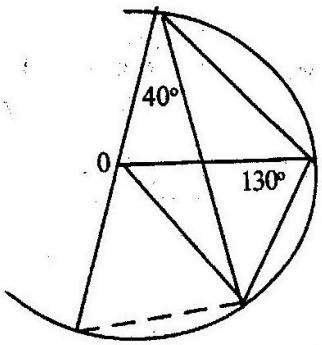
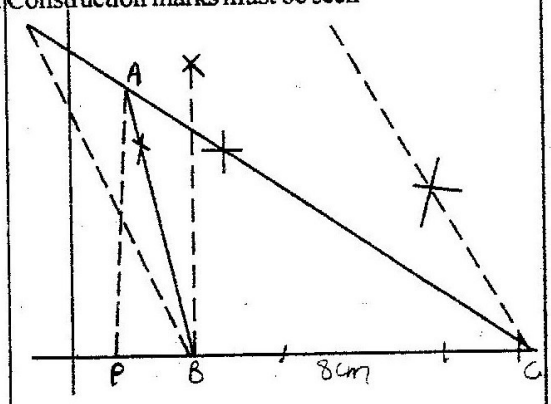
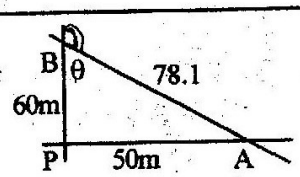
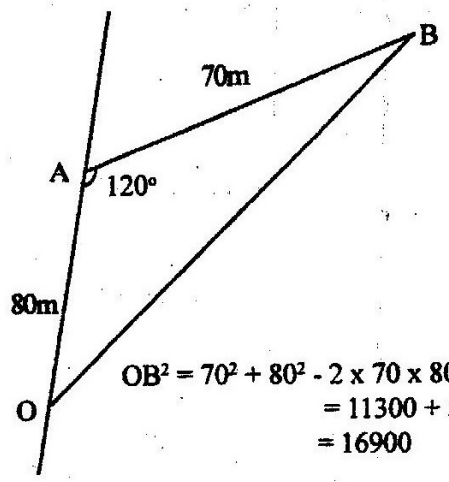
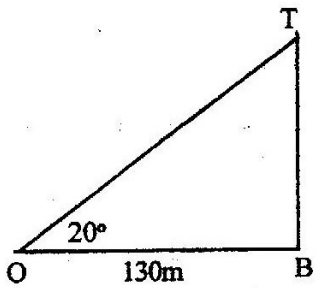
K.C.S.E 2003 MATHEMATICS PAPER 121/1 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE METHOD
1. $\frac{1}{2} \times \frac{4}{9} = \frac{2}{9}$ $\frac{2}{5} \times \frac{9}{2} = \frac{9}{5}$ $\frac{9}{5} - \frac{11}{10}$ or $\frac{18 - 11}{10} = \frac{7}{10}$ $\frac{1}{6} \times \frac{3}{8} = \frac{1}{16}$ $\frac{7}{10} : \frac{1}{16} = \frac{7}{10} \times 16$ $= 11\frac{1}{5}$	M1 M1 A1 3 marks	Simplification of numerator towards $\frac{7}{10}$ Simplification of demonimator toward $\frac{1}{16}$ or $\frac{3}{48}$ Accept 11.2
2. $\left\{\left(a + \frac{1}{b}\right) - \left(a - \frac{1}{b}\right)\right\} \left\{\left(a + \frac{1}{b}\right) + \left(a - \frac{1}{b}\right)\right\}$ $\left(a^2 + \frac{2a}{b} + \frac{1}{b^2}\right) - \left(a^2 - \frac{2a}{b} + \frac{1}{b^2}\right) = \left(\frac{2}{b}\right)(2a)$ $= \frac{4a}{b}$	M1 M1 A1 3 marks	Factorisation or expansion Simplified product or sum $\frac{4a}{b}$, $\frac{4a}{b}$, $4\frac{1}{b}a$
3. $T^2 = x^2(c^2 + d^2)$ or $\frac{T^2}{x^2} = c^2 + d^2$ $c^2 = \frac{T^2}{x^2} - d^2$ $c = \pm\sqrt{\frac{T^2}{x^2} - d^2}$	M1 M1 A1 3 marks	Removal of the root sign Making c2 the subject Award A1 if no
4. Value at end of 2nd year $\left\{21600 \times \frac{75}{100} \times \frac{80}{100}\right\}$ Value at end of 4th year $21600 \times \frac{75}{100} \times \frac{80}{100} \times \left(\frac{85}{100}\right)^2$ $= 9369.60$	M1 M1 A1 3 marks	Logs used sh. 9365 partial tables partial logs 9363, 9364, 9360 Alternative End of 1st year $21600 \times \frac{75}{100} = 16200$ 2nd year $16200 \times \frac{80}{100} = 12920$ 3rd year $12960 \times \frac{85}{100} = 11016$ 4th year $11016 \times \frac{85}{100} = 9363.60$

