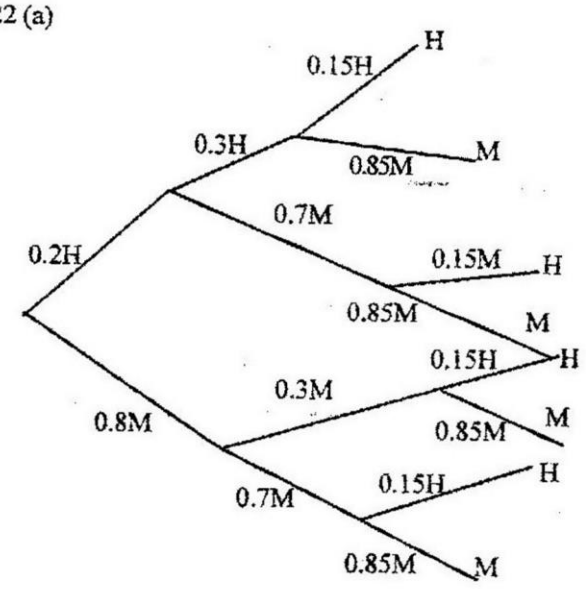
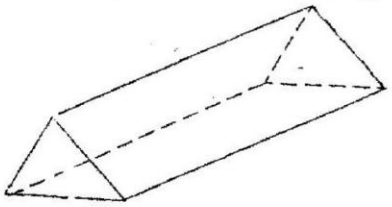
K.C.S.E 2001 MATHEMATICS PAPER 121/1 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE METHOD
20 a) i) $\angle CBD = 90° - 42° = 48°$ Subtended by diameter	B1 B1	
ii) $\angle BOD = 180° - 42° = 138°$ cyclic quadrilateral	B1 B1	
Reflex $BOD = 360° - 130° = 222°$	B1	
b) In ΔBAD $\angle BAD = \frac{1}{2} \times 138° = 69°$ $\angle ADB = 180° - 42° + \frac{1}{2} \times 138°)$ $= 180° - 111°$ $= 69°$	B1 B1 B1 8 marks	$\angle BPD = 138°$ $\angle AOB$ $= 360° - (138 + 84o)$ $= 360° - 222$ $= 138°$
21. (a) $\int(2x^2 - 5)\,dx = \frac{2}{3}x^3 - 5x + C$	M1	
$y = \frac{2}{3}x^3 - 5x + C$		
$3 - \frac{2}{3} \times 2^3\ 5x^2 + C$	M1	
$C = 7\frac{2}{3}$ or $\frac{23}{3}$	A1	
$y = \frac{2}{3}x^3 - 5x + 7\frac{2}{3}$	3 marks	

