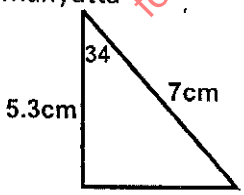
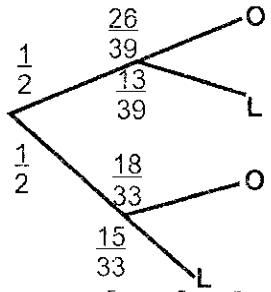
K.C.S.E 1995 MATHEMATICS PAPER 121/1 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE
1. $\sqrt{\frac{384.16 \times 0.0625}{96.04}}$ $\sqrt{\frac{2^4 \times 7^4 \times 10^{-2} \times 5^4 \times 10^{-4}}{2^2 \times 5^4 \times 10^{-4}}}$ $\sqrt{2^2 \times 5^4 \times 10^{-4}}$ $= 0.5$	M1 M1 A1 3 marks	Alternative methods 4×0.0625 m1 2×0.25 m1 $= 0.5$ $\sqrt{\frac{24.01}{96.04}}$ m1 $= \sqrt{0.25}$ m1 $= 0.5$ A1 Long method $\sqrt{384.16} = 19.6$ $\sqrt{0.0625} = 0.25$ } m1 $\sqrt{96.04} = 9.8$ 19.6×0.25 m1 9.8 $= 0.5$ A1 Long checking method must be seen to score 1st mark.
2. $\frac{2x-2}{6x^2 x-12} + \frac{x-1}{2x-3}$ $= \frac{2(x-1)}{(3x+4)(2x-3)} \times \frac{(2x-3)}{x-1}$ $= \frac{2}{3x+4}$	M1 M1 A1 3 marks	For of question completely For concellation
3. Median $= 7.5 + \frac{(23-19.5)4}{8}$ $7.5 + \frac{3.5 \times 4}{8}$ $= 9.25$	M1 A1 2 marks	Cumulative graph m1 median = 10 A1 $7.5 + \frac{5}{8} \times 4$ M0 9.75 M0
4. Manyatta  Bearing of Chamwe from Manyatta 169 ± 1 5. $\frac{y-5}{x+8} = \frac{1}{4}$ $y = -\frac{1}{4}x + 3$	S1 B1 B1 M1 A1 2 marks	Appropriate scale Scale drawing (completely)
6. $\frac{1}{S^2} = \frac{3V+2}{2\pi r^3} \Rightarrow C^2 = \frac{2\pi r^3}{(3r+2)s}$ $C^2 = \frac{2\pi r^3}{3SV + 4\pi r^3}$ $C = \sqrt{\frac{2\pi r^3}{(3r+2)s}}$	M1 M1 A1 3 marks	

SOLUTION	MARKS	ALTERNATIVE
7. $A = \left\|2x^2 - \frac{1x^3}{3}\right\|_1$ $= 8 - \frac{8}{3} - 2 \div \frac{1}{3}$ $= 3\frac{2}{3}$	M1 M1 A1 3 marks	Correct integration without limits. Substitution of limits
8.  $P(0) = \left[\frac{1}{2} \times \frac{2}{3}\right] + \left[\frac{1}{2} \times \frac{6}{11}\right]$ $= \frac{20}{33}$ Or $\frac{260}{429} = \frac{780}{1287}$	 M1 M1 M1 A1 4 marks	Tree diagram need not be drawn. Or equivalent for addition
9. $\frac{4}{3} \times \frac{22}{7} \times r^3 = \frac{1}{3} \times \frac{22}{7} \times 9 \times 9 \times 12$ $r^3 = 243$ $r = 6.24$ or equivalent $A = 4$ $r^2 = 4 \times \frac{22}{7} \times 6.24 \times 6.24 = 489.5 cm^2$	M1 A1 4 marks	 If A1 lost
10. 10, 10 + 2d, 10 + 6d $\frac{10+2d}{10} = \frac{10+6d}{10+2d}$ $100 + 40d + 4d^2 = 100 + 60d$ $4d^2 - 20d = 0$ $d = 5$ or $d = 0$ Alternative $4d^2 = 20d$ $4d^2 - 20d = 0$ $4d = 20$ $4d(d-5d) = 0$ $d = 5$ $d - 5 = 0$ or $4d = 0$ $d = 5$ or $d = 0$	B1 M1 M1 M1 4 marks	A.P identified G.P ratio equated Simplified quadratic equation D = 0 must be disqualified
11. $\frac{4 \times 12 + 4 \times 3}{7} = \frac{60}{7}$ $\frac{130}{100} \times \frac{40}{7} = 11.14$	M1 A1 M1 A1 4 marks	Accept $\frac{210}{7} \times \frac{130}{100}$ m2 -39 A2
12. $\begin{pmatrix}3 & 2\\4 & 5\end{pmatrix}\begin{pmatrix}S\\T\end{pmatrix} = \begin{pmatrix}840\\1680\end{pmatrix}$ Inverse $\frac{1}{7}\begin{pmatrix}5 & -2\\-4 & 3\end{pmatrix}$ $\frac{1}{7}\begin{pmatrix}5 & -2\\-4 & 3\end{pmatrix}\begin{pmatrix}3 & 2\\4 & 5\end{pmatrix}\begin{pmatrix}S\\T\end{pmatrix}$ $= \frac{1}{7}\begin{pmatrix}5 & -2\\-4 & 3\end{pmatrix}\begin{pmatrix}840\\1680\end{pmatrix}$ $\begin{pmatrix}S\\T\end{pmatrix} = \begin{pmatrix}120\\240\end{pmatrix}$ Shirt Sh. 120, Trouser Sh. 240	B1 B1 B1 M1 A1 4 marks	For mainly equation Or equivalent $\begin{pmatrix}S\\T\end{pmatrix} = \begin{pmatrix}1 & 5 & -2\\7 & -4 & 3\end{pmatrix}\begin{pmatrix}840\\1680\end{pmatrix}$ If transposed used B0 B0

SOLUTION	MARKS	ALTERNATIVE
13. $\frac{27 \times 4 \times 60}{60 \times 30}$ = 3.6cm Height = 23.6cm 60 x 30. h = 27x 4 x 60 H = 3.6cm Hf = 23.6	M1 M1 A1 3 marks	For division quantity through if log used
14. ∠ACE = 60° cyclic quadrilateral ∠CDA = 100° < sum of triangle or ∠ABE = 100° ext < equal ∠FED = 40°	B1 B1 B1 3 marks	or ∠DCE or ∠BEA or ∠EBC = 80° or ∠EDF = 80° 40° must be worked for NOT just seen
15. 2.5000 – 3750 = 21250 Amount to pay 21250 + 21250x $\frac{40x2}{10}$ = 38250 One instalment = $\frac{38250}{24}$ = Sh. 1,593.75	M1 A1 4 marks	Working 5.1 + 21250 From 5.1 from amount owing If A1 lost
16. $\frac{(2x+30)x\,60}{195}$ = x -20 x = 76km Actual distance = 182km 2(76) + 30 = 182km	M1 A1 B1 3 marks	
17.(a) 10000 x 1.2 = 12000 22000 x 1.2 = 26400 36400 x 1.2 = 43680 (b) A = 43680 $(1.2)^8$ = 43680 (4.2998) No Log 43680 = 4.6403 1.2^8 0.0792 x 8 = 0.6403 1.879×10^8 = 5.2739 Sh. 187900 Sh. 187900 – Sh. 30000 = 157900	M1 M1 M1 A1 M1 M1 A1 M1 A1 8 marks	For logs and operations follow through if logs used. To improve accuracy can use a calculator nowadays.
18.(a) (i) AV = AD + DV = **a** + **c** (ii) BV = BA + AV = **a** + **c** - **b** (b) BO = ½BD = ½(**a** – **b**) = ½(**b** – **a**) + **a** + **c** + **b** ½**a** + **c** – ½**b** OM = $\frac{3}{7}$OV = $\frac{3}{7}\left(\frac{1a}{2} + \mathbf{c} - \frac{1b}{2}\right)$ BM – BO + OM = $\frac{1}{2}(\mathbf{a} - \mathbf{b}) + \frac{3}{7}\left(\frac{1b}{2} + \mathbf{c} - \frac{1b}{2}\right)$ = $\frac{7a - 7b + 3a + 6c - 3b}{14}$ = $\frac{10a - 10b + 6c}{14}$ = $\frac{1}{7}(5a - 5b + 3c)$	B1 M1 A1 M1 M1 M1 A1 8 marks	Ow – 1 vector sign not used Follow the route or – BV + Vm = **a** + **c** – **b** + $\frac{4}{7} - \frac{1a}{2} - \mathbf{c} + \frac{1b}{2}$ = $\frac{10a - 10b + 6c}{14}$ = $\frac{1}{7}(5a - 5b + 3c)$ Accept $\frac{5a}{7} - \frac{5b}{7} + \frac{3c}{7}$

SOLUTION	MARKS	ALTERNATIVE
19.(a) Sin ½θ = 0.8 ½θ = 53.13° θ = 106.26 = 106.3°	M1	$\frac{300}{60} \times \frac{360\pi}{180} = 10\pi$
Area of segment = major (360-106.3) $\frac{253.7}{360} \times \frac{22}{7} \times 5^2 + \frac{1}{2} \times 5 \times 5 \sin 106.3°$ = 55.37 + 12 = 67.37cm²	A1 M1 M1 M1 M1 M1 A1	Accept $A = 12 - \frac{106.3}{360} \times \frac{22}{7}$ 25 m1 ½ x 25 Sin 106.3 m1 = 78.57 – (23.2 – 120) = 78.57 – 11.2 m1 = 67.37cm² A1 If A1 lost
(b) $\frac{300}{60} \times 2\pi = 10\pi$ radians	8 marks	
20.(a) (i) b + a = 35.1 ..... (i) 7b – 49.9 = 39.9.....(ii)	M1 A1	
(ii) 5 = -4.9t² + 40t + 10		

1	0	1	2	3	4	5	6	7	8	9	10
X	10		70.4	85.9	91.6	87.5	73.6		16.4	26.9	

	B1	If A1, lost
(b) (i) Suitable scale Plotting Curve	S1 P1 C1	
(ii) Tangent at 1 = 5 Velocity = 9.0 ± 0.5m/2	T1 B1 8 marks	If C1 lost or A1 lost
21.(a)		

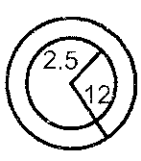
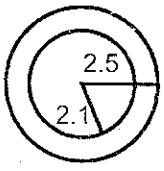
x	-3	-2	-1	0	1	2	3	4
y	3	-2	-5	-6	-5	-1	3	10

	B2	Give B1 for 6 values
(b) Suitable scale Plotting ✓Curve	S1 P1 C1	If B1 of S0 If PO for equation lost
(c) y = -2x – 4 ⇒ y = -2x – 4 line drawn roots -270 ± 0.1 or 0.70 ± 0.1	B1 L1 B1 8 marks	For both roots
22.(a) BD $\frac{60 \sin 120}{\sin 30}$ = 103.92	M1 A1	Expression with BD
$AB = \frac{103.92 \sin 55}{\sin 80} = \frac{103.92 \times 0.8192}{0.9848}$ = 86.44m	M1	$BD^2 = \frac{60^2 + 60^2}{\sqrt{=10800}} - 2(60)B0$ BD = 10800 = 103.9
$AD = \frac{103.92 \sin 45}{\sin 80} = \frac{103.92 \times 0.7071}{0.9848}$ = 74.62cm	M1	AD = 86.40 AD = 74.56
∴B to D via A is 86.44 + 74.62 – 161.06m	A1	For the two divisions by 3 (2.44) (2.62)
(b) $\frac{"86.44"}{3}$ = 28 rem 2.44 $\frac{"74.62"}{3}$ = 24 rem 2.62 ∴distance are 2.44m and 2.62m	B1 B1 8 marks	Award by B1 B1 if all in M1 scored

SOLUTION	MARKS	ALTERNATIVE
23.(a) Plotting $A^1B^1C^1D^1$ and drawing $A^1B^1C^1D^1$	B1	In case the centre is not (0, 0) award and mark out doing the last A1
(b) (i) $\begin{bmatrix}-2 & -1\\ 1 & -1\end{bmatrix}\begin{bmatrix}0 & 0 & -5 & -2\\ 2 & 6 & 6 & 2\end{bmatrix}$ A″ B″ C″ D″	A1	Accept positive ¼ turn
Matrix $\begin{bmatrix}-2 & -6 & 4 & 2\\ -2 & -6 & -11 & -4\end{bmatrix}$		$\begin{bmatrix}0 & -1\\ 1 & 0\end{bmatrix}$ M1
(ii) Plotting of A″ B″ C″ D″	B1	$\begin{bmatrix}-2 & -1\\ 1 & -1\end{bmatrix}\begin{bmatrix}0 & -1\\ 1 & 0\end{bmatrix}$ *or* $\begin{bmatrix}-1 & +2\\ -1 & -1\end{bmatrix}$ M1
(c) $\begin{bmatrix}a & b\\ c & d\end{bmatrix}\begin{bmatrix}-2 & -6 & 4 & 2\\ -2 & -6 & -11 & -4\end{bmatrix}\begin{bmatrix}2 & 6 & 6 & 2\\ 0 & 0 & 5 & 2\end{bmatrix}$	M1	Matrix is
-2a – 2b = 2.....(i) -2c – 2d .....(i) 4a-11b = 6.....(ii) 2c – 4d = 2.....(ii)	M1	$^1/_3\begin{bmatrix}1 & +2\\ -1 & -1\end{bmatrix} = \begin{bmatrix}\frac{1}{3} & \frac{2}{3}\\ \frac{1}{3} & \frac{1}{3}\end{bmatrix}$
$a = \frac{-1}{3}\ b = \frac{-2}{3}\ c = \frac{1}{3}\ d = \frac{1}{3}$	A1	Follow through if different centre of ration is used
matrix in $\begin{bmatrix}\frac{1}{3} & \frac{2}{3}\\ \frac{1}{3} & \frac{1}{3}\end{bmatrix}$	A1	
	8 marks	
24.Lat of B = 43.75° 43.45	B1	
(ii) r = 6370 Cos 43.75°	M1	
angle between B and C = 60°	B1	Only when subtraction is done to 430 – 45
BC = $\frac{60}{360}$ x $\frac{22}{7}$ x 6370 Cos 43.75°	M1	37° + 23° = 60°
= $\frac{60}{360}$ x 2 x $\frac{22}{7}$ x 6370 x 0.7224	M1	Cos 43.75 = 1.8587
= 4820.8:6km	A1	Must be correct 0.7224
(b) $\frac{60 \times 4 - 4\text{hrs}}{60}$		Either both B1 or one B1 lost
Local time at C in 2100 hours or 9.00 pm	A1	
	8 marks	Follow through logs