SOLUTION	MARKS	ALTERNATIVE METHOD
5. 		0ABC Kite <BOC = 50° - B1 <OBC = 65° ∴ <ABC = 25° - B1 See 100o - B1 See 50o - B1 See 25o - B1
< AOC = 100o, radii, base <s, < sum of a triangle Reflex <AOC = 260o <ABC = 130o ∴ <BAC = $\frac{180o - 130o}{2}$ = 25°	B1 B1	Using ABCD - <O - 50o -B1 <ABC = 130o - B1 <DAC - 25o - B1 < at centre, < at O (accept other methods and even angles marked in the diagram)
6. $p = 3\begin{bmatrix} 2 & -3 & -5 \\ 1 & 4 & 3 \\ -2 & -1 & 2 \end{bmatrix}$ $= \begin{bmatrix} 6 \\ 3 \\ -6 \end{bmatrix} + \begin{bmatrix} 3 \\ -4 \\ 1 \end{bmatrix} + \begin{bmatrix} -10 \\ 6 \\ 4 \end{bmatrix}$	M1	After simplification for substitution and removal of scalar
$p = \begin{bmatrix} -1 \\ 5 \\ -1 \end{bmatrix}$ or $\underset{\sim}{p} = -\underset{\sim}{i} + 5\underset{\sim}{j} - \underset{\sim}{k}$	A1	
$\lvert p \rvert = \sqrt{(-1)2 + (5)2 + (-1)2}$ $= \sqrt{27}$ = 5.196 to 3 sf = 5.20	M1 4 marks	

	SOLUTION	MARKS	ALTERNATIVE METHOD
7.	3 tan 2x - 4 tan x - 4 =0 Let tan x = y 3y2 - 4y - 4 = 0 (3y +2) (y - 2) = 0 y = $\frac{-2}{3}$ or y = 2 tan x = $-\frac{2}{3}$ x = 146.30°, 146.31°, 146.32° tan x = 2 x = 63.43°	 B1 B1 4 marks	if (3 tanx + 2) (tan x -2) =0 - M1 = tan x $\frac{4 \pm 16 + 48}{6}$ M1 = $\frac{4 \pm 8}{6}$ = 2 OR $-\frac{2}{3}$ - A1 146° 18' or 146°, 19' 63° 26'
8.	Construction marks must be seen  	 B1 B1 B1 4 marks	 BC = 8 cm and <BCA = 30 thro construction <ABC = 105° through construction and triangle completed AP constructed (AP = 5.5 + 0.1 cm) Area = $\frac{1}{2}$ x 8 x 5.5 = 22 cm² (21.6 22.4) A = 22 + 0.4 21.6 ≤ A ≤22.4
9.	Ratio 4:2:1 a) P (A wins) = $4/7$ b) P(either B or C wins) = $\frac{2}{7} + \frac{1}{7}$ = $\frac{3}{7}$	B1 B1 B1 3 marks	P(B) = x P(A) = 2x P(C) =1/2x P(C) = x P(B) = 2x P(A) = 4x $3\frac{1}{2}x = 1$ x = $\frac{2}{7}$ P(A) = $\frac{4}{7}$ P (B or C) = x + $\frac{1}{2}$x = $\frac{2}{7} + \frac{1}{7}$ = $\frac{3}{7}$

SOLUTION	MARKS	ALTERNATIVE METHOD
10. AreaΔ face $= \frac{1}{2} \times 6 \times 6 \times \sin 60^\circ$ $= 18 \times 0.866$ $= 15.59$ Total surface area $= (2 \times 15.59) + (3 \times 6 \times 10)$ $= 31.18 + 180$ $= 211.18\ cm^2$	M1 M1 A1 3 marks	
11. $4x + 2\left(\frac{3x}{2}\right) = 21$ $7x = 21$ $x = 3$ width is 3 cm	M1 A1 2 marks	
12.  Required angle is the supplement of <PBA or angle marked on diagram $\tan\theta = \frac{50}{60} = 0.8333$ $= 39.8^\circ\ (39^\circ\ 48^1)$ $180 - 39.8^\circ$ Obtuse $= 140.2^\circ\ (140^\circ\ 12^1)$ $\tan\theta = \frac{-50}{60} = 0.8333$ $-180 - 39.2^\circ = 140.2^\circ$	M1 M1 3 marks	or equivalent identification $\sin\theta = \frac{50}{78.1}$ $\cos\theta = \frac{60}{78.1}$
13. Ext. d = 11 cm or $r_1 = 5.5$. cm Int. d = 9 cm or $r_2 = 4.5$ cm Volume $= \pi(r_1^2 - r_2^2) \times 600$ cm $= 3.142(5.5^2 - 4.5^2) \times 600$ cm $= 18852$	M1 M1 A1 3 marks	Follow through logs 18860 cm^3
14. a) $10x + y$ b) $3(x + y) + 8 = 10x + y$ $10y + x = 10x + y + 9$ $2y - 7x = -8$ ... ... (i) $y = x + 1$ ... ... (ii) $2(x + 1) - 7x = -8$ $x = 2,\ y = 3$ The number	B1 M1 A1 A1	Forming both equations [illegible] of [illegible] known correctly

