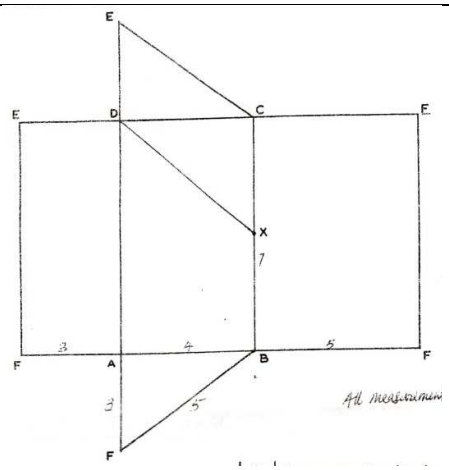
24.	(a) (i)		
	$\frac{r}{9} = \frac{4}{12}$	M1	
	$r = \frac{9 \times 4}{12} = 3\,cm$	A1	
	(ii) volume of material drilled out		
	$= \frac{1}{3}\pi \times 3^2 \times 4$	M1	
	$= 12\pi$	A1	
	(b) Slant height of cone		
	$= \sqrt{9^2 + 12^2} = 15\,\text{cm}$	B1	
	(c) Surface area of solid after conical has been drilled		
	$\pi \times 9 \times 15 + \pi \times (9^2 - 3^2) + \pi \times 3 \times 5$	M1	for $\pi \times 9 \times 15$
	$= \pi(135 + 72 + 15)$	M1 M1 M1	for $\pi(9^2 - 3^2)$ $\pi \times 3 \times 5$ summing up
	$= 222\pi$	A1	
		10	

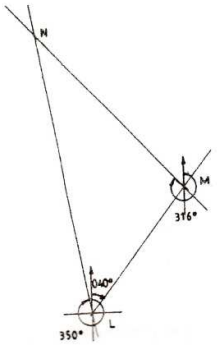
MATHEMATICS

K.C.S.E PAPER 121/ 1 2014

MARKING SCHME

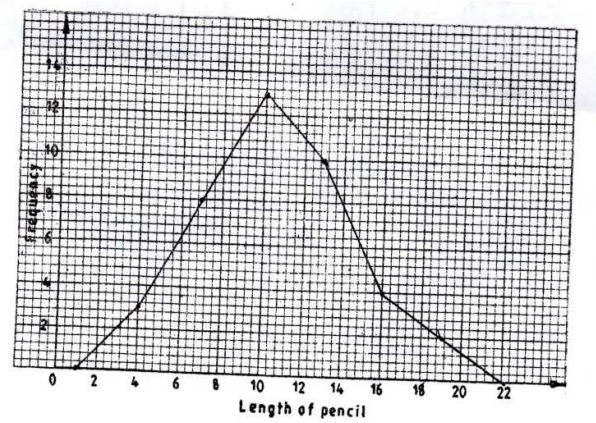
1.	Cows = 32 Sheep = 32 × 12 = 384 Goats = 384 + 1344 = 1728 Number of goats that remained $=\frac{1}{4}\times 1728$ = 432	M1 M1 M1 A1	Allow $1728 - \frac{3}{4}\times 1728$
2.	$\frac{\sqrt{1764}}{\sqrt[3]{2744}} = \frac{\sqrt{2^2\times 3^2\times 7^2}}{\sqrt[3]{2^3\times 7^3}}$ $=\frac{2\times 3\times 7}{2\times 7}$ = 3	M1 M1 A1	For prime factors of both
3.	Volume $= \frac{1}{3}\times\frac{22}{7}\times(14)^2\times 18$ $= 3696\ cm^3$ Density $= \frac{4.62\times 1000}{3696}$ $= 1.25\ g/cm^3$	M1 M1 A1	Allow 3694.51,3694.99 (Use $\pi = 3.142$) Allow 1.251,1.25 (Use $\pi = 3.142$)
4.		B1 B1 B1	Measurement and angles Complete net labelled Allow 5.315 (By calculation)