K.C.SE 1995 MATHEMATICS PAPER 121/2 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE
1. x | Log x $(0.07284)^2$ | $\bar{2}.8623 \times 2 = \bar{3}.7246$ $\sqrt[3]{0.06/95}$ | $\bar{2}.7921 \div 3 = \bar{1}.5974$ $\Rightarrow 2.272$ 1.3403×10^{-2} $= 0.13403$	M1 M1 M1 A1 3 marks	Apply Mt – 2 if a candidate was square root All two logs Multiplication & division of his logs Subtraction of logs Alternative Accept standard form
2. $y = 2x - 3$ $x^3 - x(2x - 3) = -4$ $(x + 1)(x - 4) = 0$ $= x = -1$ or $x = 4$ and $y = -5$ or $y = 5$	M1 M1 M1 A1 4 marks	Equation in one unknown Correct simplification and equation Factorization of this equation Substitution in the formula
3. $(65 + 50 + 50) : 3$ $(50 + 50 + 45) : 3$, $(50 + 45 + 45) : 3$ $(45 + 45 + 45) : 3$, $(45 + 45 \div 40)$ and $(45 + 40 + 40) : 3$ Moving av55, 48, 47, 45, 43, 42	M1 M1 A1 3 marks	
4. x – section area $= \frac{1}{2} \times 3 \times 3 \text{ Sin } 60°$ $\frac{1}{2} \times 3 \times 3 \times 0.8660$ Volume $= \frac{1}{2} \times 3 \times 3 \times 0.866 \times 0.25$ $= 97.43(97.425)$	M1 M1 A1 3 marks	or $45(45 - 3)(45 - 3)(45 - 3)$ 3.875×25
5. $7^{2(x\,1)} + 7^{2x} = 350$ $49 \times 7^{2x} + 7^{2x} = 350$ $50 \times 7^{2x} = 350$ $7^{2x} = 7$ $= 2x = 1$ $x = \frac{1}{2}$	M1 M1 M1 A1 4 marks	$49 \times 1 \div 49x = 350$ $49 \times 49x \div 49x = 350$ $50 \times 49x = 350$ $49x = 7$ $49x = 49\frac{1}{2}$ If logs used follow through
6. $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -2 \\ 2 \end{pmatrix} - \begin{pmatrix} -1 \\ 2 \end{pmatrix} = \begin{pmatrix} -3 \\ 0 \end{pmatrix}$ $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -3 \\ -3 \end{pmatrix} - \begin{pmatrix} -3 \\ 0 \end{pmatrix}$ $= \begin{pmatrix} 0 \\ -3 \end{pmatrix}$	B1 B1 2 marks	Allow for sketch of the translation vector Do not accept final answer in sector form
7. V.S.E $= 3^3 : 5^3 = 27 : 125$ Vol of larger tank $= \frac{8.1 \times 125}{27}$ $= 37.5m^3$	M1 M1 A1 3 marks	
8. $\frac{3x^2 - 1 - (2x + 1)(x - 1)}{x^3 - 1}$ $= \frac{x^2 + x}{x^2 - 1}$ $= \frac{x(x + 1)}{(x - 1)(x + 1)} = \frac{x}{x - 1}$	M1 M1 A1 3 marks	Correct expression under one denominator
9. $\text{Sin } \theta = \frac{9}{27} \times 0.333$ $\Rightarrow \theta = 19° 28 (19.47°)$ $= 19° 28° + 90$ $= 109° 281 (109.47°)$	M1 M1 A1 3 marks	Cos x – 0.333 $= 70° 32 (70.53°)$ 180 - 70° 32

SOLUTION	MARKS	ALTERNATIVE
10. $ar = 16.ar^4 = 2$ $\frac{ar}{ar} = \frac{2}{16} \Rightarrow r^3 = \frac{1}{8}$ $r = ½$ and $a = 32$	M1 A1 A1 3 marks	 or $\frac{16}{r} r^2 = 2$ Cao
11. $\angle PCB = 45°$ or $\angle DCQ = 40°$ or $\angle BCD = 140°$ $\therefore \angle BAD = 40°$	B1 B1 2 marks	Allow B1 B1 for $\angle PCQ = 140°$ $= \angle BAD = 40°$
12. $BA = 31 + 4j - (81 - j) = 51 \div 5j$ $CA = \frac{3}{5}(-51 + 5j) - 31 \div 3j)$ $DC - 2(-81 + j) - 161 + 2j)$ $DA = 2(-8j + j) + (-3j + 3j)$ $= -191 \div 5j$	M1 M1 M1 A1 4 marks	Or equivalent $BA = a - ab$ $CA + \frac{3}{5}(a - b)$ $DA - -2b + \frac{3a}{5} - \frac{3b}{5}$ $BA = a - b$
		$CA = 3(a - b) = \frac{3a}{5} - \frac{3b}{5}$ $DC = -2b$ $DA = -2b - \frac{2a}{5} - \frac{3b}{5}$ m1 $= \frac{12b}{5} + \frac{3a}{5}$ m1 $= \frac{12}{5}(81 - j) + \frac{12}{5}(31 + 4)$ m1 $= -191 \div 5j$ A1
13. $\text{Log}(x^3 \times 5x) = \log(2^5 \div \frac{2}{5})$ $x^1 \times 5x = (2^5 \div \frac{2}{5})$ $5x^2 - 80 \rightarrow x^4 = 16$ $\Rightarrow x = 2$	M1 A1 3 marks	$3 \log x \times \log 5x = 5 \log 2 \log 2$ $4 \log^5$ m1 $4 \log x - 4 \log^2$ m1 $X = 2$ m1
14. $\frac{4}{3} \times \frac{22}{7} \times r^3 = \frac{22}{7} \times 11^2 \times 5$ $r^3 = \frac{121 \times 50 \times 3}{4}$ $r = \sqrt[3]{4537.5} = 16.56$	M1 A1 2 marks	Substitutions and equating
15. $500 - 16a = b$, $16 \Rightarrow 500 = 16a + 4b$ $800 = 25a + b$, $25 \Rightarrow 800 = 25a + 5b$ $\frac{2500 - 100a + 20b}{700 = 20a}$ $a = 35$ and $b = -15$ $p = 35L - 15L$	B1 B1 A1 B1 5 marks	Attempt to eliminate one variance from variation Must come from correct variations Given if A0 lost but m1 must be correct
16. Area $= 2(8 + 6.5 + 5.6 + 6 + 6.4 + 4.7)$ $= 2(8 + 6.5 + 5.6 + 6 + 6.4 + 4.7) \times 25$ $= 2x37.2x25x100$ or equivalent $= 186000$ ha	M1 M1 A1 5 marks	At least 4 reading within 10.1 For conversion to Km^2 or km to hectares
17.(a) Area of path $= \frac{22}{7} \times 49^2 - \frac{22}{7} \times 35^2$ $= 3696m^2$ Area of slab $=$ $\frac{22}{7} \times 352 - 4 \times 4 \times 3 = 3850 - 48 = 3082m^2$ Total cost $= 3696 \times 300 + 3850 \times 400$ Amount not spent $\frac{20}{100} \times \frac{115}{100} \times 2629600$ $= 604808$ (b) Actual expenditure $= \frac{80}{100} \times \frac{115}{100} \times 2629100 = 2419232$	M1 A1 M1 M1 A1 B1 8 marks	  Cao must not loose any of A above

SOLUTION	MARKS	ALTERNATIVE

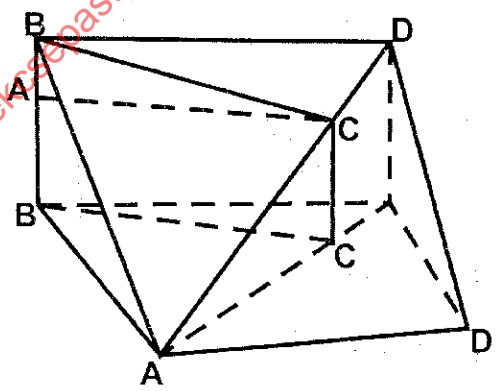
18.

UCL	19.5	39.5	59.5	79.5	99.5	11.9	139.5	159.5	179.5
CF	9	28	50	68	8	92	97	99	100

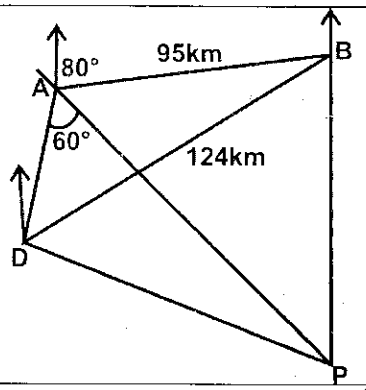
(a) Cumulative frequency — B1
Linear scale — S1 — For cf all
Plotting — P1 — Must accommodate all date
Smoothing & complete of CF curve — C1
(b) (i) Upper quartile = 90 — B1 — Reading within 1sq
Lower quartile = 36 — B1
Range = 90 − 36 = 54 — B1 — Must identify both quarterly
(ii) No. of days = 100 − 93 = 7 — B1 — Reading within 1 sq must be a CT curve
8 marks

19. P(both alive) = 0.7 x 0.9 = 0.63 — M1 A1
P(neither alive) = 0.3 x 0.1 = 0.03 — M1 A1
P(one alive) = 0.7x0.1 + 0.9x0.3-0.34 — M1 A1
P(at least one alive) = — M1 — Or equivalent 1-0.08 = 0.97
0.7 x 0.1 + 0.9 x 0.3 + 0.3 + 0.7x0.9 — M1 — Can be 1 p(neither)
= 0.7 x 0.9 x 0.3 + 0.7 x 0.9 — A1
8 marks

20. (a) BB^1 = 800 Sin 30° — M1
= 800 x 0.5 — A1
(b) (i) $Ad = \frac{800}{\text{Cos } 60} = \frac{800}{0.5}$
$\therefore AC\ \frac{3}{4}AD = \frac{3}{4} \times \frac{800}{0.5}$
= -1200m
(ii) $CB^2 = 800^2 + 1200^2 - 2 \times 800 \times 1200 \text{ Cos } 60°$ — M1
$= 800^2 + 1200^2 - 2 \times 800 \times 1200 \times 0.5$ — A1
$\therefore CB = \sqrt{1120000} = 1058$
(iii) $\frac{3}{4}BB = BB^1 = \frac{3}{4} \times 400 = 300$ — M1
$\therefore \text{Sin } \theta = \frac{400 - 300}{1058} = 0.945$ — A1
$\Rightarrow \theta = 5°\ 25(\text{"}5.42\text{"})$
8 marks



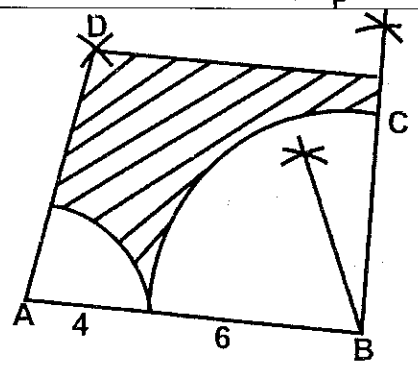
21. ΔABD constructed — B1
ΔABP constructed — B1
(i) AD = 4.5 ± 0.1CM — B1
Distance A to D = 4.5x10 = 45km — B1
(ii) Bearing D from B = 241 + 1 — B1
(iii) Bearing P from D = 123 + 2 — B1
(iv) DP = 12.9 + 0.2 CM — B1
Distance D to P = 12.9x10 = 129km — B1
8 marks



22. ∠ABC = 105° or ∠BAD = 75 — B1
Complete // gram constructed — B1
Construct of locl : AP < 6cm — B1
Area // gram = 7 x 10 Sin 105° — M1
= 7 x 10 x 0.9659
= 67.61cm²

Total area of sectors — M1
$\frac{75}{360} \times \frac{22}{7} \times 42 + \frac{105}{360} \times \frac{22}{7} \times 6^2$
= 10.48 + 33 = 43.48

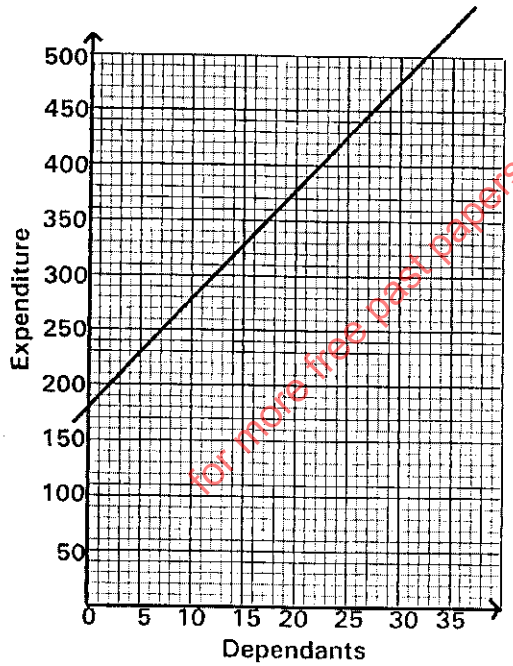
Required area = 67.61 − 43.48 — M1
24.13 — A1
8 marks



K.C.S.E 1996 MATHEMATICS PAPER 121/1 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE METHOD
1. No. | Log 36.15 | 1.5581 0.02573 | $\bar{2}.4104$ | $\bar{1}.9685$ 1.938 | 0.2874 | $\bar{1}.6811 \div 3$ | $(\bar{3} + 2.6811) \div 3$ $7,829 \times 10^{1}$ 1.8937 = 0.7829 or 0.7828	m1 m1 A1 3 marks	✓ ✓ 3 log (All logs) Additional, subtraction & division by 3 for -ve characteristic division by 3 Accept 0.78.28 or standard form
2. $3x^2 - 3xy + xy - x^2$ $3x(x-y) + y(x-y)$ $(x-y)(3x+y)$	m1 A1	Award marks for working by inspection be $(x-y)3x = y)$ m1 A1
3. $5s + 3b = 1750$.....(i) $3s + b = 850$ .....(ii) $5s + 3b = 1750$ ..... (iii) $9s + 3b = 2550$ ..... (iv) $4s = 800$ $S = 200$ $b = 250$	B1 m1 A1 3 marks	For forming simultaneous equations Elimination of equivalent T/E evidence Scores B1 M1 A1
4. $\tan 45° = \frac{h}{60}$ or $h = 60$ m $\tan\theta = \frac{60}{240} = 0.25$ $= 14.04°$ ($14° 2^{1}$)	m1 m1 A1 3 marks	Scale drawing 90°, 45 ± 1 m1 θ 45° h 80° m com⊥ m1 θ = 14° ± 1° A1
5. $67° = \angle ADB = 180° - (45 + 68)$ $31° = \angle ABD = 180° - 67 + 82$ $68° - 31 \angle DBC$ $= 37°$	m1 A1 m1 A1 4 marks	98 ∠DCB m1 37O ∠DBC A1 68° - 37° ABD m1 = 31°
6. $a = 6000$ $n = 5$ $s_5 = 32400$ $32400 = \frac{5}{2}(12000 + 20d)$ $64800 = 60000 + 20d$ $20d = 4800$ $d = 240$	 B1 m1 A1 3 marks	1st year = 6000 2nd year = 6000 + d 3rd year = 6000 + 2d 4th year = 40000 + 3d 5th year = 6000 + 4d 30000 + 10d = 32400