SOLUTION	MARKS	ALTERNATIVE METHOD
15. 		
$OB^2 = 70^2 + 80^2 - 2 \times 70 \times 80 \text{ Cos } 1200$ $= 11300 + 5600$ $= 16900$	M1	
$OB = \sqrt{16900} = 130m$	A1	
b) 		
$\text{Tan } 20° = \frac{BT}{130}$		
$BT = 130 \tan 20o$ $= 130 \times 0.3640$ $= 47.32$	M1 A1	
	4 marks	
16. $V = 3t^2 - t + 4$ $S = \int_1^5 (3t^2 - t + 4)\, dt$	M1	
$= \left[t^3 - \frac{t^2}{2} + 4t\right]_1^5$ $= \left(25 - \frac{25}{2} + 20\right) - \left(\frac{1}{2} - 1 + 4\right)$	M1	
$= \frac{256}{2} - \frac{9}{2}$ $= \frac{256}{2}$ $S = 128m$	A1	
	3 marks	

SOLUTION	MARKS	ALTERNATIVE METHOD
17. a) Volume of milk		
$\frac{3}{4}(1.7m \times 1.4m \times 2.2\,m)$	M1	
$= 3.927\ m^3$	A1	Logs used 3.926
b) i) Volume of each		
$\frac{1}{3} \times \frac{1}{2} \times 16 \times 16 \sin 60o \times 13.6$	M1	Or equivalent for base area
$= \frac{1}{3} \times \frac{1}{2} \times 256 \times 0.866 \times 13.6$	M1	
$= 502.5\ cm^2$	A1	Accept 502.4, 502.7 log used
in 2 sf $= 500\ cm^3$	B1	50.75 Heroes formula used
ii) Number of full packets		
$\frac{3.927 \times 10^6}{502.5} \times 25 = 7814 \times 25$	M1	Long multiplication and division using 3.926 give Sh. 195 300
= Sh. 195 350	A1	
1. $7814 \times 25 = 195350 - \frac{3.927 \times 10^6}{502.5}$		
2. $195350 = 7814 \times 25$ -3.926 log used		
3. $195272 = 7811 \times 15$ - altitude correctly or heroes formula (13.86)		
4. $195400 = 7816 \times 25$ - when 502.4 is used		Logs used sung 3.926 gives Sh. 195 350
5. 195225 - Using 13.86 or heroes formula 3.926 (7809 x 25)		Accept sh. 195, 400, 195, 275 Heroes formula used
6. $195300 = \frac{3.926 \times 10^6}{502.5} = 7812 \times 25$	8 marks	

18. a)

x	1.0	2.0	3.0	4.0	5.0	6.0
	1.9	2.9	3.9	4.9	5.9	6.9
f	6	14	10	7	2	1
cf	6	20	30	37	39	40

B1 — fit can be implied

Lower quartile $= 1.95 + 1 \times \frac{4}{14}$ — M1

$2.236 = (2.24)$

Upper quartile $= 3.95 + 1 \times \frac{10}{10}$ — M1

$= 3.95$

Interquartile $= 3.95 - 2.246 = 1.714$ — A1

$= 1.714$

SOLUTION	MARKS	ALTERNATIVE METHOD

b)

x	f	dx-a	fd	fd^2
1.45	6	-2	-12	24
2.45	14	-1	-14	14
3.45	10	0	0	0
4.45	7	1	7	7
5.45	2	2	4	8
6.45	1	3	3	9
			-12	62

M1 — $\sum$fd - column andsum

M1 — $\sum fd^2$ column and sum

$sd = \sqrt{\frac{62}{40} - \left(\frac{-12}{40}\right)^2}$ — M1

$= \sqrt{1.55 - 0.09}$

$= 1.55 - 0.09$

$= \sqrt{1.46}$

$= 1.208$ — A1

8 marks

19. a) Area $= \frac{120}{360} \times 7 \times 7 \times \frac{22}{7} = 51\frac{1}{3}$ cm2 — M1, A1 — Accept = 3.142; Accept 51.33 cm2, 51.34 cm^2 iflog used