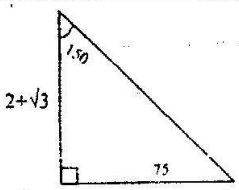
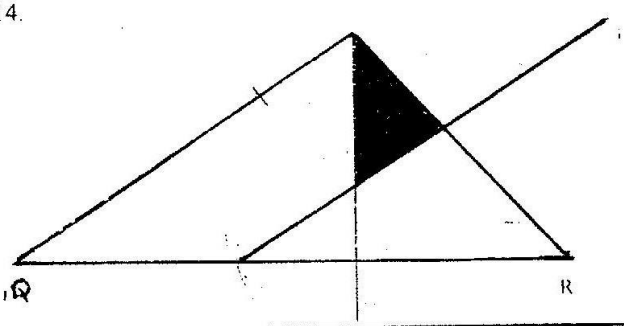
SOLUTION	MARKS	ALTERNATIVE METHOD
21. (b) $\int(2t^3 + t^2 - 1)\,dt = \frac{2}{4}t^4 + \frac{t^3}{3} - t + C$	M1	$\frac{2}{4}t^4 + \frac{1}{3}t^3 - t$
$\int(2t^3 + t^2 - 1)\,dt = \left[\frac{2}{4} \times 3^4 + \frac{3^3}{3} - 3\right] - \left[\frac{2}{4} + \frac{1}{3} - 1\right]$	M1	$\left[\frac{2}{4}t^4 + \frac{1}{3}t^3 - t\right]_1^3$
$= \left(\frac{81}{2} + 9 - 3\right) - \left(\frac{1}{2} + \frac{1}{3} - 1\right)$	M1	
$-46\ \frac{1}{2}\ \left(\frac{1}{6}\right)$		
$= 46\frac{2}{3}$	A1	
	8 marks	
22 (a) 		
b) (i) $0.2 \times 0.3 \times 0.15 = 0.009$	M1	
(ii) $0.2 \times 0.7 \times 0.85 = 0.119$ $0.8 \times 0.3 \times 0.85 = 0.204$ $0.8 \times 0.7 \times 0.15 = 0.084$ 0.407	A1	
(iii) HHM $0.2 \times 0.3 \times 0.85 = 0.051$ HMH $0.2 \times 0.7 \times 0.15 = 0.021$ MHH $0.8 \times 0.3 \times 0.15 = 0.036$ HHH $0.2 \times 0.3 \times 0.15 = 0.009$ 0.117	M1 A1 8 marks	1-(0.407 + 0.476) = 1-0883 = 0.117

K.C.S.E 2001 MATHEMATICS 121/2 MARKING SCHEME

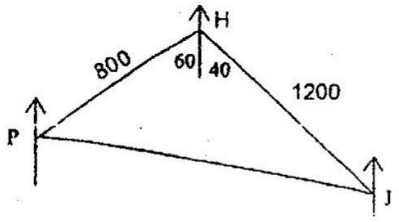
SECTION 1 (52 MARKS)

1.	$\frac{1}{3}\times\left(\frac{11}{4}-\frac{22}{4}\right)\times\frac{27}{7}\times\frac{4}{9}$ $\frac{1}{3}\times\frac{11}{4}\times\frac{27}{7}\times\frac{4}{9}$ $=-\frac{11}{7}$ or $-1\frac{4}{7}$	M1 A1 2 marks	All multiplication Simplified to lowest form
2.	$2^{5(x-3)}\times 2^{3(x+4)}=2^{6}\times 2^{x}$ $5(x-3)+3(x+4)=6+x$ $8x=8$ $x=1$	M1 M1 A1 3 marks	Mark for equating correct powers of 2 Mark for equating powers from above
3.	Mliwa: $\frac{3}{8}\times\frac{2}{3}x=\frac{1}{4}x$ Amina: $x-\left(\frac{1}{3}+\frac{1}{4}\right)x=\frac{5}{12}x$ $\frac{5}{12}x-\frac{1}{4}x=40000$ $\frac{2}{12}x=40000$ $x=240000$	B1 M1 A1 3 marks	Or $\frac{5}{12}$ $40000\times\frac{12}{2}$ do not award for 60
4.	$A=mB+nB$ $30=9m+3n$ $16=14m+n14$ $420=126m+42n$ $144=126m+33.68n$ $276=8.32n$ $n=33.17$ $9m=30-99.51=-69.51$ $m=-7.723$ When $B=36$, $A=-7.723\times36+33.17\times6$ $=-278.0+199.0$ $=-79$	M1 M1 M1 A1 4 marks	Mark for at least one equation Mark for attempt to solve equation Mark for substitution of pupils constants
5.	a)  b) Four (4) planes of Symmetry	B2 B1	B1 If dotted lines omitted or fully drawn Accept either (lines to be dotted)
6.	Kshs (4320 + 3060 + 2080) = 9660 Total bill = $9660\times\frac{115}{100}$ = 11109 (long mult.) OR 11110 (Table)	M1 A1 marks	Or equivalent