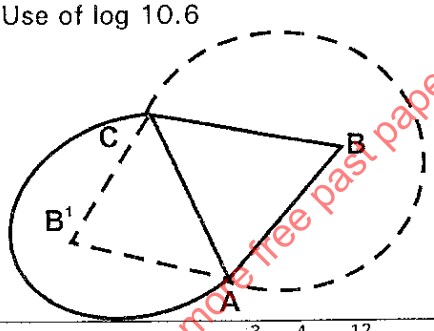
SOLUTION	MARKS	ALTERNATIVE
7. (a) $21000 \times 48 - 560000$ $10080000 - 560000$ (b) $448000 - \frac{560000 \times R \times 4}{100}$ $r = \frac{44800 \times 100}{560000 \times 4}$ $= 20\%$	M1 A1 M1 A1 4 marks	
8. Cap of the tank $= 3.4 \times 2.8 \times 3 \times 1000$ $= 20160$ litres Amount needed $= 20160 - 3600$ $= 16560$ litres Time $= \frac{16560}{0.5 \times 60 \times 60}$ $= 92$ hours	M1 M1 M1 A1 4 marks	When converting litres For the subtraction $2.4 \times 2.8 \times y \times 100 = 3600$ $y = 0.5357$
9. $17500 \times \frac{95}{5} = 332500$	M1 A1 2 marks	$\frac{5.5}{100} = 17500$ $S = 350000$ $\therefore = 350000 - 17500 = 332,500$
10. 25, 289, 4, 484, 4 806 $O = \sqrt{\frac{806}{5}}$ $= \sqrt{161.2}$ $= 12.7$	B1 M1 A1 4 marks	B0 if item missing For $\frac{806}{5}$ For sqrt. Method of S.D manipulation if B0
11. $A^2 = \begin{Bmatrix}1 & 2\\4 & 3\end{Bmatrix}\begin{Bmatrix}1 & 2\\4 & 3\end{Bmatrix} = \begin{Bmatrix}9 & 8\\16 & 17\end{Bmatrix}$ $B = \begin{Bmatrix}9 & 8\\6 & 17\end{Bmatrix} = \begin{Bmatrix}1 & 2\\4 & 3\end{Bmatrix} - \begin{Bmatrix}8 & 6\\12 & 14\end{Bmatrix}$	M1 A1 M1 A1 A1 4 marks	 If A1 above lost But first must be second
12. $\frac{5}{2}\theta$ - 210°, 330 $\theta = \frac{420°}{5}, \frac{660°}{5}$ $= 84°, 132°$	B1 B1 2 marks	
13. B.P $= \frac{144}{6} \times 100 = 2400$ S.P $= \frac{165}{100} \times \frac{144}{6} \times 100 = 3960$ Let pineapples sold at Sh. 72 for every 3 be x and at Sh. 60 for every 2 be $144 - x$. $\frac{144-x}{2} \times 60 + \frac{x}{3} \times 72 = 3960$ $4320 - 30x + 24x = 3960$ $60x = 360$ $x = 60$	M1 M1 A1 3 marks	BP $= \frac{144}{6} = 100$ SP $= \frac{x}{3} \times 72 + \frac{144x}{2} \times 60$ $24x + (144 - x)30$ $24x + (144 - x)30 - 2400$ $= 2400$ m1 $= 55$ m1
14. $\frac{2T}{m} = U^2 - V^2$ $V^2 = U^2 - \frac{2T}{3}$ $V = \sqrt{U^2 - \frac{2T}{m}}$	M1 M1 A1 3 marks	$Mu^2 - Mv^2 = 2T$ m1 $MV^2 = Mu^2 = 2T$ $V^2 = Mv^2 - 2T$ m1 $V^2 = \frac{Mu-2T}{M}$ $V = \sqrt{\frac{Mu^2-2T}{M}}$ m1

SOLUTION	MARKS	ALTERNATIVE
15. R = 8.5 r = 5.5 $v = \pi R^2h - \pi r^2h$ $= \frac{22}{7} \times 14(8.5 - 5.5)(8.5 \div 5.5)$ = 44 (3) (14) = 1848	B1 M1 A1 3 marks	 Award m1 for (8.5 – 6.5) (8.5 + 6.5) only CAO
16. Let speed of B be x km/h and " " A be (x + 5) km/h Time for A = $\frac{3120}{x+5}$ hrs Time for B = $\frac{3120}{x}$ hrs $= \frac{3120}{x} - 4 = \frac{3120}{x+5}$ $3120(x + 5) - 4x(x^{15}) = 3120x$ $3120x + 15600 - 4x^2 - 20x = 3120x$ $4x^2 + 20x - 15600 = 0$ $x^2 + 5x - 3900 = 0$ $(x - 60)(x + 65) = 0$ x = 60km/h	B1 M1 M1 A1 5 marks	Speed A 15x, B is x – 5 A = $\frac{3120}{x}$ B = $\frac{3120}{x-5}$ $\frac{3120}{x} - 4 = \frac{3120}{x+5}$ m1 $3120(x - 5) + 4x(x - 5) = 3120x$ m1 $x^2 - 5x - 39600 = 0$ m1 $(x - 65)(x \div 60)$ x = 60km/h A1
17. (a)  (b) gradient = $\frac{440 - 305}{25 - 12} = 10\frac{5}{13} = 10.385$ (c) $e = \frac{135}{13}d + 175$ (d) $E = \frac{135}{13}(9) + 175 = 268.46$		
18. (a) 13120 + 3000 = 16420 sh per month $\frac{16420}{20}$ = £821 (i) 325 x 2 = 650 325 x 3 = 975 171 x 4 = 684 2309 before relief		

(ii) 2309 – 455 = 1854 (b) Other deductions 100 + 280 + 2624 = 3004 (i) Total monthly deductions = 488 (ii) Net income = 16420 – 4858 = 11,562/=		
19. $y = 3x^2 - 4x + 1$ (a) $\frac{dy}{dx} = 6x - 4$ where $x = 2\ \frac{dy}{dx} = 8$ (b) Let m(xy) be a point on the curve (i) $\frac{y-5}{x-2} = 8$ $y = 8x - 16 + 5$ $y = 8x - 11$ (ii) $\tan\theta = 8$ $\theta = 82.8°$ (iii) gdt of perpendicular = $^{-1}/_{8}$ $\frac{y-5}{x-2} = {}^{-1}/_{8}$ $8y - 40 = -x + 2$ $8y + x = 42$		
20.(a) 131 + 49 = 180° (b) $\frac{180}{360} \times \frac{22}{7} \times 2 \times 6370 \cos 36 = 16{,}196.18\text{km}$ (c) $\frac{x}{360} \times \frac{22}{7} \times 2 \times 6370 \cos 36 = 840$ $x = \frac{840 \times 9}{11 \times 91 \times 0.8090} = 9.34$ Town C longitude = 131° - 9.34° = 121.66°W		
21.(a) $\frac{x-5.5-5-4.25-3.75}{y-16.25\ 12\ 6.56\ 3.56}$ $y = x^2 + 2x - 3$ (b) A = 0.5(18.56 + 14.06 + 10.06 + 6.56 + 3.56 + 106) 0.5 x '53 x '53.86' = 26.93s1 units (c) (i) $= \frac{x^3}{3} + x^2 - 3x \begin{matrix}3\\-6\end{matrix}$ = 9 + 18 = 27 sq units (ii) $\frac{27-26.93 \times 100}{27}$ $= \frac{0.07}{27} \times 100$ $= (0.2592\%, 0.2593\%)$	B1 M1 A1 M1 A1 M1 A1 8 marks	
22.(a) (1) AC = OA + OC = a + b (b) BN = BA + AN = -b $\frac{-2a}{3}$ (c) (i) AX = hAC, BX = kBN OX = OA + AX = a + h(b–a).....(1) OX = OA + AB + BX a + b + K(-b – 2a) .....(2) (1 - h) a + hb = $\frac{(1-2k)}{3}$ a + (1 – k)b (1 – h) a + hb = $\frac{(1-2k)}{3}$ a + (1 – k)b 1 – h1 – 2 – k .....(3) h = 1 – k .....(4)	B1 M1 A1 M1 M1 M1 A1	

$h\frac{2}{5}$ $k = \frac{3}{5}$ (ii) $OX = a + \frac{2}{5}(b - a)$ $= \frac{3a}{5} + \frac{2b}{5}$	B1 8 marks	
23.(a) Bisecting ∠BAD (b) Construction of 1 at B and at A " " 45° or 135° at B Bisecting 45° or 135° to get 67½° at B Construction of 1 bisector of AB Identification of AB Identification of the centre O Identification of the locus P (c) Size of the ∠ABC = 131° ± 1°	B1 B1 B1 B1 B1 B1 B1 B1 8 marks	A construction of 67½ at A If complete circle drawn B0 unless otherwise illustrate
24.(a) (i) $P(B) = {}^{8}/_{15}$ (ii) P (g or R) = $^{7}/_{15}$ (b) (i) P (first two pens picked are both green) $\frac{2}{15} \times \frac{1}{14} = \frac{1}{105}$ or $\frac{2}{210}$ any other multiples (ii) $\frac{8}{15} \times \frac{5}{14} + \frac{2}{15} \times \frac{5}{14} + \frac{5}{15} \times \frac{8}{14} + \frac{1}{15} \times \frac{2}{14}$ $\frac{40 + 10 + 40 + 10}{15 \times 14}$ $= \frac{10}{21}$	B1 B1 B1 M1 A1 M1 M1 A1 8 marks	For tree diagram branches required For both b(i) and (ii) follow through a multiple of ratio 8:2:5 M1 All produces For summary products It tree diagram missing 0w - 1

K.C.SE 1996 MATHEMATICS PAPER 121/2 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE
1. $\sqrt{\frac{62.5 \times 25.6}{25 \times 8 \times 5}}$ $= \sqrt{16}$ $= 4$	M1 M1 A1 4 marks	Removal of dp in denominator $\sqrt{\frac{605 \times 25.6}{25 \times 80 \times 5}}$ Mt – 2 Use of log
2. $R = \frac{k}{d^4} - 2 - \frac{k}{3^2}$ k = 18 When d = 4 $R = \frac{18}{4^2} = \frac{18}{16}$ $= 1.125$ or $1\frac{1}{8}$	M1 M1 A1 3 marks	See constant K – m1 But first m0 Use 'his' k but A0 Or $\frac{9}{8}$ CAO
3. Let Ali have a goats $= a+a+2+3(a+2)+a+2+3(a+2-10$ $= 9a + 6$ $9a + 6 - 17 \times 3$ $9a = 45$ A = 5 Odupoy sold 28 – 10 = 18 goats	B1 M1 A1 4 marks	or the total must be for all or equivalent 3m – 12, 3k – 12 m-7, k = 12 allow if B1 and m1 are earned
4. Ksh. bought = 98 x 84 = 77112 £ bought = $\left\{\frac{918 \times 84}{85}\right\}$ = £ 907.2 £lost = £918 £907.2 = £10	M1 M1 A1 3 marks	$\frac{77112}{85}$ m1 $\frac{918}{85}$ 918 $\frac{92.81}{85} = 10.8$ $\frac{918}{85} \frac{(155-84)}{85} = \frac{918}{85} = 10.8$
5. Use of log 10.6  	M1 M1 A1 3 marks	Construct segment centre B Identifying second centre D Constructing segment with new centre D. Note: apply 0w – 1 circle are complete and lock not identified.
6. P(both winning) = $\frac{3}{8} \times \frac{4}{7} = \frac{12}{56}$ $= \frac{3}{14}$ P(at least one winning) $= 1 - \frac{5}{8} \times \frac{3}{7} = 1 - \frac{15}{56} = \frac{41}{56}$	M1 A1 M1 4 marks	$\frac{3}{8}$ $\frac{4}{7}$ L V $\frac{3}{7}$ $\frac{8}{7}$ Or $\frac{3}{8} \times \frac{4}{7} + \frac{3}{8} \times \frac{3}{7} + + \frac{5}{8} \times \frac{4}{7}$ $\frac{12}{56} + \frac{9}{56} + \frac{20}{56} = \frac{41}{56}$
7. $1 + x2 = (2x -)^2 - 1$✓ $3x^2 - 4x - 1 = 0$✓ $x = \frac{4 \pm \sqrt{28}}{6}$✓ $= 1.549$	M1 M1 M1 A1 4 marks	Use Pythagras therorem $1 + x^2$ and $(2x - 1)^2 = 4x^2 - 4x$ Simplification and equation to zero or equivalent For choosing positive root only
8. Area = $S^4(2x^3 - 5)\,dx$✓ $= \left[\frac{x4^2}{2} - 5x\right]_2^4$✓ $= 108 + 2$ $= 110$ Sq units✓	M1 M1 A1 3 marks	Integration By numerical substitution all coordinates m1 m1 A1 4 strips area = 111.4915 8 strips area = 110.38 (110.3708)