b) $\frac{1}{2}$ AD = 7 sin 60° — M1

$= \frac{7\sqrt{3}}{2} = 6.062$

AB = 14 - 2 x 7 Cos 60° — M1

= 14 - 2 x 7 x 0.5

= 7

Area of trapezium XABY $= \frac{1}{2}(7+14) \times 6.062$ — M1

$= 63.65cm^2$ — A1 — Accpt 63.66, 63.63 tangent of 60°

c) Area of shaded region — M1

$= 2\left(63.65 - 51\frac{1}{3}\right)$

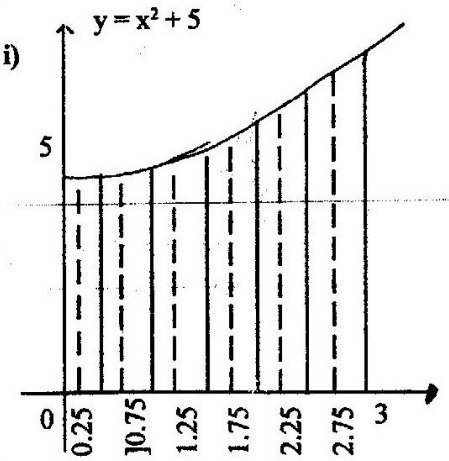
$= 127.30 - 102.67$ — A1

$= 24.63cm^2$

8 marks

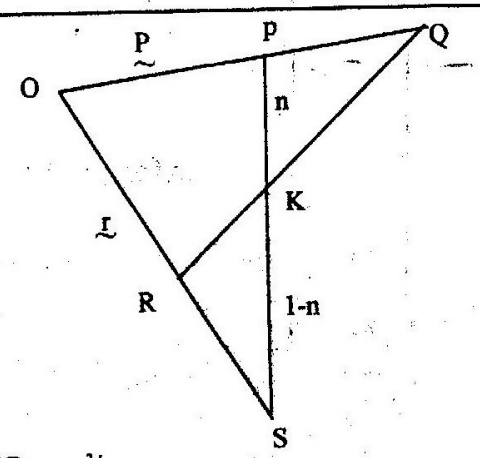
20.

a) i)



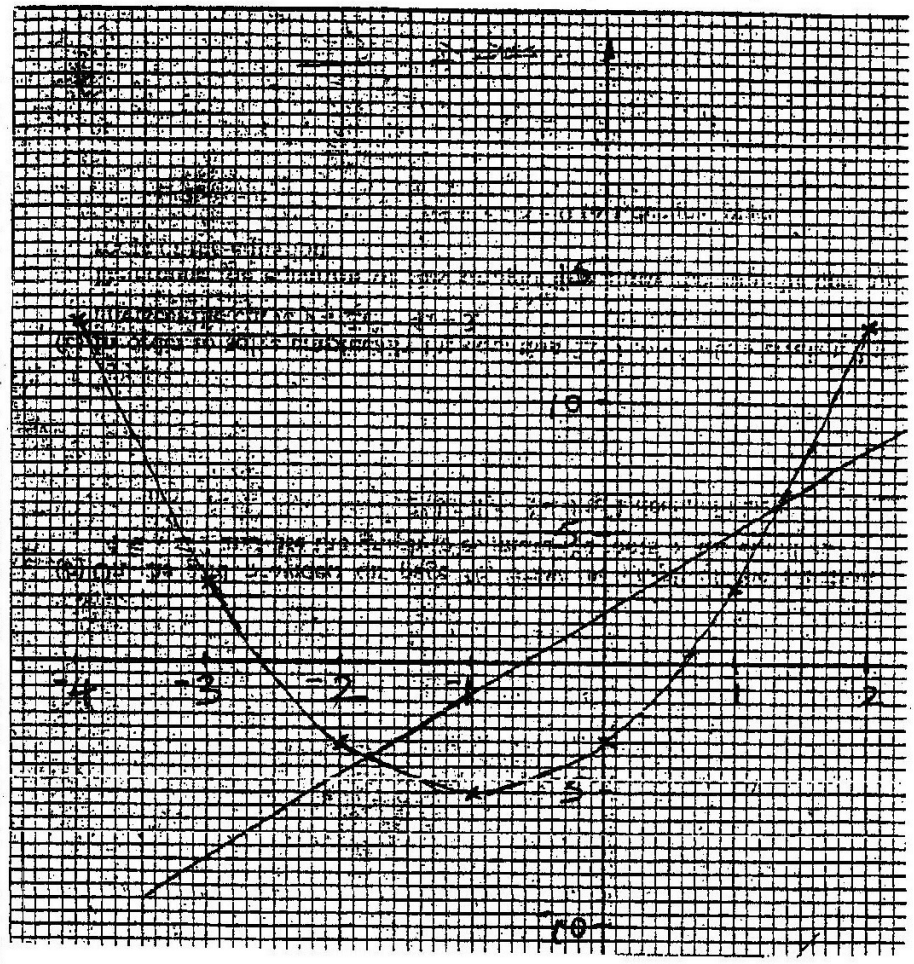
SOLUTION	MARKS	ALTERNATIVE METHOD
x: 0.25, 0.75, 1.25, 1.75, 2.25, 2.75 y: 5.0625, 5.5625, 6.5625, 8.0625, 10.0625, 12.5625 $5^{1}/_{16}$, $5^{9}/_{16}$, $69^{1}/_{16}$, $8^{1}/_{16}$, $10^{1}/_{16}$, $12^{9}/_{16}$	B2	Accept 4 significant figures
Area = $^{1}/_{2}$ (5.0625 + 5.5625 + 6.5625 + 8.0625 + 10.0625 + 12.5625)	M1	
=1/2 (47.875) = 23.9375 = 23.94	A1	Accept 23 $^{15}/_{16}$
a) ii) Exact area $\int_0^3 (x+5)\frac{dx}{3} = \frac{x^3}{3} + 5x \Big\|_0^3$	M1	
= 9 + 15 = 24	A1	
b) % error = $\frac{24 - 23.94}{24} \times 100$	M1	$\frac{24 - 23\,5^{15}/_{16}}{24} \times 100$
= $\frac{0.06}{24} \times 100$ = 0.25%	A1 8 marks	= 0.26%

21.