	 DX =5.3± 0.1		
5.	C.P for carpet $=\frac{36000 \times 100}{120}$ = 30000 % profit made during trade fair $= \frac{33600 - 30000}{30000} \times 100$ = 12%	M1	Look out for misreads $\frac{120}{100}x = 36000$ $x = 30000$
6.	$=\frac{243^{-\frac{2}{5}} \times 125^{\frac{2}{3}}}{9^{-\frac{3}{2}}}$ $= \frac{3^{-2} \times 5^2}{3^{-3}}$ $= \frac{27 \times 25}{9}$ = 75	M1 M1	Manipulation of all indices or equivalent Simplification (Removal of all indices, where powers are reversed)
7.	$= \frac{\theta}{2\pi} \times \pi \times 2.1 \times 2.1 = 2.31$ $=\theta = \frac{2.31 \times 2}{2.1 \times 2.1}$ = 1.05^c	M1 A1	Allow M1 where 3600 is used and A1 in converting degrees to radians
8.	$(x + 2y)^2 - (2y - 3)^2$		

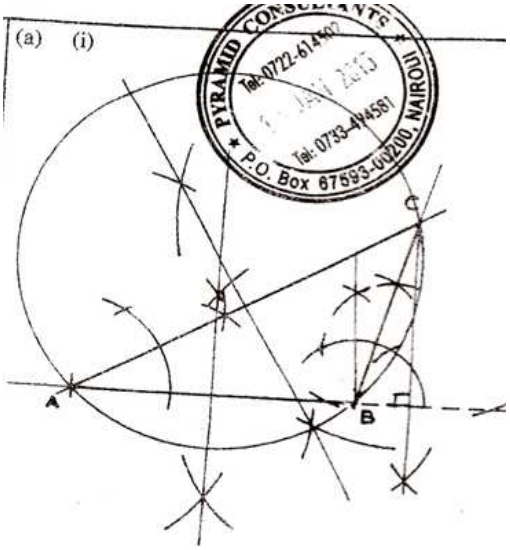
	$=(x^2+4xy+4y^2)-(4y^2-12y+9)$ (Expansion of both and a subtraction sign) $=x^2+4xy+12y-9$	M1 A1	Allow for difference of two squares.
9.	 Distance MN = 6.8 × 100 = 680 km	B1 B1 M1 A1	Location of M Location of N MN =6.8 ± 0.1 cm
10.	$=(2n-4)\times 90=1800$ $180n=2160$ $n=12$ Size of each exterior angle $=\frac{360}{12}=30^0$	M1 M1 A1	
11.	Let age of cow be x years $=x\left(x-4\frac{2}{3}\right)=8$ $=3x^2-14x-24=0$ $=(3x+4)(x-6)=0$ $x=6\ or-\frac{4}{3}$ Age of cow = 6 years Age of heifer = $1\frac{1}{3}$ (1 year 4 months)	M1 M1 A1 B1	
12.	$=4\leq 3x-2<9+x$ $=4\leq 3x-2\ 3x-2<9+x$ $=6\leq 3x2x<11$	M1	For separation of both

	$= x \geq 2x < 5\frac{1}{2}$ $= 2 \leq x < 5\frac{1}{2}$ Integral values: 2,3,4,5	A1 B1	
13.	Volume of water in container $= \frac{80}{100} \times 90(40 \times 25 - \pi \times 7.5^2)$ $= 59276.54975$ $= \frac{59276.54975}{1000}$ $= 59.3$	M1 M1 M1 A1	For $\frac{80}{100} \times 90$
14.	Angle for major arc $=360 - 105$ $= 255^0$ Length of arc $= \frac{255}{360} \times 2 \times 8.4 \times \frac{22}{7}$ $= 37.4$cm	B1 M1 A1	Accept $2\pi r - \frac{105}{360} \times 2\pi r$ Or 52.8 -15.4
15.	Amount of work $= 25 \times 16 \times 9$ Machines required $= \frac{25 \times 16 \times 9}{12 \times 10}$ $= 30$	M1 M1 A1	$\div by\ 12 \times 10$
16.	$=\|AB\| = \sqrt{(-3+2)^2 + (7-2)^2} = \sqrt{26}$ $=\|A'B'\| = \sqrt{(4)^2 + (-20)^2} = \sqrt{416}$ Scale Factor $= \frac{\|A'B'\|}{\|AB\|} = \frac{\sqrt{416}}{\sqrt{26}}$ $= 4$	M1 M1 A1	For $\|AB\|$ and $\|A'B'\|$
17.	(a) Equation of L Gradient $= \frac{6-3}{-1--2}$		