SOLUTION	MARKS	ALTERNATIVE
9. $= 2^{3(4 \times 3)}$ $\Rightarrow 4x^2 = 12x - 9$ $4x^2 - 12x + 9 = 0$ $= (2x - 3)(2x - 3) = 0$ $x = 1\frac{1}{2}$	M1 M1 A1 3 marks	 $4x^2 = 3(4x - 3)$
10. Vol. of container $= 36 \times 24 \times 18 = 15{,}558cm^3$ v.s.f $= (L.S.F)^3 = 1:216$ $\Rightarrow 216 = 15{,}558 = \frac{15558}{216} = 72cm^2$ $1 = ? \quad 72cm^2$	B1 M1 M1 A1 4 marks	 or 6 x 4 x 3
11. Missing values of y:26, 138 Area $= \frac{1}{2} \times 2(10 + 230) + 2(6 + 26 + 70138)$ $= 240 + 480$ $= 720$	B1 M1 M1 A1 4 marks	 Integration used MR – 2 Simplification formula Simplification of inner bracket
12. $(1+a)^5 = 1 + 5a + 10a^2 + 10a^3 + 5a^4 + a^5$ $(1-02)^5 = 1-5(-0:2) + 10(-0.2)^2 + 10(-0.2)^3 + 5(-0.2) + (-0.2)^5$ $1 - 1 + 4 - 0.08 + 0.008 - 0.00032$ $= 0.40800 - 0.8032 = 0.32768$ $= 0.3277$	B1 M1 A1 3 marks	 Subtraction of a = -0.2
13. (a) (b) $AC^3 - 2(a)^2 + (2a)^2 - 8a^2$ $AC = 2a\sqrt{2} \Rightarrow \frac{1}{2} AC = a\sqrt{2}$ $\text{Cos}\,\theta = a\frac{\sqrt{2}}{3a} = \frac{\sqrt{2}}{3} = \frac{1.414}{3} = 0.4713$ $\theta = 61°\,53°\ (61.88°)$	 B1 M1 A1 4 marks	 $\text{Cos} = AC^2 + VC^2\ VA^2$ $2AC\ VC$ $\frac{2}{\sqrt[3]{2}}$ $= 0.476$
14. OUT OF SYLLABUS		
15. OUT OF SYLLABUS		
16. $(1 + \sqrt{3})(1\sqrt{3}) = 1 - 3 = -2$ $\frac{1}{1+\sqrt{3}} = \frac{1}{1+\sqrt{3}} \times \frac{1-\sqrt{3}}{1-\sqrt{3}} = \frac{1-1.7321}{-2}$ $\frac{-0.7321}{-2} = 0.366$	B1 B2 2 marks	 Must make use of -2
17. (a) (i) Total collection = Sh. 80x25x6 = Sh. 12,000 (ii) Net profit $= 1200 - (1500 + 200 + 150 + 4000)$ = Sh. 12000 + 5850 = Sh. 6150 (b) The day's collections $= \frac{80}{100} \times 12000$ Shares $\frac{2}{5} \times 3700$ or $\frac{3}{5} \times 3750$ Sh. 1500 and Sh. 2250	M1 A1 M1 A1 M1 M1 A1 8 marks	MRE – 34 trip used (i) 6000 (ii) 150 $\frac{80}{100} \times 600 = 4800$ $\frac{80}{100} \times 25 - 80 \times 69{,}600$ C.A.O. 4800 5850 $\frac{2}{3}(-10.50)$ m1 $\frac{3}{5}(-10.50)$ m1 For both CAO
18. (a) (i) $\angle BAC$ or $\angle BCA = \frac{1}{2} \times 90° = 45°$ $\angle CAD = 180-(90+25)$ or $\frac{1}{2} \times (180-2x25)$ $= 65°$ $\angle BAD = 45° + 65° = 110°$ (ii) Obtuse $\angle BOD = 2(45 + 25)$ $= 140°$ (iii) $\angle ACB = \angle BAC = 45°$ base $\angle ABE = \angle ACB = 45°$ S in all segment $\angle CBF = \angle BAC = 45°$ S in all segment $\therefore \angle ABE = \angle CBF$	M1 M1 A1 B1 B1 B1 B1 B1	 Can be indicated on diagram Or BAD – 180(25 + 45) 110° m1, m1 A1 140°m1, A1, 0w – 1 Allow B1 to ABE – 450 – CBF Adequate reason

SOLUTION	MARKS	ALTERNATIVE
19.		

Md x	f	fx	fx^3
9	4	36	324
12	7	84	1008
15	11	165	2475
18	15	270	4860
21	8	168	3528
24	5	120	2880
$\Sigma fx = 843$			

FX : 36, 84, 165, 270, 168, 120

(a) Mean $= \frac{843}{50} = 16.86$ — M1 M1 A1

(b) (i) fx^3 : 324, 1008, 2475, 4860, 3528, 2880 — M1

Variance $= \frac{15075 - 16.86^2}{50}$ — M1

$= 301.5 - 284.2$

$= 17.3\ (17.24)$

(ii) S.D $= \sqrt{17.3} = 4.159$ — M1

Or 4.152 — A1

4 marks

x	1	d	fd	Fd^2
9	4	-6	-24	144
12	7	-3	-21	63
15	11	0	0	0
18	15	3	45	135
21	8	6	48	388
24	5	9	45	405
fd = 93			Σfd^2	103

For at least 5 values

$15 + \frac{93}{50} = 16.86$

$15 + 1.86 = 16.86$

20. Location of T — B1

Location of K — B1

Location of G — B1

(a) Distance TK = 80 ± km — B1

Bearing of t from K: 043° ± 1 — B1

(b) Distance GT = 72 ± 2km — B1

Bearing of G from T: 245° ± 2° — B1

(c) Bearing of R from G: 130° ± 2° — B1

8 marks

Measure length 8.4 + 1cm

6.0 + 1cm

30 + 0.1cm

Apply if either K of G is positive located

If the diagram initially constructed

21. (a) 2nd year saving $= 2000 \times \frac{115}{100}$ — B1

$= Sh. 2300$

(b) 3rd year saving $= 2300 \times \frac{115}{100}$ — B1

$= Sh. 2645$

Compound interest formula used will earn the candidate B1 B1

(c) Common ratio $= \frac{115}{100}$ or $\frac{23}{20}$ — B1

or Equivalent $\frac{2300}{2000} - 15$

(d) $2000\ \frac{(1.15^n - 1)}{1.15 - 1} = 58000$ — M1

m0 wrong use of formula

$2000 \times 1.15^n = 8700 + 2000$

$1.15^n = 8700 + 2000$

$n\log 1.15 = \log 5.35$

$0.0607n = 0.7284$

$n = \frac{0.7284}{0.0607} = 11.99$

$= 12$

$\frac{\log 29}{\log 1.15} = \frac{\log \text{atithms}}{\log}$

$n = \frac{\log \text{arithms}}{\log} = 1.4$

(e) $S30 = \frac{2000 \times 1.1520 - 200}{0.15}$ — M1

Numerical simplification of

$\frac{2000 \times 1.1520 - 2000}{0.15}$

$= \frac{2000 \times 16.37 - 2000}{0.15} = \frac{30730}{1.15}$ — M1

$= 204800$

$= 204933$ — A1

8 marks

SOLUTION	MARKS	ALTERNATIVE
22.(a) $x > 0$ and $y > 0$ $x + y = 7$ $64x + 48y \geq 384$ or $(4x + 3y \geq 24)$	 B1	
(b) $x + y = 7$ drawn $64x + 48y = 384$ Shading	L1 B1	
(c) No. of buses for minimum cost 3 type of x and 4 type y or for $x = 3$ and $y = 4$	B1 B1 8 marks	

23.

x	20	40	80	120	140	160	180
-3 Cos 28°	-2.30	-0.52	2.82	1.50	-0.52	-2.30	-3.00
2 Sin (½ + 30°)	1.73	2	1.00	-1.00	-1	-2.00	-1.73

All values Allow B1 for all least 5 values Use of the scale Plotting -3 Cos 2° values Plotting of 2 Sin (3.2° + 30°) Curves Roots $x = 62 \pm 2°$ $x = 156 \pm 2°$	B2 S1 P1 P1 C1 B1 B1 8 marks	

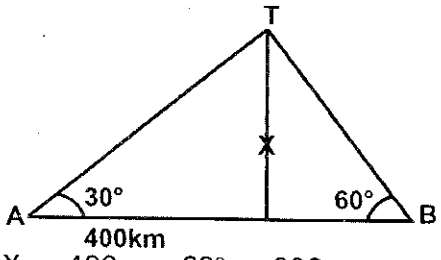
24.

x	1.1	1.2	1.3	1.4	1.5	1.6
y	-0.3	0.5	1.4	2.5	3.8	5.2
x^3	1.331	1.728	2.197	2.744	3.375	4.096

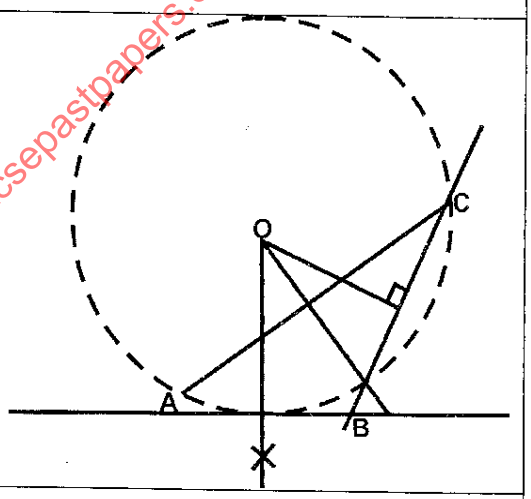
(a) All values of x^3 Allow B1 for at least 4 or if all values are correct to 1 2d p Linear scale used	B2	
(b) (i) Line of best fit drawn 4 of his points Correctly plotted Plotting points a = 2 b = -3 (ii) $y = 2x^3 - 3$	S1 P1 B1 B1 B1 8 marks	

K.C.S.E 1997 MATHEMATICS PAPER 121/1 MARKING SCHEME

	SOLUTION	MARKS	ALTERNATIVE METHOD
1.	NO LOG 1934 3.2865 x 2 6.5730 + 0.0324 3.5105 ÷ 2 $\frac{4 + 4.5105}{2}$ 2.75525 5.32825- 436 2.63950 4.884 2.6888 = 488.4 OR 488.5✓	M1 M1 M1 A1 4	all ✓ logs Multiplication and division Addition and subtaction
2.	G.C.F. = XY^2✓ $Xy^2 (x^2 - 4y^2)$ ✓ $xy^2 (x - 2y) (x+2y)$ ✓	B1 B1 B1 3	
3.	SR=RQ $\therefore$ < QRS = 55° <SQP = 550 ALT to <RSQ <STQ = 90° – 55° = 35° OR 180° – (90° + 55°) ✓ = 35°✓	B1B1 2	
4.	$\frac{ar^2}{a + ar} = \frac{16}{12} = \frac{4}{3}$ ✓ $3r^2 - 4r - 4 - 0$ $3r^2 - 6r - 2r - 4 = 0$✓ $(3r + 2) (r-2) = 0$ $r = \frac{-2}{3}$ or $r = 2$ $r = \frac{-2}{3}$ ✓	B1 M1 A1	

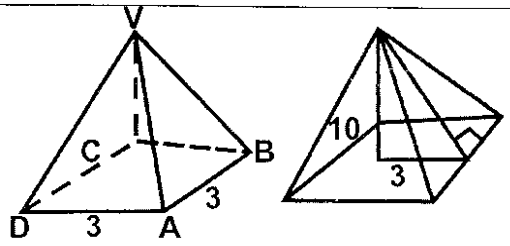
SOLUTION	MARKS	ALTERNATIVE
5.  $X = 400 \cos 60° = 200m$ $H = 200 \sin 60°$ $H = 200 \times 0.8660$ $= 173.2m$	B1 M1 A1 3 marks	For sketch ALT. METHOD $\text{Tan } 30° = \frac{h}{400 - x}$ $h = (400 - x) \tan 30°$ $\tan 60° = \frac{h}{x} \therefore h = \tan 60°$ $1.732x = 400 \times 0.5574 - 67774x$ $x = \frac{230.96}{2.3095}$ $h = \frac{230}{96} \times 1.7301 = 113.2m$
6. Volume of the cone $= {}^{1}/_{3} \times {}^{22}/_{7} \times 7 \times 7 \times 18$✓ $= 924cm^3$ Let change in height be H Volume of water displaced $= \frac{22}{7} \times 14 \times 14 \times H = 616xm^2$ $\pi = 14 \times 14 \times H = {}^{1}/_{3} \pi \times 7 \times 7 \times 18$ $H = \frac{49 \times 6}{14 \times 14} = 1.5$✓	M1 M1 M1 A1 4 marks	
7. $CR = \frac{4000 \times 100}{42,000} = 9.52$ Commission $= \frac{5}{3} \times \frac{58}{100} \times \frac{360,000}{100}$✓ = Sh. 33586.5✓	B1 B1 A1 3 marks	Accept 5891, 5891.80 When logs are used
8. (a) Mode = 934 (b) Take any no = a a = 934 - 9 = 925 (ii) $x = 925 + \frac{115}{20}$ x = 930.75	B1 B1 M1 A1 3 marks	
9. $\underbrace{\begin{pmatrix}1 & 3\\5 & 3\end{pmatrix}\begin{pmatrix}3 & 1\\5 & -1\end{pmatrix}}_{M} = \underbrace{\begin{pmatrix}3 & 1\\5 & -1\end{pmatrix}\begin{pmatrix}p & 0\\0 & q\end{pmatrix}}_{n}$ $\begin{pmatrix}18 & -2\\30 & 2\end{pmatrix} = \begin{pmatrix}3p & q\\5p & -q\end{pmatrix}$ p = 6, q = -2	B1 B1 B1 3 marks	
10. $\frac{dy}{dx} = 3ax^2 - 6x - 2$ $3ax^2 - 6x - 2 = 1$ $3a - 6 - 2 = 7$ at x = 1 3a = 15 a = 5	M1 M1 A1 3 marks	
11. Sin 0 = $\frac{4}{5}$ or -0.8 3rd Quadrant 180 + 53.13 = 233.13 4th Quadrant 360 - 53.5 = 306.87	B1 B1 B1 2 marks	

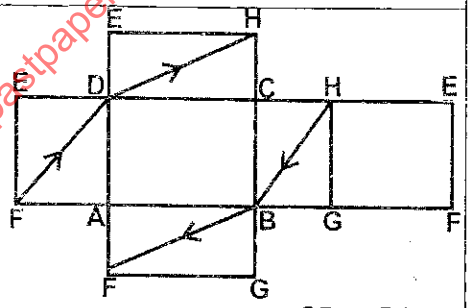
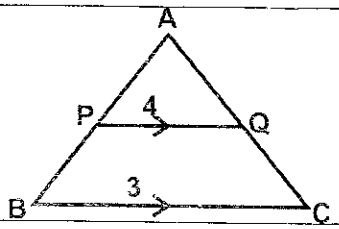
SOLUTION	MARKS	ALTERNATIVE
12. Let the buying price be x Profit = (1040 – x) Loss = (x – 880) 1040 – x = 3(x – 880) 4x = 3680 X = Sh. 920	B1 M1 A1 3 marks	
13. $y(cx^2 - a) = b - bx^2$ $bx^2(b + yc) = b + ya$ $x^2 - b + ya$ $x = \sqrt{\frac{b+ya}{b+yc}}$	M1 M1 A1 3 marks	
14. (a) $\frac{300}{t-1}$ (b) Speed of the bus $= \frac{500}{t-1}$ $\frac{500}{t-1} : \frac{300}{t-1} = 5 : 3$	B1 B1 A1 3 marks	
15. Let the cost be Sh. C – cup S – spoons 3c + 4s = 324 5c – 2s = 228 15c + 20s = 1620 15 – 6s = 684 26s = 936 s = 36 c = 60	M1 M1 A1 3 marks	
16. (a) $R = \frac{1}{0.000016} = \frac{1}{1.6} \times 10^5$ = 62500 (b) (i) Approximate value = $\frac{1}{0.00315 - 0.00313}$ $= \frac{1}{0.00002} = {}^1/_2 \times 10^5$ = 50000 (ii) Error = 62500 - 50000 = 12500	M1 A1 M1 A1 B1 3 marks	
17. (a) (i) (0.8x1.2) + (1.2)x2 + (0.8x1.2) + ½x0.8x0.3x2 = 0.96 + 2.4 + 1.6 + 0.24✓ = 5.2m²✓ (ii) 0.6 x 1.2 x 2✓ = 1.44✓ (b) 300 x 1.44✓ +350 x 5.2 = 432 + 1820 = Sh. 2252✓ (c) 432(1.5)²✓ = Sh. 972✓	M1 A1 M1 M1 A1 A1 M1 A1 8 marks	