A) OR = r - $^{3}/_{2}$p PS = 2r - p	B1 B1	
b) OK = $^{3}/_{2}$p + m (r - 3/2p) OK = p + n (2r -p) $^{3}/_{2}$ + m(r-$^{3}/_{2}$p) = p + np + 2nr $^{3}/_{2}$p - $^{3}/_{2}$mp + mr = p - np + 2nr $^{3}/_{2}$ - $^{3}/_{2}$m)p + mr = (1 - n) p + 2nr .: 2n = m ... ... (1) $^{3}/_{2}$ - $^{3}/_{2}$m = 1 - ... .. (2) m = $^{1}/_{2}$ n = $^{1}/_{4}$	M1 M1 M1 M1	
c) PK : KS = 1:3		

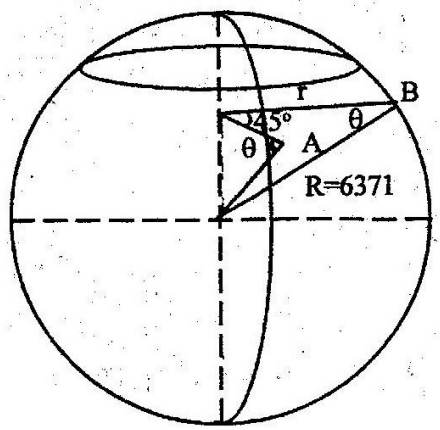
SOLUTION								MARKS	
22. a)	x	-4	-3	-2	-1	0	1	2	B2	For all entries
	$2x^2$	32	18	8	2	0	2	8		
	4x - 3	19	15	-11	-7	-3	1	13	B1	for 7 entries
	y	13	3	-3	-5	-3	3	13		



b) P1 for linear scale and plotting C1
B1 for both roots correct
c) B1 equation y = 3x + 2
L1 line drawn
B1 roots

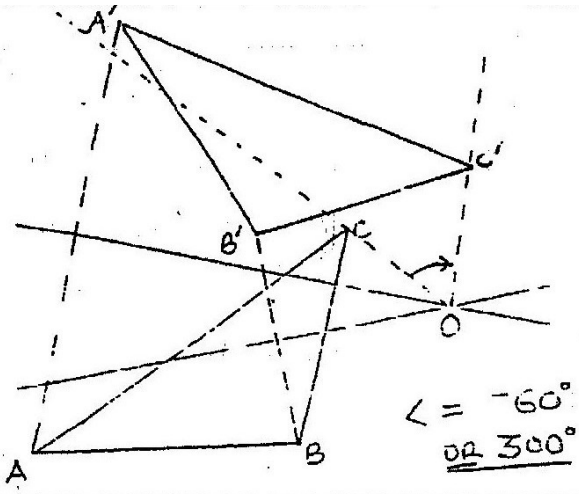
8 marks

SOLUTION	MARKS
23. a) Interest periods	
$3/2 \times 4 = 6$	
$A = 450\,000 (1 + \frac{6}{100})^6$	
$= 450\,000 \times 1.06^6$	
$= 450\,000 \times 1.419$	M1
= Sh. 638 550	A1
b) $1500 \times 280 \times 3$	M1
= Sh 1260 000	A1
c) New value	
$450\,000 (1 - \frac{16}{100})^3$	
$= 450\,000 (0.84)^3$	M1
$= 450\,000 (0.5927)$	
= Sh 266 715	
Total profit	
(1 260 000 + 266715) - 638 300	M1
= Sh 888 415	A1
	8 marks
24. a) Difference in time = 3h	
.: Longitude difference	
= 3 x 15° or 45°	B1
Longitude of B	
= 15° + 45°	
= 60°E	B1
	M1
b) i) distance travelled	
= 850 x 31/2 km	M1
= 2975 km	M1
arc AB = 2975	M1
.: $45 \times 3.142 \times 2r = 2975$	A1
360	
$r = \frac{2975 \times 360}{45 \times 3.142 \times 2}$	
= 3788, (7,9)	
(ii) 6371 Cos θ = 37[illegible]	
Cos[illegible] 3788	
[illegible]371 = 0.594	
[illegible]3.51°	
.: Latitude [illegible] two towns is 53.51°N	