7.	$\begin{pmatrix}5\\-4\end{pmatrix}-\begin{pmatrix}3\\2\end{pmatrix}=\begin{pmatrix}2\\-6\end{pmatrix}$ $OQ=\begin{pmatrix}2\\5\end{pmatrix}+\begin{pmatrix}2\\-6\end{pmatrix}=\begin{pmatrix}4\\-1\end{pmatrix}$ $\therefore PQ=\begin{pmatrix}4\\-1\end{pmatrix}-\begin{pmatrix}5\\-4\end{pmatrix}=\begin{pmatrix}-1\\3\end{pmatrix}$ $\lvert PQ\rvert=\sqrt{(-1)^2+3^2}$ $=\sqrt{10}$	B1 M1 A1 3 marks	**OR** $\sqrt{(4-5)^2+(-1+4)^2}$
8.	$\text{Log}\left(\frac{x+24}{3^2}\right)=\log(9-2x)$ $\frac{x+24}{9}=9-2x$ $19x=57$ $x=3$	M1 M1 A1 3 marks	
9.	Moving average of order **3** $x=331\times3-670=323$ $y=\frac{323+343+350}{3}=338\frac{2}{3}$	B1 B1 B1 3 marks	
10.	$(2+x)^5=2^5+2^4\times5x+2^3\times10x^2+2^2\times10x^3+\ldots$ $=32+80x+80x^2+40x^3$ $(2.03)^5=32+80\times0.03+80\times(0.03)^2+40\times(0.03)^3$ $=32+2.4+0.072+0.00108$ $=34.47308$ $\simeq 34.47$ (*4 significant figures*)		
11.	(a) $\frac{dy}{dx}=15x^2-14x+3$ Grad. $=15\times1^2-14\times1+3=4$ (b) $\frac{y-3}{x-1}=4$	M1 A1 M1 A1 4 marks	**OR** $y=4X-1$
12.	Area of pentagons $=\frac{1}{2}\times4.25\times4.25\sin72^0\times5\times2$ $=\frac{1}{2}\times4.25\times4.25\times0.9511\times5\times2$ $=18.06\times0.9511\times5$ $=85.88$ **OR** (85.9) Area of rectangle faces $=5\times12\times5=300$ Total area $=300+85.88$ $=\underline{385.88}$	M1 A1 M1 A1 4 marks	Allow from area of one pentagon H = 11.81 − 3.43 Area $=\frac{1}{2}\times5\times3.43$ $=8.59$ Area $=\sqrt{6.75\times2.5^2\times1.75}$

13.  $\tan 15 = \frac{1}{2+\sqrt{3}}$ $\frac{1}{2+\sqrt{3}} \times \frac{2-\sqrt{3}}{2-\sqrt{3}}$ $= 2-\sqrt{3}$	B1 M1 A1 3 marks	
14. 	B1 B1 B1 3 marks	Angle bisector l bisector (mediator) of p mark for shading region
15. $4(1-\cos^2\theta)+4\cos\theta=5$ $4\cos^2\theta-4\cos\theta+1=0$ $(2\cos\theta-1)(2\cos\theta-1)=0$ $\cos\theta=\frac{1}{2}$ $\theta=60^0, 300^0$	M1 M1 A1 3 marks	
16.	B1 B1 B1 B1 4 marks	Mark for shading Mark for labeling the region

17.



a) i) $PJ^2 = 800^2 + 1200^2 - 2 \times 800 \times 1200\cos 100$
$= 640.000 + 1.440.000 + 2 \times 960.000 \times 0.1736$
$= 2413312\ (2413000)$
$= PJ = 1553km$

ii) $\frac{\sin\theta}{800} = \frac{\sin 100}{1553}$ $\quad \sin\theta = \frac{800 \times 0.9848}{1553}$

$= 0.5075 \quad \theta = 30^0 29'\ (30^0\ 30')$
Bearing $= 360 - (40 + 30^0\ 29')$