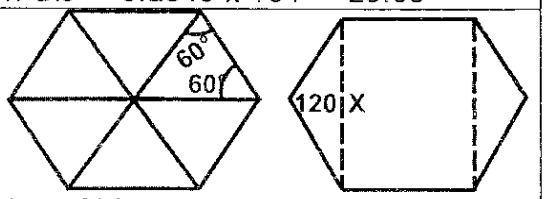
SOLUTION	MARKS	ALTERNATIVE
18.(a) (i) 120 x 27✓ = 3240✓ (ii) 120x27x1.853 = 6003.72km✓ (b) Speed in km/h $\frac{6003.72}{120}$ = 50.031km/h✓✓ (c) $\frac{\theta \times 2}{360} \times \frac{22}{7} \times 6370 \cos 5 = 6003.72$ $\theta = \frac{6003.72 \times 360 \times 7}{2 \times 22 \times 6370 \cos 5}$ ✓ = 54.19° Position (5°N. 99. 19°E)✓	M1 A1 M1 M1 A1 A1 8 marks	
19.Construct 60° / 120° Complete Δ AB = 4cm, BC = 5cm Length of AC = 7.8 ± 0.1 cm Bisectors mediators Location O Complete O drawn pasting Through vertical A1 B1 C1 Radius 4.5 ± 0.1cm Shortest distance 3.8 ± 0.1cm	B1 B1 B1 B1 B1 B1 B1 B1 8 marks	
20. x: -4, -3, -2, -1, 0, -0.5, 1, 2, 3, 4, 5 y: -14, -6, 0, 4, 6, 0.25, 6, 4, 0, -6, -14		
B1 for all values correct Line graph : y = 2 – 2x✓ (b) x = 1, x = 4✓ (both x) (c) 6 + x^2 – x = 2-2x Suitable scale Plotting Smooth curve x = 1	 L1 S1 P1 C1 B1 8 marks	 Should be correctly, read from the table Working be shown NB: Turning points of the curve must be well drawn.
21.(a) 0.9 x 0.8 = 0.72 (b) 0.1 x 0.2 = 0.02 (c) 0.9 x 0.2 + 0.8 x 0.1 Or (0.9 x 0.2 + (0.8 x 0.1) = 0.26 (d) 1 – 0.02 = 0.95	M1 M1 A1 M1 A1 M1 8 marks	

SOLUTION	MARKS	ALTERNATIVE
22. (a) (i) $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{AB} = b - a$ (ii) CD = CB + BD $= (a - b) + {}^{1}/_{3}\,b, = \underline{a} - \frac{2}{3}\underline{b}$ (b) (i) $\underline{DE}$ = KCD $= K(a - {}^{2}/_{3}\,b)$..... (ii) In Δ ODE $\underline{OD} + \underline{DE} = \underline{OE}$ ${}^{4}/_{3}\,b + K(a - {}^{2}/_{3}\,b) = \underline{a} + m\underline{a}$ $({}^{4}/_{3} - {}^{2}/_{3}\,K)\,\underline{b} = 0$ K = 2 $K\underline{a} = \underline{a} + m\underline{a}$ K = 1 + m 2 = 1 + m m = 1	B1 B1 B1 M1 A1 M1 A1 8 marks	
23. (a) ± 180° rotation centre origin Matrix M = $\begin{bmatrix}-1 & 0\\ 0 & -1\end{bmatrix}$ $\begin{bmatrix}a & b\\ c & d\end{bmatrix}\begin{bmatrix}2 & 4 & 4\\ 0 & 1 & 3\end{bmatrix} - \begin{bmatrix}-2 & -4 & -4\\ 0 & -1 & -3\end{bmatrix}$ $\begin{bmatrix}2a+0 & 4a+b & 4a+8b\\ 2c+0 & 4c+d & 4c+d\end{bmatrix} = \begin{bmatrix}-2 & 4 & 4\\ 0 & -1 & -3\end{bmatrix}$ $2a = -2$ $\quad 4c + d = -1$ $a = -1$ $\quad d = -1$ $4a + b = 4$ $\quad m\begin{bmatrix}1 & 0\\ 0 & -1\end{bmatrix}$ $b = 4 - 4$ b = 0 $2c - 0 \quad c = 0$ (b) $\begin{bmatrix}2 & 1\\ 1 & 1\end{bmatrix}\begin{bmatrix}2 & 4 & 4\\ 0 & 1 & 3\end{bmatrix} = \begin{bmatrix}4 & 9 & 11\\ 2 & 5 & 7\end{bmatrix}$ $\begin{bmatrix}2\times2+0\end{bmatrix}\begin{bmatrix}2\times4+1\end{bmatrix}\begin{bmatrix}2\times4+3\end{bmatrix}\begin{bmatrix}4 & 9 & 11\\ 2 & 5 & 7\end{bmatrix}$ $\begin{bmatrix}2\times1+0\end{bmatrix}\begin{bmatrix}1\times4+1\end{bmatrix}\begin{bmatrix}4+3\end{bmatrix}$ A″(4,2) B″(9,5) C″(11,7) (c) Area of Δ ABC = ½ x 2 x 2 = 2cm²✓ Determinant of $\begin{bmatrix}2 & 1\\ 1 & 1\end{bmatrix}$ = 2 - 1 = 1✓ Area of Δ A″B″C″ = 1 x 2 = 2cm²✓	B1 B1 B1 B1 B1 B1 B1 B1 8 marks	
24. (a) OT = $\frac{1}{3}\begin{bmatrix}1\\ -2\end{bmatrix} + \frac{2}{3}\begin{bmatrix}4\\ 10\end{bmatrix} = \begin{bmatrix}3\\ 6\end{bmatrix}$✓ T(3,6) (b) Gradient PQ = 4, $\frac{10+2}{4-1} = 4$ Gradient normal = ${}^{-1}/_{4}$, $g_1 \times g_2 = -1$ (ii) $\frac{y-6}{x-3} = {}^{-1}/_{4}$ 4(y - 6) = (x - 3) 4y - 24 = -x + 3 4y = -x + 27 (iii) $(6\,{}^{3}/_{4} - 6)^2 + (3 - 0)^2$ $= \sqrt{9.5625}$ = 3.092 = 3.09 (Sig. Fig) Or 3.093	M1 A1 M1 A1 B1 A1 B1 A1 8 marks	

K.C.SE 1997 MATHEMATICS PAPER 121/2 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE
1. $\frac{19 \times 32}{20 \times 38}$ $= 0.8 = \frac{4}{5}$	M1 M1 2 marks	 for✓ removal of decimal points or 0.032 and 0.0038 stated in standard form.
2. Let number of ten shillings coins be t ∴number of five shillings coins = 2t Number of one shilling coins = 21 = 3t Value = 10t+2t x5 +(21 −30x1 =72 = 17t = 51 t = 3	 B1 B1 M1 A1 4 marks	Let number of 5 – sh. coins be f Number of 10-sh. coins be ½f Number of 1-sh. coins 21 1½f ½fx 10+5ft(21 – 1½f) x 1 = 72 17f = 102 f = 6 ∴ no of 10 sh. coins = 3 A1
3. No. of yens $\frac{30000}{0.5446}$ = 55086	M1 A1 2 marks	Allow 55080 from tables
4. ✓Const. of 1bisector of BC ✓Const of 1bisector of AC or AB Locus of P drawn	B1 B1 B1 3 marks	
5. Area of the sector = $\frac{75°}{360} \times \frac{22}{7} \times 14 \times 14$ = 128.3cm Area of Δ = ½ x 14 x 14 Sin 75° = ½ x 14 x 14 x 0.9659 = (6,5) = 94.64cm (94,66) Area of segment = 128.3 – 94.64 = 33.64 or (33.68) LM	M1 M1 M1 A1 4 marks	 Simplified expression or equivalent Simplified on P Subtract at simplified numerical stage Stage and at least one area is correctly obtained.
6. Labeled sketch of the pyramid (dimensions may be implied) VN = $10^3 - 3^2$ = 109 = 10.44cm	 B1 M1 A1 3 marks	
7. $\left(\frac{1}{3}\right)^m \times (3^4)^{-1} = 3^5$ $3^{-m} - 4 = 3^5$ - m = 5 + 4 = 9 m = 9	M1 M1 A1 3 marks	For equivalent in power of 3 at least one index Alternative method -in log 27 – 1 x log 81 = log 243 -mx 1.4314.1.9085 – 23856 M1 -m = 4.2941 M1 1.4314 = -3.001 A1

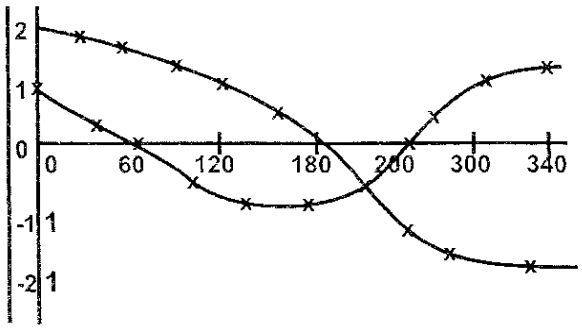
SOLUTION	MARKS	ALTERNATIVE
8. 3.55 ± 0.05, 4.85 ± 0.05, 5.7, 6.3, 6.7 & 6.9 Area = $\frac{1}{2} \times 1(0 + 7 + 2(3.6 = 4.9 + 5.7 + 6.3 + 6.7 + 6.9)$ $= \frac{1}{2}\ 1(7 + 68.20)$ $= 37.6$	B1 M1 M1 A1 4 marks	For any 4 middle ordinates interval of ½ MR – 2 Use of formula all individual trapezia are for simplification of inner brackets in a trapezoidal rule Mid ordinate rule use MR - 2
9. $(1-3x)^3 = 1 + 5(-3x) + 10(-3x)^2 + 10(-3x)^3$ $= 1.15x + 90x^2 - 270x3 + ...$ $= 3x - 0.03$ or $x = 0.1$ $(0.97)5 = 1\text{-}15(0.01) + 90(0.01) - 270(0.0)$ $= 1 - 0.15 + 0.009 - 0.00027$ $= 0.85873$ $= 0.8587$ to d.p	M1 A1 B1 M1 A1 5 marks	For complete expansion to the expansion accept only to x3 incase of any (condone) error or $1 + (5t\text{-}0.03) + 10(0.03)^2 + 10(-0.03)^3$
10. Any✓ drawn and labeled net of a net of a cuboid (condone net of a cube✓ path drawn All ✓ directions (condone a net of cube a ward first) B1. Diff net 12mm	B1 B1 B1 3 marks	 GF = BA
11. (i) AQ : QC = 4:3 allow 8:6 (ii) QC = $\frac{3}{7} \times 14 = 6cm$	B1 B1 2 marks	
12. $\frac{\sqrt{14}(\sqrt{7}+\sqrt{2}) - \sqrt{14}(\sqrt{7}-\sqrt{2})}{(\sqrt{7}-\sqrt{2})(\sqrt{7}+\sqrt{2})}$ $= \frac{\sqrt{7}\sqrt{2} + 2\sqrt{7} - \sqrt{7}\sqrt{2} + 2\sqrt{7}}{7-2}$ $\frac{4\sqrt{7}}{5}$ $\therefore a = \frac{4}{5}$ $b = 0$	M1 M1 A1 A1 4 marks	Single term or Write common 2 terms with common denominator expansion of both numerator & denominator
13. OUT OF SYLLABUS		
14. Let Onduso take x days $\Rightarrow$ Mogaka takes x + 5 days $\therefore \frac{1}{x} + \frac{1}{x+5} = \frac{1}{6}$ $6(x + 5) + 6x = x(x + 5)$ $x^3 - 7x - 30 = 0$ $(x - 10) = x + 3)$ $X = 10.3$ $\therefore$ Onduso takes 10 days	M1 M1 M1 A1 4 marks	Or equivalent ✓equivalent (removal of all denominators) Equivalent for factorization or use of formula

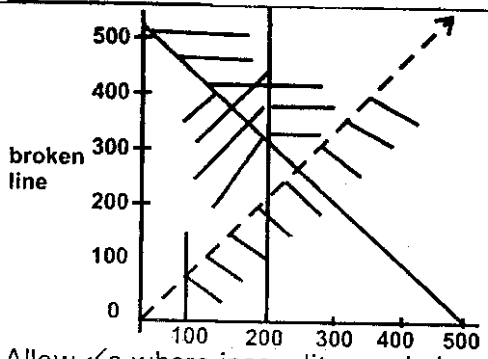
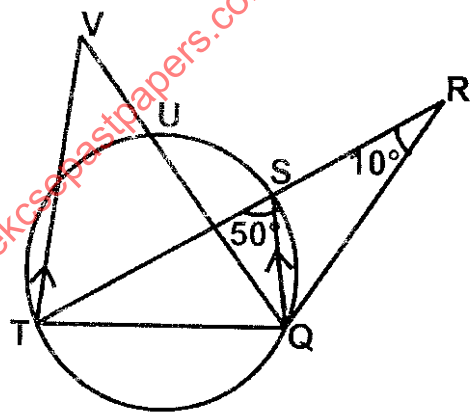
SOLUTION	MARKS	ALTERNATIVE
15. Speed of slower athlete $= \frac{800}{108}$ $\therefore$ Distance $= \frac{800}{108} \times 4$ $= 29.63$	M1 A1 2 marks	Slower speed $\frac{800}{108}$ Distance $= \frac{800 \times 104}{108}$ R.V $= \frac{800}{104} - \frac{800}{108}$ $= 0.2849$ $\therefore$ Dis $= 0.2849 \times 104 = 29.63$
16. (i) Area of Equi. $\Delta = \frac{1}{2} \times 6 \times 6 \times \text{Sin } 60°$ $= \frac{1}{2} \times 6 \times 6 \times 0.8669$ $= 15.588(15.59)$ X-section Area $= \frac{1}{2} \times 6 \times 6 \times 0.8660 \times 6$ $= 15.59 \times 6$ $= 93.54(93.528)$ (ii) Vol. of prism $= 93.54 \times 30$ $= 2806.2(2805.9)$	M1 M1 A1 M1 A1 5 marks	 Area of Isis $\Delta = \frac{1}{2} \times 6 \times 6 \times \text{Sin } 120°$ $= \frac{1}{2} \times 6 \times 6 \times 0.8660$ $\frac{1}{2} \times 6 \times \sin 30° = 15.57 \Rightarrow x = 10.35$ x-sec area $= 15.59 \times 2 + 6 \times 10.3$ $= 93.52$ A1 Vol. $= 93.52 \times 30$ M1 $= 2805.6$ A1
17. (a) (i) Vol $= 135 \times 0.15 = 20.25m^3$ (ii) mass $= 2500 \times 20.25$ $= 50625kg$ (50630) $=$ mass of cement $= 50625 \times \frac{1}{9}$ (b) Bags of cement $= \frac{5625}{50} = 112.5$ (c) No of lorries of sand $\frac{50625}{7000} \times \frac{4}{9}$ $= 3.214$ $= 4$ lorries	B1 B1 M1 A1 M1 A1 M1 A1 8 marks	For evaluation

18.