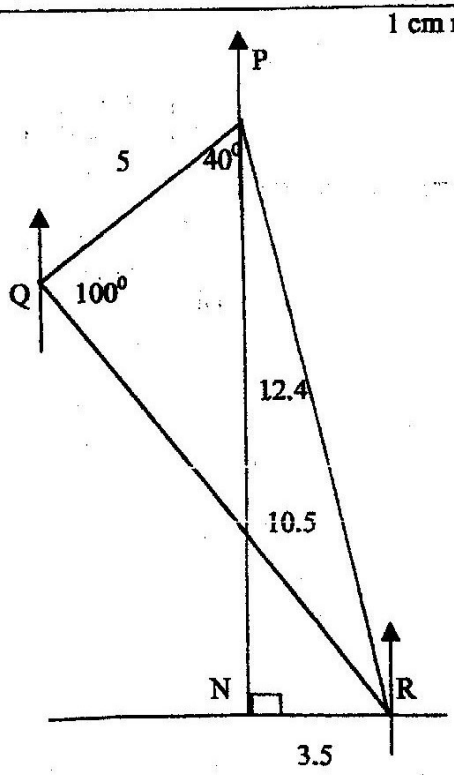


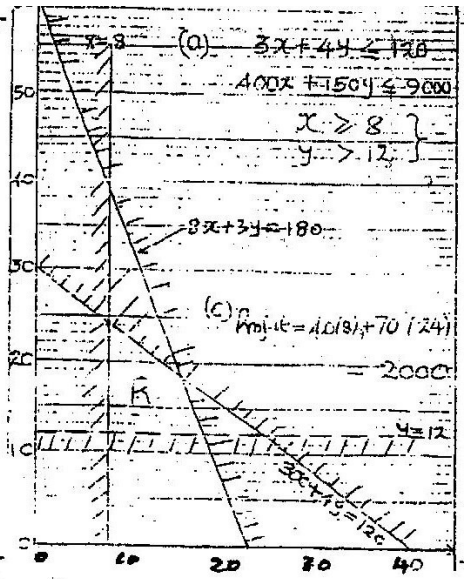
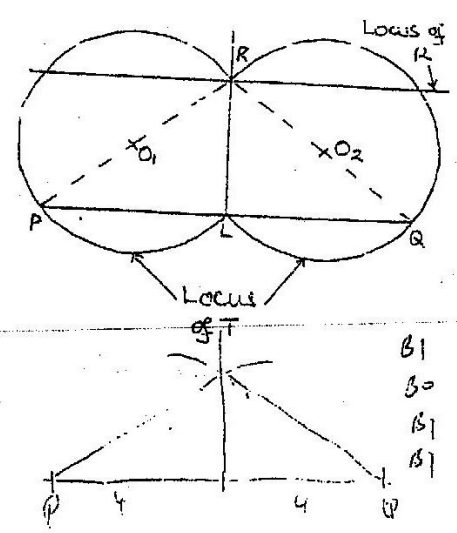
121/2 MATHEMATICS PAPER II KCSE 2003

1.	23.47 $\longrightarrow$ 3.3705 0.4666 $\longrightarrow$ $\bar{1}$ 6689 = 3.0394 $\sqrt[3]{0.0924}$ $\longrightarrow$ $\frac{\bar{2}.9657}{3} = \frac{\bar{1}6552}{3.3842}$ 2.422×10^3 $\longleftarrow$ $2.422 \text{ X } 10^3$ $0.423 \text{ X } 10^3$ $\quad 2422^3$	M_1 M_1 M_1 A_1 4 marks	All 3 logs $3\sqrt{tables}$ Attempt to add logs M_0 M_1 Attempt to divide by 3 & sin Accept standard form.
2	Selling price $= \frac{87}{100}\times800$ $=696$ Cost price $= \frac{100}{120}\times696$ $= 580$	M_1 M_1 A_1 3	
3	a) Mode = 1 b) Mean $= \frac{0\times5+1\times6+2\times4+3\times3+4\times1+5\times1}{20}$ $= 1.6$	B_1 M_1 A_1 3 marks	accept 32 20 or $1\frac{3}{5}$
4	Grade. AB $\frac{-4-8}{3-(-3)}$ $= -2$ through (3,40 $\frac{y-4}{x-3} = -2$ y=-2x+10	M_1 M_1 A_1 3 marks	Y = -2x+C 4= -2(3) +C substitute C=10
5	Log (6x-2)-log 10= log (x-3) $\text{Log}\left(\frac{6x-2}{10}\right) = \log(x-3)$ $\frac{6x-2}{10}\ x-3$ 6x-2=10x-30 x=7	M_1 M_1 A_1 3 marks	for single logs on both s for dropping logs correctly
6	a) 72 km/h $= \frac{72\times1000m}{60\times605}$ $= 20m/s$ b) let l be length of train $\frac{l+80}{20} = 15$ l=300-80 =220m	B_1 M_1 A_1 3 marks	let length of train & bridge be x x ÷20=15 =300 l=300-80