	=3 Equation = $\frac{y-6}{x+1} = 3$ $=y - 3x = 9$ (b)Equation of P $= \frac{y-6}{x+1} = -\frac{1}{3}$ = 3y + x =17 (c)Equation of Q $= \frac{y-2}{x-1} = 3$ $= y = 3x - 1$ x intercept When $y = 0 \Rightarrow\ x = +\frac{1}{3}$ y intercept When $x = 0 \Rightarrow\ y = -1$ (d) Intersection of lines P and Q $3y + x = 17 \ldots\ldots (i)$ $y - 3x = -1 \ldots\ldots (ii)$	A1 M1 A1 B1 B1 B1 M1	Accept other forms e.g $y = 3x + 1$ $y - 3x - 9 = 0$ Accept $x + 3y = 17$ Do not accept coordinates For elimination of one unknown
	$3y + x = 17$ $3y - 9x = -3$ $10x = 20 \Rightarrow x = 2$ Subset $3y + 2 = 17 \Rightarrow y = 5$ $\therefore point\ of\ intersection\ (2,5)$	A1	For both$x = 2\ and\ y = 5$
18.	(a) Class: 3-5 | 6-8 | 9-11 | 12-14 | 15-17 | 18-20 Freq: 3 | 8 | 13 | 10 | 4 | 2 (b) (i) Mean length = $\frac{\Sigma fx}{\Sigma f}$	B1 B1 B1	Accept use of frequency e.g 1,2.7,4.3,3.3,1.3 For all mid points i.e 4,7,10,13,16

	$= \frac{4\times3+7\times8+10\times13+13\times10+16\times4+19\times2}{40}$ $= 10.75$ (ii) $= \frac{23}{40} \times 100$ $= 57.5\%$ (c)  	M1 A1 B1 B1 S1 P1 C1	and 19 For 23 Linear/accommodating all values Vertical scale may be given in frequency density The first and last pair should be (1,0) and (22,0) respectively
19.	(a) 15m/s (b) Maximum speed $\frac{1}{2}(15+h)\times10+\frac{1}{2}(10+30)h = 825$ $75+5h+20h = 825$ $25h = 750$ $h = 30m/s$ (c) (i) $= \frac{30-15}{10}$ $= 1.5\text{m/s}^2$ (ii) $= \frac{0-30}{20} = -1.5\text{m/s}^2$ (d) $\left[\frac{1}{5}(15+30)\times10+10\times30\right]\div20$ $= (225+300)\div20$ $=26.25$ m/s	B1 M1 M1 A1 M1 A1 B1 M1 M1 A1	 Removal of brackets Accept 1.5 m/s2 retardation or decelaration For distance covered in the first 20 secs For div by 20.

20.	(a) Base area $= \frac{1}{2} \times 15 \times 15sin72 \times 5$ = 534.97 (b) Length AV $= \sqrt{36^2 + 15^2} = 39$ (c) Area of triangular faces $= \frac{AB}{Sin\ 72} = \frac{15}{Sin\ 54}$ $= AB = \frac{15Sin72}{Sin54}$ = 17.63 Area = $\sqrt{\left\{\frac{1}{2}(39 + 39 + 17.63)(30.185)(8.815^2)\right\}}$ = 334.89 Total area = 334.89 × 5 + 534.97 = 2209.42 (d) Volume of pyramid $= \frac{1}{3} \times 534.97 \times 36$ $=6419.63cm^2 \approx 6420\ (4\ s.f)$	B1 M1 B1 M1 M1 M1 A1 M1 A1	72^0 seen or implied Accept AB = $15Sin36 \times 2$ $= 8.817 \times 2$ = 17.63 Applications of Heron's formula For process of getting area of S
21.	(a) 	x	-2	-1	0	1	2	3	4	5	6	7	8
---	---	---	---	---	---	---	---	---	---	---	---
y	16	10	6	4	4	6	10	16	24	34	46 | (b) Area using trapezium rule $=\frac{1}{2} \times 1[16 + 46 + 2(10 + 6 + 4 + 4 + 6 + 10 + 16 + 24 + 34)]$	B2 M1 M1	Y values. B1 for at least 6 correct Simplification