X	30	60	90	120	150	180	210	240	270	300	330	360
Cosx	0.87	0.5	0	-0.5	-0.87	-1.0	-0.87	-0.5	0	0.5	0.87	1.0
2cos ½x	1.93	1.73	1.41	1.0	0.52	0	0.52	-1.00	1.41	1.73	1.93	-2.00

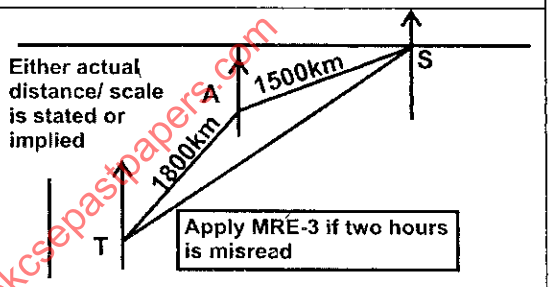
cosx✓ row 2cos½x row✓ Graph of cosx✓ Graph of 2 cos½x✓ For any error in fitting Table the graph drawn should have <that 2 points out B1✓ Period $= 720°$ Ambitute $= 2$ Enlargement of 2 about centre (0,0)	B1 B1 B1 B1 B1 B1 8 marks	Allow 1d.p apply PA once allow B1 for any 12✓ (✓) all points must be correctly B1✓ plotted using given scale Apply 0w – 1 if scale not used.



SOLUTION	MARKS	ALTERNATIVE
19. $x + y \leq 500$ $y > x$ $x \geq 200$ (b) $x + y \leq 500$ drawn and shaded $y > x$ (c) (i) No enrolled in technical = 249 No enrolled in boys = 251 (ii) Max. profit $249 \times 2500 + 251 \times 1000 - 873500$	B1 B1 B1 L1✓ L1✓ B1 B1 8 marks	 Allow ✓s where inequality symbols are wrongly applied
20. (a) $\angle QTS = 40°$ $< S$ in alt. segment (b) $\angle QRS = 10°$ Reasons : $\angle SQT = 90°$ on semi-circle $\Rightarrow \angle TSQ = 50°$ $\therefore \angle QRS = 50 - 40$ ext $<$ of $\Delta = 10°$ (c) $\angle QVT = 35°$ Reasons: $\angle QVT = <SQV$ alt, $<$s (d) $\angle UTV = 15°$ Reasons: $\angle QUT = \angle UTV + \angle QVT$ ext $<$ of Δ $UTV = 50 - 35 = 15°$	B1 B1 B1 B1 B1 B1 B1 B1 8 marks	
21. (a) $V = k_1r^2 + mr^3$ $k + m = 54.6$ $4k + 8m = 226.8$ $4k + 4m = 218.4$ $4m = 8.4$ $m = 2.1$ $k = 52.5$ $\Rightarrow K_1 = 2.1$ and $K1 = 52.5$ $\therefore V = 52.5r^2 + 42.1r^3$ (b) $V = 52.5 \times 4^2 + 2.1 \times 4^3$ $= 52.5 \times 16 + 2.1 \times 64$ $= 840 + 134.4$ $= 974.4$ (c) $52.5r^2 = 2.1r^3$ $(2.1r - 52.5)r^2 = 0$ $\Rightarrow r = 25$	B1 M1 M1 A1 M1 A1 M1 A1 8 marks	Must use different constants (or implied in the equation) (✓) if error is formed in determining the constants) (✓) condone divisions of both sides by r^3

22.

Class	14.5-18.5	18.5-22.5	22.5-26.5	26.5-30.5	30.5-34.5	34.5-38.5	38.5-42.5
Frequency	2	3	10	14	13	6	2
C. freq	2	5	15	29	42	48	50

Cumulative frequencies (a) Linear scale used Plotting d against upper class limit Complete of d curve drawn (b) (i) median = 29.5 (ii) Reading at mass 25.28 = 11 and 20 Probability $= \frac{20}{5} - \frac{11}{0} = 0.8$	B1 S1 P1 C1 B1 B1 A1 8 marks	Must accommodate all data (allow reading of varied scale) (✓)Allow curves from *a* against mid-points lower class limits upper class limits boundaries. (✓)Accept reading at *d* = 25.0 or 25½ within 1 small square. (✓)Allow the two Vs above for reading from *d* curves.
23.(a) Bearing of 060°✓ drawn Bearing of 210°✓ drawn Distance on scale drawing representing 1500 km Representing 1800 km (b) (i) Actual distance (16 ± 0.1) x 200 or equivalent = 3200km (ii) Bearing of T from S = 224° ± 1° (iii) Bearing of S from T = 044° ± 1°	B1 B1 B1 B1 M1 A1 B1 B1 8 marks	 (✓) Apply✓ if S or T is correctly located (✓)
24.(a) a+b, a+8d, a+24d (b) (i) $\frac{a+8d}{a+2d} = \frac{a+24d}{a+8d}$ $a^2+16ad+64d^2 = a^2+26ad+48d^2$ $16d^2 = 10ad$ $d(16d-10a) = 0$ $\Rightarrow d = \frac{5a}{8}$ $2(a+5d) + (a+6d) = 78$ $3a + 16 \times \frac{5a}{8} = 78$ $13a = 78$ $\Rightarrow a = 6$ $d = \frac{5}{8} \times 6 = 3.75$ (ii) $S9 = \frac{9}{2}(2 \times 6 + (9-1)\frac{15}{4})$ $= \frac{9}{2} \times 42$ $= 189$	B1 M1 M1 M1 M1 A1 M1 A1 8 marks	All the 3 terms written. Allow the terms in the form a + (n – 1)d Condone 16d = 10a For the formation of equ in one variable ✓only from an error numerical either a list

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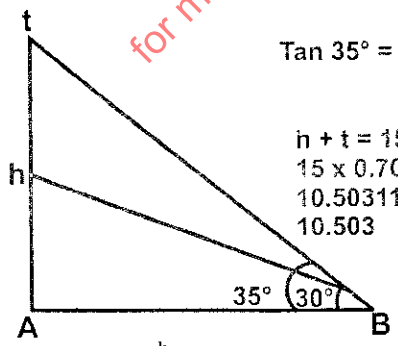
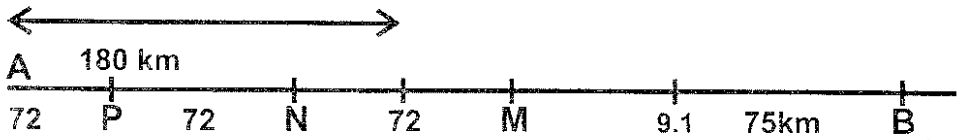
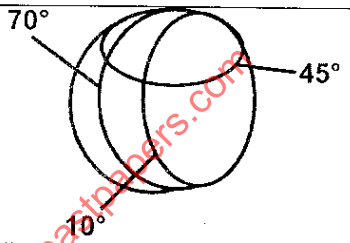
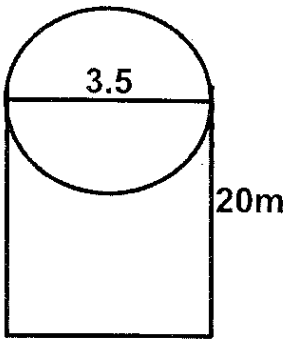
SOLUTION	MARKS	ALTERNATIVE
1. $1000\sqrt{\frac{0.0064}{100}}$ $= 1000 = \frac{(0.08)}{10}$ ✓ 1000 x 0.008 = 8✓	M1 A1 2 marks	
2. (a + b) (a – b) ✓ (2557 + 2547) (2557 – 2547) ✓ 5104 x 10 = 51040✓	B1 M1 A1 3 marks	
3. 6a + 4b = 72 ..... (i) 2a + 3b = 3.4 .....(ii) 6a + 4b = 7.2 6a + 9b = 10.2 5b = -3✓ b = $\frac{3}{5}$ ∴ 6a + $\frac{4 \times 3}{5}$ = 7.2 6a = 4.8 A = 0.8 One art book = 0.8kg One Biology book = 0.6kg✓	M1 M1 A1 3 marks	Forming inequalities Eliminating one variable Both answers correct
4. (a) ∠CDF = 110° - 60° = 50° (b) ∠ABD = ∠BDE = 25° Both reasoning given and both reasoning given wrong – ow-1✓ One reason given (right or wrong) ow - 1✓	A1 B1 1F 3 marks	Sum of two interior opposite angles add up to exterior angle. ALT. METHOD (180-(60+(180-110) =(180-130) (A0)
5. Commission = $\frac{2.4}{100}$ x 100,000 + $\frac{3.9}{100}$ x 180,000 2400 + 70.20 Sh. 5100 = Sh. 9420	M1	
6.  Tan 35° = $\frac{(h + t)}{15}$ h + t = 15 tan 35° 15 x 0.7002075 10.5031113 10.503 Tan 30° = $\frac{h}{15}$ h = 15 tan 30° h = 15 x 0.5773502 = 8.660254 h = 8.611 (b) 10.503 – 8.661 = 1.842	B1 B1 B1 3 marks	(Accept 8.66, 8.662) if log used (Accept 1.841)

SOLUTION	MARKS	ALTERNATIVE
7. $\begin{bmatrix} x & 0 \\ 5 & y \end{bmatrix}\begin{bmatrix} x & 0 \\ 5 & y \end{bmatrix}$ $\begin{bmatrix} x^2 & 0 \\ 5x+5y & y^2 \end{bmatrix}$ $\begin{bmatrix} x^2 & 0 \\ 5x+5y & y^2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ $0 \quad 5x+5y=0$ $1 \text{ if } x1, y=-1$ if x = -1, y = 1 then x = 1, y = -1 x = -1, y = 1	B1 B1 M1 A1 4 marks	
8. log y = log(10x^n) = logy = log 10 + n logx nlogx = logy – log 10 $n = \frac{\log y - \log 10}{\log x}$	M1 M1 A1 3 marks	
9. T = a + b$\sqrt{S}$ or T = b + a$\sqrt{S}$✓ a + b $\sqrt{16}$ = 24 a + b $\sqrt{36}$ = 32✓ a + 4b = 24 a + 4(4) = 24 a + 6b = 32✓ 2d = -20 -2b = -8 a + 2(-10) = 10 b = 4 a = 30✓	 B1 B1 M1 A1 4 marks	 For substitution and elimination Both answers correct
10. $S_{14} = \frac{15}{2}(2x+(n-1)d$ $= \frac{15}{2}(2 \times 30) + (14 \times -10)$✓ $\frac{15}{2}(60-140)$ = 600✓	 M1 A1 A1 3 marks	a, a+d, a+ 3d, a+d, a +2r -10 = 10 a + 2d = 10 a = 30 a + 4d = 10 m1 -2d = 20 d = 10 1st tan = 30 d = -10
11. Volume = $\Pi r^2 h = \Pi 15 \times 1.2$✓ 270Π✓ (b) $^1/_3 \pi \times r \times 9 = 270\pi$✓ $r^2 = \frac{270 \times 3}{9} = 90$ $r = \sqrt{90} = 9.49$✓	M1 A1 M1 A1	
12. Cum. Freq 3 11 30 44 50✓ $M = \frac{L1+\left(\frac{n}{2}-cfa\right)i}{f_m}$ $8 + \frac{25-11)}{19} \times 4 = 10.947$✓	B1 A1 3 marks	mdn = $L + \frac{(n-1-fc)i}{f_m}$ $7.5 + \frac{(255-11)}{19} \times 4$ m1 = 10.553 A1
13. $1600\frac{(1+r)^2}{100} = 25{,}000$✓ $\frac{(1+r)^2}{100} = \frac{25000}{16000}$ $1 + \frac{r}{100} = \sqrt{1.5625} = 1.25$✓ $\frac{r}{100} = 0.25$✓ r = 25%✓	M1 M1 M1 M1 4 marks	$\frac{25}{16} = 1 + \frac{2R}{100} + \frac{R2}{10{,}000}$ m1 16r2 + 13200r + 90,000 = 0 r2 + 200r + 5625 = 0 m1 $r = \frac{200}{2} + 250$ m $r = \frac{50}{2} = 25\%$ m
14. Cos(30θ + 120°) - $\frac{1.731}{2}$ = 0.8660 3θ + 120° = 390°⇒3θ + 120 = 330✓ 3θ = 20 3θ = 210✓ θ = 90✓ θ = 70°✓	B1 B1 B1 A1 4 marks	Both answers correct

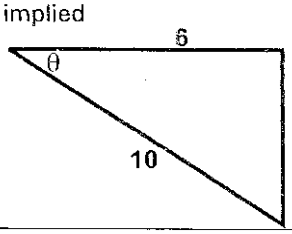
SOLUTION	MARKS	ALTERNATIVE
15. $C = 2 \times 2.8 \times \frac{22}{7} = 17.6cm$ $= \frac{C}{\Pi} = 17.6 \times \frac{7}{22} = 5.6$✓ 3.142 x 2.8 x 2 = 17.595 3.142 x 5.5 = 17.281✓ 3.142 x 5.7 = 19.909 Limits: 17.28 + 17.91✓	M1 M1 A1 2 marks	Working limit Lowe limit Upper limit 17.27 – 17.91 logs used
16.  		
Distance covered by Bus A at 10 a.m = 90 x 2 = 180km Bus B Time between 2 stops = 72 = 1.2hrs (1hr 12 min) Bus B leaves L at 9.17 a.m Distance between 9.17 – 10 a.m = $60 \times \frac{43}{60} = 43km$ At 10 a.m bus B has covered (72+43) = 115km Distance between bus A and B at 10 a.m = 360 – (180+115) = 65km	B1 B1 B1 8 marks	
17.(a) $\frac{3.5}{100} \times 50 = 1.75$ 4.75 x 30 = 1.425✓ Total = 3.175kg✓ 3.175 x 100 = 3.9688✓ 3.969✓ No of fat kg = $\frac{x}{50} \times 100 = 4$ x = 2kg fat Kg of A $\frac{3.5y}{100} + 4.75\frac{(50-y)}{100} = 2$ (50-y)Kg of B: 3y + 237.5 – 4.75y = 200 1.25 = 37.5 $y = \frac{37.5}{1.25}$ y = 30 a = 30kg b = 20kg B ≥ 20kg	M1 A1 M1 A1 M1 M1 B1 B1 8 marks	
18.(a) Taxable pay $\frac{20,000}{20} \times \frac{115}{100} - \frac{700}{20}$✓ $1000 \times \frac{115}{100} - 35$✓ 1150 – 35 = £1115 Taxable income 342x2+342x3+342+89x5 684+1026+1368+445 – 600 3523 – 600 = Sh. 2923 Net tax = 35.23 – 600 Sh. 2923 (£146.15)	M1 M1 M1 M1 M1 A1 B1 8 marks	M1 must mult. By 89