$= 289^0\ 31'\ (289^0\ 30')$ **OR** 289.5^0

b) Time for jet $= \frac{1553}{1035} = 1.501h$
$\therefore$ Time for helicopter $= 1.501 + 0.2$
$= \text{Speed} = \frac{800}{1.701} = 470.6$

M1
M1
A1
M1
A1
M1
A1
8 marks

ALT.

a)
i) From scale drawing
Bearing dist. PH – B1
Bearing dist HJ – B1
PJ measured converted B1
$(15.5 \pm 0.1$ **OR** $7.75 \pm 0.2)$

ii) $\angle HJP = 30 \pm 1^0$
Bearing $= 360 - (40 + 30)$
$= 290^0$

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18. a (i) $225 + 1196 + 144 = 169 + P^2 + 256 + 121 + 169 + 144 + 1289 = 1794$
$P^2 + 1713 = 1794$
$P^2 = 81$
$P = 9$

M1 Mark for all values added
A1 Mark for correct value of P

a (ii) ***Standard deviation***
Mean $= (915 + 14 + 12 + 13 + 9 + 16 + 11 + 13 + 12 + 17) \div 10 = 13.2$

M1 Or equivalent
A1

X	15	14	12	13	9	16	11	13	12	17
$X - \bar{X}$	1.8	0.8	-1.2	-0.2	-4.2	2.8	-2.2	-0.2	-1.2	3.8
$(X-\bar{X})^2$	3.24	0.64	1.44	0.04	17.74	7.84	4.84	0.04	1.44	14.44

$\sum(X - \bar{X})^2 = 51.6$

s.d $= \sqrt{\frac{51.6}{10}}$ OR $\sqrt{\frac{1794}{10} - (13.2)^2}$
$= 2.272$ OR 2.28

M1 Mark for at least $(X - \bar{X})$
A1
B1
B1

b (i) New mean = 16.2
b (ii) New S.d = 2.272

8 marks

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19. a) 5, 7, 9, 11

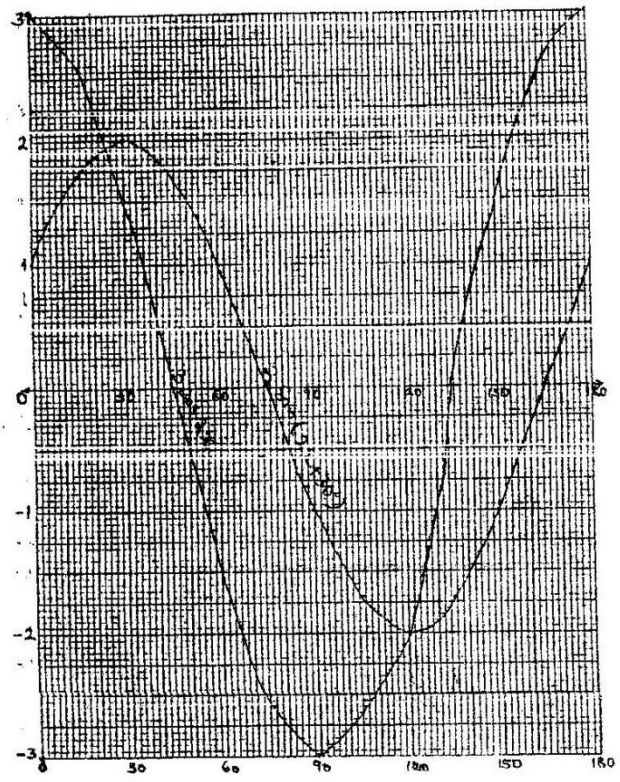
b) $S_{50} = \frac{50}{2}\{2 \times 5 + (50 - 1)2\} = 2700$