7		B_1 B_1 B_1 3 marks	for 1 mediator for 2nd mediator and centre labelled or equivalent
8	$\frac{dy}{dx} = 2 - 8x = 0$ $x = \frac{1}{4}$ $y = 6 + 2\left(\frac{1}{4}\right) - 4\left(\frac{1}{4}\right)^2$ $= 6\frac{1}{4}$ turning point $\left(\frac{1}{4}, 6\frac{1}{4}\right)$	M_1 M_1 A_1 3 marks	derivative equated to zero at least 1 term correctly differential
9	S.A. $= \frac{1}{2}(4\pi^2) + \pi r^2 75\pi$ $r^2 = \frac{75\pi}{3\pi} = 25$ $r = 5$ $V = \frac{1}{2}\left(\frac{4}{3}\pi \times 5^3\right)$ $= 88\frac{1}{3}\pi$	M_1 A_1 M_1 A_1 4 marks	S.A. of sphere MRE –5 R = 4.33 1 V = 108.3 Accept $\frac{250}{3}\pi 83.33\pi$
10	$A = \frac{1}{\sqrt{3}} \Rightarrow \sqrt{3}\, a = 1$ $\sqrt{3} - 6\sqrt{39} = 2\sqrt{3} - 6\sqrt{3}\sqrt{13}$ $= 2\left(\frac{1}{a}\right) - 6\left(\frac{1}{a}\right)b$ 2 $= \frac{2}{a} - \frac{6b}{a}$ $= \frac{2-6b}{a}$ or $\frac{2}{a}(1-3b)$	B_1 M_1 A_1 3 marks	$A = \frac{1}{\sqrt{3}} \Rightarrow a\sqrt{\frac{3}{3}}$ $\Rightarrow \sqrt{3} = 3a$ 2(3a) – 6 (3a)b =6a-18ab =6a(1-3b)
11	(a) $(8-x)^2 = 2^6 - 6.2^5 x + 15.2^4 x^2 -$ $20.2^3 x^3 + 15.2^2 x^4 - 6.2x^5 + x^6$ $= 64 - 192x + 240x^2 - 160x^3$ $+ 60x^4 - 12x^5 + x^6$ (b) $1.993 = (2 - 0.01)^6$ $\approx 64 - 192(0.01) + 240(0.0[illegible]$ $= 64 - 1.92 + 0.24$ $= 62.[illegible]$	M_1 A_1 M_1 A_1 4 marks	coefficient and correct powers of x

12	$x+y \le 440$ $y \ge 120$ $x > 150$	B_1 B_1 B_1 3 marks	
13	Work done by $A = 3\frac{1}{2} \times \frac{1}{6}$ $\frac{7}{2} \times \frac{1}{6} = \frac{7}{12}$ Remaining work $= 1 - \frac{1}{6} - \frac{7}{12}$ Time taken by B $= \frac{5}{12} \div \frac{1}{9}$ $= \frac{5}{12} \times \frac{9}{1} = \frac{45}{12}$ $3\frac{3}{4}hr$	M_1 M_1 A_1 3 marks	
14	A:W : M = 10:8:5 Amount shared $= \frac{23}{5} \times 10000$ $= 46000$ Atieno's extra $= \frac{2}{23} \times 46000$ $= 4000$	M_1 M_1 A_1 3 marks	or equivalent or equivalent
15	A=250, r=2, n=$\frac{16}{2}$+1=9 $T_9 = 250 \times 2^8$ $= 250 \times 256$ $= 64000$ Days: 0, 2, 4, 6, 8, 10, 12, 14, 16 Insects: 250, 500, 1000, 2000, 4000, 8000, 16000, 32000, 4000	B_1 M_1 A_1 3 marks B_1 M_1 A_1	for a, r and n correct allow for T_8 M_1 M_0 For 250 seen, evidence of doubling and nine terms. For consistent doubling for 64000
16	$S \alpha t + \sqrt{t} \Rightarrow S = kt + p\sqrt{t}$ $14 = 4k + p\sqrt{4}$ $27 = 9k + p\sqrt{9}$ $42 = 12k + 6p$ $54 = 18k + 6p$ $-12 = -6k$ $k = 2$ & $p = 3$ $S = 2t + 3\sqrt{t}$	 M_1 M_1 A_1 B_1 4 marks	 for 1 equation attempt to solve simultaneous equations
17 (a) (b)	$\left.\begin{matrix} x+y=19 \\ -x+3y=9 \end{matrix}\right\} \Leftrightarrow \begin{pmatrix} 5 & 1 \\ -1 & 3 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 19 \\ 9 \end{pmatrix}$ $inverse = \frac{1}{16}\begin{pmatrix} 3 & -1 \\ 1 & 5 \end{pmatrix}$ $\frac{1}{16}\begin{pmatrix} 3 & -3 \\ 1 & 5 \end{pmatrix}\begin{pmatrix} 5 & 1 \\ -1 & 3 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{16}\begin{pmatrix} 3 & -1 \\ 1 & 5 \end{pmatrix}\begin{pmatrix} 19 \\ 9 \end{pmatrix}$ $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{16}\begin{pmatrix} 48 \\ 64 \end{pmatrix}$ $x = 3$ *and* $y = 4$ $\sqrt{(11-3)^2 + (-2-4)^2}$ $= \sqrt{64+36}$ $= 10cm$	B_1 B_1 M_1 M_1 A_1 M_1 M_1 A_1 8 marks	