SOLUTION	MARKS	ALTERNATIVE
19. (B) $\begin{bmatrix}0 & -1\\1 & 0\end{bmatrix}\begin{bmatrix}4 & 2 & 6 & 4\\-4 & -2 & -6 & 12\end{bmatrix} = \begin{bmatrix}4 & 4 & 2 & 2\\4 & 2 & 6 & 4\end{bmatrix}$ A'(4,4) B'(4,2) C'(6,6) D'(2,4)	B1	
C (i) $\begin{bmatrix}1 & -2\\0 & 1\end{bmatrix}\begin{bmatrix}4 & 4 & 2 & 2\\4 & 2 & 6 & 4\end{bmatrix} = \begin{bmatrix}-4 & 0 & -10 & -6\\4 & 2 & 6 & 4\end{bmatrix}$ A"(-4,4), B"(0,2) C"(-6,6) D"(-6,4)	M1 A1	
d) $\begin{bmatrix}1 & -2\\0 & 1\end{bmatrix}\begin{bmatrix}0 & -1\\1 & 0\end{bmatrix} = \begin{bmatrix}-2 & -1\\1 & 0\end{bmatrix}$	M1 A1 2 marks	
20. Longitudinal difference 70 -10 = 60°	B1	
(i) Distance between x and y $\frac{60}{360} \times \frac{22}{7} \times 2 \times 6371 \cos 45°$	M1	R = 6371 cos 45
$\frac{1}{6} \times \frac{22}{7} \times 2 \times 6371 \times 0.7071 = 4719\text{km}$	A1	(Accept 4719, 4720, 4715)
(ii) Distance between x and y $\frac{4919.45}{1.85} = 2551.05\text{mm}$		
(c) Time diff = 60x4 = 240 min = 4hrs Local time at x = 10.00 am	B1 B1 8 marks	
21. (a) Are of the circular based $\frac{22}{7} \times 3.5 \times 3.5 = 38.5$ ✓	A1	
(b) Area of the curved S.A $\frac{22}{7} \times 2 \times 3.5 \times 20 = 440\text{cm}^2$✓	M1 A1 M1	
(c) $^4/_3 \pi r^2 = {}^2/_3 \times {}^{22}/_7 \times 3.5^2$✓ 44 x 0.5 x 3.5 22 x 3.5 = 77cm²✓	A1 M1 M1	
(d) 38.5 + 440 + 77 = 555.5cm²✓	A1 8 marks	
22. (a) (i) a + b✓ (ii) AD = AB + BD✓ $a + \frac{(-2)b}{3}$ $a - \frac{2a}{3}$✓	B1 M1 A1	
(b) $\frac{-2}{3}$ AD + $\frac{(-4H)}{3}$✓ $^2/_3 (a - \frac{2b}{3} + \frac{-4b}{3})$	M1	
$\frac{2a}{3} - \frac{4b}{9} - \frac{4b}{3}$ $\frac{-2a}{3} - \frac{8a}{9} = \frac{2}{3}(-a - \frac{4b}{3})$✓	A1	

(c) $\overrightarrow{PR} = \frac{1b}{9} - \frac{8a}{3}$ $\overrightarrow{px} = K\frac{(1b}{9} - \frac{8a)}{3}$ $\overrightarrow{BX} = h(-a) = ha$ $BX = \frac{-2a}{3} - \frac{8b}{9} + K\frac{(1b}{9} - \frac{8a)}{3}$ $= 2a + \frac{K8a}{3} - \frac{8b}{3} + \frac{1kb}{9}$ $= \frac{(-2}{3} - \frac{-8k)}{3}a + \frac{(8}{9} + \frac{1k)}{9}b$ $-h = \frac{2}{9} + \frac{8k}{3}$ $\frac{-8}{9} + \frac{1k}{9} = 0$ $\frac{1k}{9} = \frac{8}{9}$ $K = 8$ $+h = \frac{+2}{3} + \frac{8x}{9}k$ $= \frac{+2}{3} + 64 = \frac{66}{3}$ $H = 6^*\ \ h = 22$ $Px = 8\frac{(1b}{9} - \frac{8a)}{3} = \frac{8b}{9} - \frac{64a}{3}$ $PR : RX = 1 : 7$	M1 M1 A1 8 marks	$PX = \frac{1b}{9} - \frac{1a}{3}$ $\frac{(8b}{9} - \frac{64a)}{3} - \frac{(1b}{9} - \frac{1a)}{3} = \frac{7b}{9} - \frac{56a}{3}$ $= 7(1b - 81) : PR : RX = 1 : 7$
23. CD = 5.4cm Not to scale Line parallel to BC and 4.5 away from it BC = 5cm AD = 6cm $\frac{3}{4} \times 6 = 4.5$ (c) Location of A' line parallel to BC and 4.5 cm away from BC	B1 B1 B1 B1 B1 B1 B1 B1 8 marks	x const of 20° B1 (Check for const marks) x Length of AB Completed ABC Const of 1 from A to BC produced *Length CD = 5.4 + 0.1 – B1 (60) *Location of A1 (DA = 4.5 or AA^1 = 1.5 X location of A1 Line thro' A' parallel To BC accept equivalent statement
24. (a) (i) Treated with the drug $\frac{20}{36} = \frac{5}{9}$ (ii) treated with the drug $\frac{16}{36} = \frac{4}{9}$ 1 mark (b) (i) treated with the drug and will die $\frac{5}{9} \times \frac{1}{10} = \frac{5}{90} = \frac{1}{18}$ 2 marks (ii) $\frac{4}{9} \times \frac{1}{10} = \frac{28}{90} = \frac{14}{45}$ 2 marks (iii) $\frac{4}{9} \times \frac{3}{10} = \frac{12}{90} = \frac{6}{45} = \frac{2}{15}$ 2 marks	B1 B1 A1 B1 A1 B1 A1 8 marks	

K.C.SE 1998 MATHEMATICS PAPER 121/2 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE
1. NO | LOG 55.9 | 1.7474 0.2621 | $\bar{1}.4185$ 0.01177 | $\bar{2}.0708$ | 3.4893 | $5+\frac{2.4893}{5}=\frac{1.4979}{2.2495}$ 1.776×10^{2} $=177.6$	M1 M1 A1 4 marks	All three logs✓ ✓attempt to divide by 5
2. $\frac{3(x-1)-(2x+1)}{3x}=\frac{(3x-3-2x-1)}{3x}$ $=\frac{x-4}{3x}$ $\frac{x-4}{3x}=\frac{2}{3}$ $3x-12=6x$ $X=4$	B1 M1 A1 3 marks	Equating & removal of den
3. $\frac{\sqrt{14}+2\sqrt{3}-\sqrt{14}-2\sqrt{3}}{(14)2-(23)2}=\frac{4\sqrt{3}}{2}$ $=2\sqrt{3}$	M1 A1 2 marks	Single term with denominates expanded
4. (a) $AC=\sqrt{4^2+\frac{(4\sqrt{3})^2}{3}}=\sqrt{16+\frac{16}{3}}=\checkmark\sqrt{\frac{64}{3}}$ $\frac{8}{\sqrt{3}}$ or 4.618✓ (b) $BC=\frac{4.618}{\tan 30}=\frac{4.618}{0.5774}$ $=8$✓	M1 A1 M1 3 marks	$\frac{8}{\sqrt{3}}\div\frac{1}{\sqrt{3}}$ if A is lost
5. 1995 value $=50{,}000\times1.2$✓ $=60{,}000$ 1997 value $=60{,}000\times(1.1)^3$✓ $=79860$✓	A1 B1 M1 A1 3 marks	(7,996, 7,997, 7,998, 7,999)
6. Sh. to £ $=\frac{500{,}000}{102}=4902$✓ £ to \$ $=\frac{500{,}000}{102}\times1.7=8.333$✓ \$ to Sh. $=\frac{500{,}000}{102}\times1.7\times60.6$✓ $=505{,}000$✓	M1 M1 M1 A1 4 marks	Allow Sh. 505,100
7. Trade B.P $=\frac{84}{120}\times100$✓ $=70$✓ (b) Cost of manufacturers $=70\times\frac{100}{140}=50$✓	M1 A1 B1 3 marks	
8. (a) ✓ Const of 1 bisector of AB (b) ✓Const of 1 bisector of AC or BC Or $\angle OAB=12°\pm1°$ Or $\angle OBA=12°\pm1°$ Drawn ✓position of P on XY of AB	B $1/3$ B1 B1 3 marks	Points P and O must be on opposite sides
9. $3v-u=w+v$ $2u=w+v$	M1 A1 2 marks	*if its $3v+u=v+w$ without evidence M1A1OW -1 vector egn. Or equivalent

SOLUTION	MARKS	ALTERNATIVE
10. $3p^2 + {}^2/_3 P = 1$ $= P^2 + 2p - 3 = 0$ $(p - 1)(p + 3) = 0$ $\Rightarrow p = 10 \quad p = 3$ $\therefore 3½$ $\Rightarrow y = 0$	B1 M1 A1 B1 4 marks	or equivalent at lost if all values given
11. Initial volume $= \frac{4}{3\pi r^3} \times 2^3 = \frac{3211}{3}$ New vol $= 32\Pi \times 337.5$ $= 36\Pi$	M1 M1 2 marks	
12. Log ${}^1/_{125} x^2 =$ Log ${}^1/_{125}$ ${}^1/_{125} x^2 = {}^1/_{125}$ $x^2 = 1$ $x = 1$	M1 M1 A1 3 marks	For single logs for both sides For dropping logs must convert 3 logs 5 or log ${}^1/_{125}$ M1 for solving x condone $x \pm 1$ for A1
13. $1 + 6 \times 15^2 + 15x^2 + 20x^2 + 6x^5 + x^6$✓ $1 + 6(0.03) + 15(0.03)^2 + 20(0.03)^3$✓ $= 1 + 0.18 + 0.135 + 0.0054$ $= 1.19404$ $= 1.194$✓	B1 M1 A1 3 marks	Accept descending powers of x Allow more than 3 terms if used and if used and follow thro'
14. (a) P(all boys) $= {}^5/_{12} \times {}^4/_{11} \times {}^3/_{10}$ $= {}^1/_{77}$ (b) (2 girls) $= \frac{5}{12} \times \frac{6}{10} \times \frac{7}{12} \times \frac{5}{11} \times \frac{6}{10} \times \frac{7}{12} \times \frac{6}{11} \times \frac{5}{10}$ $= \frac{21}{44}$	M1 A1 M1 A1 4 marks	
15. Cos $\theta = \frac{6}{10} = 0.6000$ $\theta = 53°8^3 (53.13°)$	B1 M1 2 marks	For identification of the angle it may be implied  $\theta = 36.52$ or $126° 55$
16. (a) $BN^2 = 10^2 - 5^2 = 75$ $\Rightarrow BN = 8.65$ $EN^2 = 5^2 + 12^2 = 169$ $\Rightarrow EN = 13$ (b) Tan $\alpha = \frac{8.66}{13} = 0.6662$ $\alpha = 33° 40(i) \quad (33.67°)$	B1 B1 M1 A1 4 marks	
17. (a) Vol $= \frac{22}{7} \times 3.5 \times 2.8 = 107.8$ Capacity $= \frac{22}{7} \times 3.5 \times 3.5 \times 2.8 \times 100 = 107800$ (b) Water used per day $= 6 \times 15 + 80 + 60 = 230$ No of days $= \frac{107800}{230} = 468.7$ Complete days $= 468$ Water saved in 90 days $= 2 \times 15 \times 90 + \frac{20}{100} \times 60 \times 90$ $2700 + 1080 = 3780$ litre No of extra days $= \frac{3780}{230} = 16.43$ Total no of days $= 468.5 + 16.43$ $= 485.13$ Complete days $= 485$	M1 A1 A1	Conversion to litres (✓) All M but AO Water used in 90 days $90(4 \times 15 \times \frac{80}{100} \times 60 \times 80$ $= 90 \times 100 = 16920$ Water rem $= 107800 - 16 = 90880$ Total days $= 90 + \frac{908}{23}$ $= 90 + 395.13 = 485$ 0.7×107800 $\uparrow$ $\frac{3780}{230} + 160 = 17.13$ $468 + 17.3$ C.a.o

18.

x	0	30	45	60	90	120	135	150	180	225	270	315	360
2Sinx	0	1	1.4	1.7	2	1.7	1.4	1	0	-1.4	-2	-1.4	0
Cosx	1	0.9	0.7	0.5	0	-0.5	-0.7	-0.9	-1	-0.7	-1	0.7	1
y	1	1.9	2.1	2.2	2	2.3	0.7	0.1	-1	-2.1	-2	-0.7	1

B2 Both columns

(b) ✓ scale used — S1
All points✓ by plotted — P1
Smooth curve — C1
(c) $140° \pm 3° < 140° \pm 3°$ — B1
Range $0 \leq x \leq 140° \pm 3°$ — B1
$348° \pm 3° \leq x \leq 360°$ — B1
8 marks

Allow B1 for one column
(✓) for✓ simplification for two limits
accept $x < 140 \pm 3°$
Accept $x > 348 + 3°$

19.(a) $\angle RST = 104$ — B1
(b) TSU = 180 − 104 = 76° — B1
$\angle QTS = 180 - (90 - 37) = 53°$
Or $\angle QRU = 180 - 48 = 132°$
$\angle SUT = (48 + 53°) - 76$
Quadrilateral
Or $360 - (132 + 76 + 127) = 25°$ — M1 A1 A1

(c) Obtuce $\angle RUT = 76 \times 2$
$= 152°$ — M1

(d) $\angle PST = 70 - 48$ or equiv $= 42°$ — A1
8 marks

For ✓values of all is < necessary for application of < properties of triangle or quadrilateral
for✓ use in Δ of quad or equivalent (may be implied)
may be implied

20.(a) $x^2 - 2x - 3 = 0 \Leftrightarrow (x-3)(x+1) = 0$ — M1 A1

(b) $\int (x^2 + 2x - 3)\,dx = \frac{x^3}{3} - x^2 - 3x + c$ — M1

(c) $\left|x^3 - x^2 - 3x\right|_2^3 = \left(\frac{27}{3} - 9 - 9\right) - \left(\frac{8}{3} - 4 - 6\right)$
$= 1\frac{2}{3}$

$\left|x^3 - x^2 + 3x\right|_3^4 = \left(\frac{64}{3} - 16 - 12\right) - \frac{27}{3} - 9 - 9$ — M1
$= \frac{21}{3}$

Sum of areas $= \frac{12}{3} + \frac{21}{3}$✓
$= 4$✓ — M1
8 marks

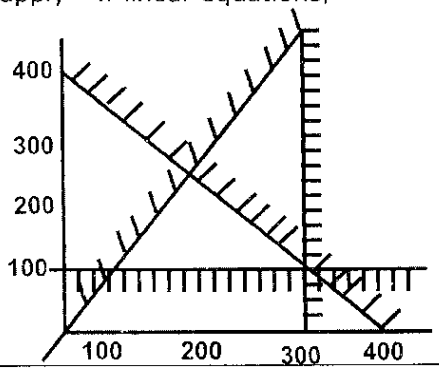
At least two in the integral
At least two terms in the integral
Allow for substitution in absolute value of $-\frac{12}{3}$

21.