B2 OR
M1 $\frac{50}{2}5 + 2 \times 50 + 3$
A1

c) $S_n = \frac{n}{2}\{2 \times 5 + (n-1)2$ $= \frac{n}{2}(8+2n)$ $= 4n + n^2$	B1	Mark for following working
$n^2 + 4n < 725$ $n^2 + 4n - 725 < 0$ $(n + 29)(n-25) < 0$ $\therefore n = 24$	M1 A1 B1 8 marks	Allow if = used For n< 25
20. a) RA = $\frac{30}{\tan 26^0}$ or = RA 30 tan 64^0 $= \frac{30}{0.4877}$ or 30×2.050 $= 61.51$ (61.5)	Mi A1	
RB = $\frac{30}{\tan 32}$ or $= 30\tan 58^0$ $= \frac{30}{0.6249}$ or 30×1.600 $= 48.01$ (48)	M1 A1 M1	
AB = $\sqrt{61.51^2 + 48.01^2}$ $= \sqrt{3783 + 2305} \quad - \sqrt{6088}$ $= 78.03$	A1 M1	OR $\sin 0 = \frac{48.01}{78.03}$
b) $\tan\theta = \frac{48.01}{61.51}$ $= 0.7805$ $\theta = 37^0\ 58'$ bearing $= 360 - 37^0\ 58'$ $= 322^0\ 2'$ (322.03)	A1 8 marks	

21.

X^0	15^0	75^0	150^0	165^0
$3\cos 2x^0$		-2.598	1.5	
$2\sin(2x+30)$	1.732		0	



B1	
B1	
S1	Mark for scale used
P1	Mark for all points
P1	
C1	Mark for all points
B1	Mark for smooth curves
B1	
8 marks	Mark for 25^0, 116^0 stated Accept (24^0 – 27) From his graphs read within 1^0 Mark for $25 \leq x \leq 116$

22.

a) $\dfrac{dx}{dt} = 3t^2 - 4t$

Velocity $= 3 \times 2^2 - 4 \times 2$

$= 4\text{m/s}$

b) (i) $3t^2 - 4t = 0 \Leftrightarrow t(3t-4) = 0$

$\therefore t = \dfrac{4}{3}$

$x = \left(\dfrac{4}{3}\right)^3 - 2\left(\dfrac{4}{3}\right)^2 + 6$

$= \dfrac{64}{27} - \dfrac{32}{9} + 6 = \dfrac{64-96}{27} + 6$

$= 4\dfrac{22}{27}$ (4.815)

(ii) $\dfrac{d^2x}{dt^2} = 6t - 4$

$\therefore a = 6 \times \dfrac{4}{3} - 2$

$= 4\text{m}/15^2$

M1	
M1	Mark for one term correct
A1	
M1	
M1	
A1	
M1	
A1	
8 marks	

23. a) i) Vol. cylindrical part $= \frac{22}{7} \times 0.7 \times 0.7 \times 1$ $= 1.54m^3$ ii) X-Section $= \frac{1}{2} \times 0.4^2 \times \sin 60^\circ \times 6$ $= \frac{1}{2} \cdot 0.4 \cdot 0.4 \cdot 0.866 \cdot 6$ $= 0.41568$ (0.4157) Vol. hexagonal part $= 0.41568 \times 4$ $= 1.6628$ (1.663) b) Volume of pillar $(1.54 + 1.6628) - 0.25 \times 5$ $= 3.2028 - 1.25 = 1.9528$ (1.953) c) Mass $= 1.953 \times 2400$ $= 4687.2kg$ (4687kg)	M1 A1 M1 M1 A1 M1 M1 A1 8 marks	
24. a) $800x + 1600y \geq 8000 (x + 2y \geq 10)$ $4x + 7y \leq 41$ $x \geq 2$ and $y \geq 2$	B1 B1 B1 B1 B1 B1 B1 8 marks	Mark for each line draw and shaded Mark for type A = 3 & type B = 4 Mark for numbers of ... tors $3 \times 4 + 4 \times 7 = 40$