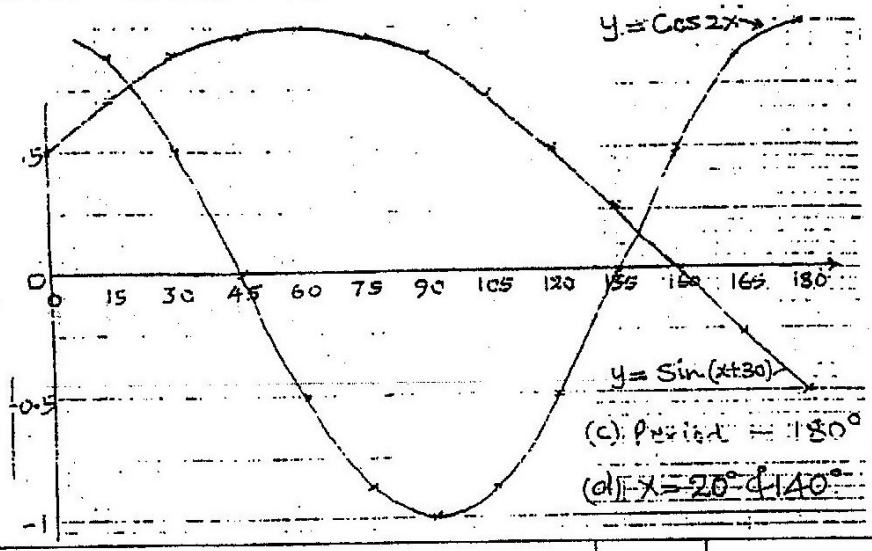
18 a)	Cost of 1st brand per kg $= \frac{5\times140+3\times160}{8}$ $= 147.50$ % profit $= \frac{180-147.50}{147.50}\times100\%$ $= 22.03\%$	M_1 M_1 A_1	
b)	(i) $X:Y=5:3 \Rightarrow x=\frac{5}{3}y$ $Y:Z=2:5 \Rightarrow Z=\frac{5}{2}y$ $X:Y:Z=\frac{5}{3}Y:Y:\frac{5}{2}Y$ $=10:6:15$	M_1 A_1	
	(ii) Cost/kg $= \frac{10\times140+6\times160+15\times256}{31}$ =sh. 200 New price $= \frac{130}{100}\times200$ =sh. 260	M_1 M_1 A_1	
19	1 cm rep 40km  Time $= \frac{496}{1.853\times40}$ $= 6.91$ hr	B_1 B_1 B_1 B_1 B_1 M_1 A_1 8 m	

20		B_1 B_1 B_1 L_1 L_1 L_1 M_1 A_1 8 marks	$8x+3y \leq 180$ accept if x = 8 given $3x + 4y \leq 120$ drawn & shade $8x + 3y \leq 180$ drawn & shade $x \geq 8$ and $y >$ drawn & shade accept if x = 8 drawn
21	$\frac{dy}{dx} = 3x^2 - 3 = 0$ $3(x^2 - 1) = 0$ $(x-1)(x+1) = 0$ $x = 1,\ y = 0\ \&\ x = -1,\ y = 4$ *Coordinates are* $(1,0)\ \&\ (-1\ 4)$ *for* $(1,0)$ $x < 1, \frac{dy}{dx}$ *is* $-$ $x > 1, \frac{dy}{dx}$ *is* $+$ $\Rightarrow (1,0)$ *is a* min*imum* *for* $(-1\ 4)$ $x < -1, \frac{dy}{dx}$ *is* $+$ $x > -1, \frac{dy}{dx}$ *is* $-$ $\Rightarrow (-1,4)$ *is a* max*imum*			
22			a perpendicular to PQ drawn a parallel line 3cm above PQ drawn perpendicular to PQ drawn at L R identified Locating centre 0_1 Major arc RPL drawn Locating centre 0_2 Major arc RQL drawn apply 0W-1 once if complete circles drawn.

23

x	30	75	105	135	165
Cos x^0		0.87	0.97	0.97	
Sin $(x+30)^0$		0.97		0.26	-26

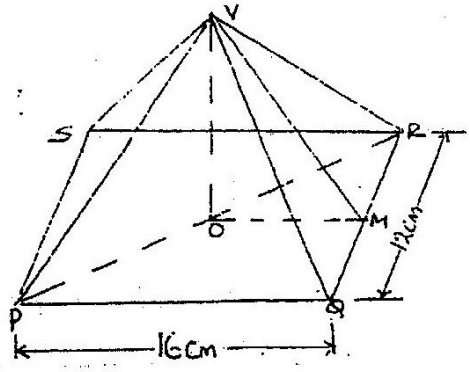
B_2 S_1 P_1



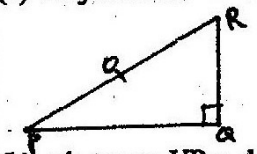
P_1 C_1 B_1 B_1

8 marks

24



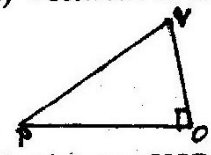
(a) Projection of VP on plane PQRS=PO



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

$\frac{1}{2}\sqrt{400} = 10cm$ M_1

(b) < between VP and PQRS = <VPO

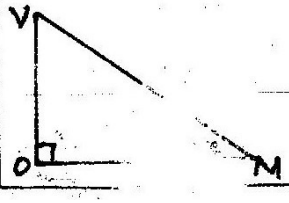


$\text{Cos } Q = \frac{10}{13}$

$= 0.5556 \quad Q = 56^0\ 15'$

(56.25^0)

(c) < between VQR and PWRS = <VMO=α



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

$= \sqrt{288} = 16.977$

cos x = 1[illegible] = [illegible]5.97

α = 61° 52'

$= (61.87^0)$