	$=\frac{1}{2}[62 + 2(114)]$ $= 145$ (c) Area using mid-ordinate rule $= 2 \times (10 + 4 + 6 + 16 + 34)$ $= 140$ (d) Area using integration method $\int_{-2}^{8} x^2 - 3x + 6 = \frac{x^3}{3} - \frac{3x^2}{2} + 6x \Big|_{-2}^{8}$ $= \left[\frac{512}{3} - \frac{192}{2} + 48\right] - \left[\frac{-8}{3} - \frac{3\,x\,4}{2} - 12\right]$ $= 122\frac{2}{3} + 20\frac{2}{3}$ $= 143\frac{2}{3}$	A1 M1 A1 M1 M1 A1	Integration Accept 143.3
22.	(a) (i)  	B1 B1 B1 B1 B1	Construction of 30^0 Construction of 105^0 Completion of ABC Bisectors Circle

	(ii) Radius = 3.5 ± 0.1 (iii) Height construction Height = 3.5 ± 0.1 (b) Area of circle outside triangle $=\pi \times 3.5^2 - \frac{1}{2} \times 3.4 \times 5$ = 30	B1 B1 B1 M1 A1	Height constructed Accept 29.98 (if π is used) 29.99 (if 3.142 is used)
23.	(a) $Tan\ \theta = \frac{70}{240}$ = 0.2917 $\theta = 16.26^0$ (b) AC = $\sqrt{70^2 + 240^2}$ = 250m $< ACD = 150^0 - (90^0 - 16.26^0)$ $= 76.26^0$ $AD^2 = 200^2 + 250^2 - 2 \times 200 \times 250cos76.26$ $AD = \sqrt{40000 + 62500 - 100000cos76.26^0}$ = 280.6 (c) Area of plot $= \frac{1}{2} \times 240 \times 70 + \frac{1}{2} \times 250 \times 200sin76.26^0$ = 8400 + 24284.59 = 32684.59 m^2 $= \frac{32684.59}{10000}$ = 3.27 ha	M1 A1 B1 M1 M1 A1 M1 M1 M1 A1	250 seen For Area 1 For Area 2

24.	(a) Value of y when $x = -1$ $y = -1$ -4 +3= -2	B1	
	(b) Stationary points $\frac{dy}{dx} = 3x^2 - 8x - 3$	M1	
	For stationary points		
	$3x^2 - 8x - 3 = 0$		For equivalent factors to zero
	$(3x + 1)(x - 3) = 0$	M1	
	$x = -\frac{1}{3}$ or $x = 3$	A1	
	When $x = -\frac{1}{3}, y = \frac{14}{27}$		
	When $x = 3, y = -18$		
	Stationary points $\left(-\frac{1}{3}, \frac{14}{27}\right)$ and $(3, -18)$	B1 B1	
	(c) Equation of normal to curve: Gradient of tangent at $x = 1$		
	$\frac{dy}{dx} = 3 - 8 - 3 = -8$	B1	
	Gradient of normal $= \frac{1}{8}$	B1	
	Equation of normal at $x = 1$		
	$\frac{y+6}{x-1} = \frac{1}{8}$	M1	
	$y+6 = \frac{1}{8}x - \frac{1}{8}$		
	$y = \frac{1}{8}x - 6\frac{1}{8}$	A1	Accept equivalent forms