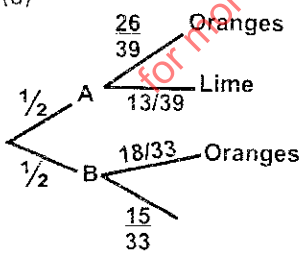
Log V	0.48	0.60	0.70	0.78	0.85	0.90
Log R	1.43	1.69	1.88	2.03	2.17	2.28

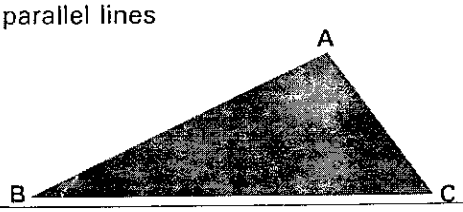
(b) Points if plotted — P1
Line of best fit drawn — L1
(c) (i) Gradient = 2 — B1
(ii) Intercept = 0.48±0.02 — B1
K = 3.02 — B1
⇒R = 3.02 — B1

✓Give one if he uses "his" scale
At least 4 points, 2 of which are
(✓) points used must be on the line
(✓)
(✓)
(✓) allow rounding off

SOLUTION	MARKS	ALTERNATIVE
22.(a) 600km and 500km seen or used (✓) scale used ✓bearing and distance of P ✓bearing and distance of Q (b) PQ = 10.6 ± 0.1 = 1060 ± 10km (c) (i) 254° ± 1° (ii) 074° ± 1°	B1 S1 B1 B1 B1 B1 B1 B1 B1 8 marks	(✓) measurement and conversion of (✓) Apply✓ if one plane is✓ by
23.(a) PS = $(34^2 - 16^2)$ = 900✓ = 30✓ (b) Cos Pos = $\frac{17^2+17^2-30^2}{2 \times 17 \times 17} = \frac{-322}{578} = -0.5572$ ∴Pos = 123°50$^{(2)}$ (123.86) (c) Area of sector = $\frac{123.8}{360}$x3.142x17x17✓ = 312.3 Area of Δ = ½ x 17 x 17 sin 123° 50' = ½ x 17 x 17 x 0.8307✓ = 120 Area of segment = 312.3 - 120✓ = 192.3	M1 M1 A1 M1 M1 A1 8 marks	172 – 82 = 152 15 x 2 = 30 0 = 61.93 Sin 0 = 15/17 20 = 123.86 Tan ½0 = 15 ½0 = 61° 55 = 125° 50 at ½ = ½ x 15 x 8 = 60 M1 ½ segment = 156.2 – 60 M1 = 96.2 Segment = 96.2 x 2 = 192.4 A1
24.(a) x + y ≤ 400, x. y; x ≤300, y≥80 (if A and B are used throughout) (b) All 4 inequalities✓ by drawn and shaded (c) (i) x = 300 and y = 100 (ii) Max profit = 600x300+400x100 = 220,000	B3	For all inequalities (allow B2 for 3✓ and B1 for 2 apply✓ if linear equations) 

K.C.SE 1999 MATHEMATICS PAPER 121/1 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE
1. (a) $\frac{-8 \div 2 + 12 \times 9 - 4 \times 6}{56 \div 7 \times 2}$ $= \frac{-4 + 108 - 24}{16}$ $= \frac{80}{16} = 5$ (b) $5a - 4b - 2\{a - (2b + c)\}$ $= 5a - 4b - 2a + 4b + 2c$ $= 3a + 2c$	M1 M1 M1 A1 4 marks	Divisions and multiplication operations Removal of brackets
2. $\begin{bmatrix}-5\\4\end{bmatrix} + T = \begin{bmatrix}-1\\1\end{bmatrix}$ $T = \begin{bmatrix}-1\\1\end{bmatrix} - \begin{bmatrix}-5\\4\end{bmatrix} = \begin{bmatrix}4\\-5\end{bmatrix}$ $\begin{bmatrix}-4\\5\end{bmatrix} + \begin{bmatrix}4\\-5\end{bmatrix} = \begin{bmatrix}0\\0\end{bmatrix}$ The image of (-4, 5) is (0, 0)	M1 A1 2 marks	Must be in coordinate form even without the coma Also accept reflection by use of diagram
3. 2n – 4 right angles 2 x 9 – 4 = 14 right angles 14 x 90° = 1260°	M1 A1 2 marks	Accept use of triangles or quadrilaterals 3 quadrilateral and 1 triangle Reject measurement
4. Area = 3.142 x 5 x 13 = 204.23cm² If base area included M1 A0	M1 A1 2 marks	Logs used with 2.142, 204.2 or 204.3 Logs used with $\frac{22}{7}$ 204.3 or 204.4 follow through
5. (a) Area = $10 + \frac{17}{2} = 18.5$ (b) Area in hectares $= \frac{18.5 \times 50{,}000 \times 50{,}000}{100 \times 100 \times 10000} = 462.5$ ha	M1 A1 M1 A1 4 marks	Accept A = 6+9 = 15cm² A = 6+10 = 16cm² Accept 36 – (20 or 21) 16 or 15 $\frac{18.5 \times 50{,}000 \times 50{,}000}{100 \times 100 \times 10000} = 462.5$ ha Accept 462.5
6. OUT OF SYLLABUS		
7. (a)  (b) P(orange) $= \frac{1}{2} \times \frac{2}{3} + \frac{1}{2} \times \frac{6}{11}$ $= \frac{1}{2} + \frac{3}{11}$ $= \frac{20}{33}$	B1 M1 A1 3 marks	Accept $\frac{26}{39}$ $\frac{13}{39}$ $\frac{18}{33}$ $\frac{15}{33}$ Half must be indicated Or equivalent if a half used in calculation recovery of B1 mark
8. (a) $y^2 - 2x^2$cm² (b) $2x^2 = 14^2$ $x = 7\sqrt{2}$ (c) Area of the octagon Y = 14+2x = 14+2x9.9 = 33.8 A = $y^2 - 2x^2$ = 33.82 – 2 x 98 = 1142.44 – 196 = 946.44cm²		y(14 + 2x) = 2 x 2 14y + 2xy – 2 x 2 or Accept – 9.9 - 9.8999 or 2(1(y+14)x + 14y yx + 14x + 14y 1142.1 – 196 = 946.4cm²

SOLUTION	MARKS	ALTERNATIVE
9. (a) Maximum possible area 4.11 x 2.21 = 9.083 Minimum possible area 4.09 x 2.19 = 8.9571 (b) Maximum possible wastage 9.083 – 8.9571 = 0.126m^2	 M1 A1 B1 3 marks	4.11 x 2.21 and 4.09 x 2.19 9.0531 and 8.9571 9.082 8.956 8.957
10.(a) by 30th June, 1996 A = 12000 x 1.09 = Sh. 13080 (b) By 30th June 1997 A = 12000 x 1.09 + 12000 x 1.092 = 13080 + 14257.20 = Sh. 27337.20	B1 M1 M1 3 marks	(Use of tables) Accept 27330, 27340 1st m1 for 12000 x 1.092 2nd m1 for 12000 x 1.09 = 13080 13080 + 12000 = 25,080m1 m1 20,080 x 1.09 = 27337 A1
11.Construction marks for 37½ ∠ABC = 37½° ± 1° Subdivision of AB Subdivision of BC (ruler and set square) for parallel lines  	B1 B1 B1 B1 4 marks	*60°, 30°, 1°, 7½° *60°, 150°, 75°, 37½° *90°, 45°, 60°, 15°, 7½°
12.∠ABC = 180° - 117° = 63° ∠ACB = 90° ∠BAC = 90° - 63° = 27°	B1 B1 B1 3 marks	Opposite <S cyclic quadrilateral Angle in semicircle ΔABC right angled 0w – 1 if at least 1 reason mission or wrong for 90 & 63° only.
13.Length of the pipe $\frac{63}{7000}$ = (0.15 x 0.12 x 0.12 x 0.1) = 0.009 ÷ 0.006 = 1.5m	M1 M1 M1 A1 4 marks	For volume (or equivalent For x –section area For the operations Accept cm unit used all through
14.(for tangent) height of ΔABC = x√3 = $\tan^{-1}\frac{x}{x\sqrt{3}}$ = $\tan^{-1}\frac{1}{x\sqrt{3}}$ = 30°	M1 M1 A1 3 marks	Sin θ = $\frac{x}{2x} = \frac{1}{2}$ for $\frac{\sin\varsigma}{2x}$ x √5 m1 = 30° Cosθ = $\frac{x\sqrt{3}}{2x}$ = 30° For 2x, x√3 = 30°
15.$(x+y)^2 + (y-x)^2 - 2(x-y)(x+y)$ = $x^2 + 2xy + y^2 + y^2 - 2xy + x^2 + 2x^2 + 2y^2$ = $2x^2 + 2y^2 - 2x^2 + 2y^2$ = $4y^2$ = $22(2-a)^2$	M1 M1 A1 3 marks	Substitution Expansion of the sum Expansion of the difference Expansion of two squares Removal of bracket Accept $4(2-a)^2$
16.V = $3t^2 - 6t - 8$ S = ζvdv = $t^3 - 3t^2 - 8t + c = 10$ S = 1 – 3 – 8tc = 10 C = 20 8 – 12 – 16 + 20 = 0	 M1 M1 A1 3 marks	$t^3 - 3t^2 - 8t^2$ (8-12-16) – (1-3-8) -20 + 10 = -10 -10 + 10 = 0 For integration the constant must be ALT $t^3 - 3t^2 - 8t^2$

SOLUTION	MARKS	ALTERNATIVE
17. (a) $950000\left[1-\frac{5}{100}\right]^2$	M1	
$920000\left[1-\frac{5}{100}\right]^2\ \left[\frac{1-15}{100}\right]^3$	M1	
Sh. 526535	A1	
(b) 526535 x 1.25	M1	
= sh. 658169	A1	
$\left[1-\frac{r}{100}\right]^{60}=\frac{658000}{950000}=0.6926$	M1	
$1-\frac{r}{100}=\sqrt[60]{0.6926}$		
$=1-\sqrt[60]{0.6926}$	M1	
$\frac{r}{100}=\sqrt[60]{0.6926}$		
$=\frac{1}{100}-\sqrt[60]{0.6926}$		Or equivalent
= 0.0062		Accept 0.60%
R = 0.62%	A1	0.61%
	8 marks	
18. $BC^2 = 34^2 + 66^2 - 2 \times 34 \times 66 \cos 96.7°$	M1	Follow through when logs used
$= 1156+4356-4488\times0.1167$	M1	
$=5512+524$		
$=6036$		
$=\sqrt{6036} = 77.69$m	A1	
(b) Area of triangle ABC	M1	
$= \frac{1}{2} \times 34 \times 66 \sin 96.7°$		
$= 1122 \times 0.9932$	A1	Accept 115 from councils table
$= 1114m^2$		
Area of triangle PB		
$= \frac{1}{4} \times 1114$		
$= 278.5m^2$	B1	If any A0 (above is lost)
(c) Height of triangle APB		
$h = \frac{278.5 \times 2}{34} = 16.35$m		
Distance of the pipe from P		
$=\sqrt{\frac{4}{9} \times 16.35}$		
$=\frac{2}{3} \times 16.35$		
= 10.92m	B1	
	8 marks	
19. (a) ∠BAR = 80°	B1 B1	Cyclic quadrilateral and supplement of equivalent
(b) ∠STR = 30°	B1 B1	
(c) ∠BSU = 45°	B1 B1	
(d) ∠BRS = 45°	B1 B1	
	8 marks	

20. (a)

x	-2	-1.5	-1	0	1	2	3	4	5
x^2	-8	-3.4	-1	0	1	8	27	64	175
$-5x^2$	-20	-11.3	-5	0	-5	-20	-45	-80	-125
2x	-4	-3	-2	0	2	4	6	8	10
9	9	9	9	9	9	9	9	9	9
y	-23	-8.7	-1	9	11	1	-3	-1	69

For the 10 numerical points
B1 for at least 6 points

B2

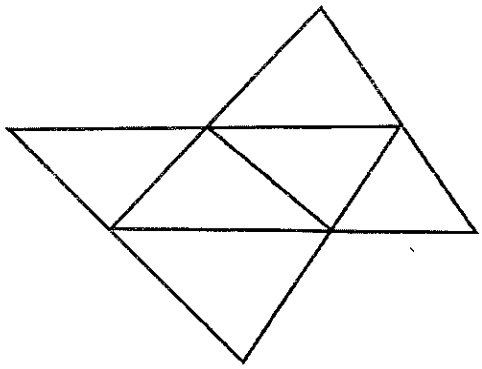
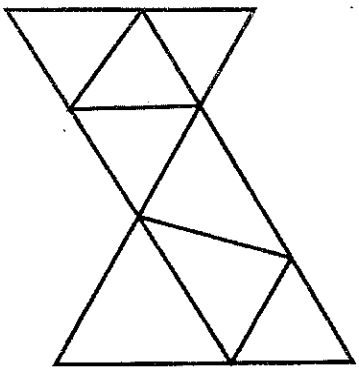
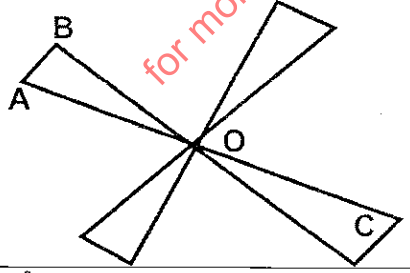
(b) On the graph : scale	S1	
Plotting	P1	Accommodates all values and uniform
Curve	C1	
(c) 2.15 ± 0.1	B1	Can score from the graph
(d) y = 4 – 4x drawn	L1 B1	
x = -0.55 ± 0.1	8 marks	(Reject coordinate form)

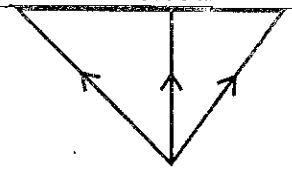
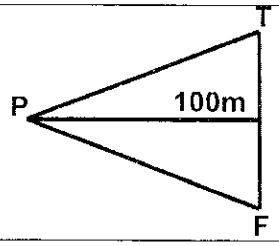
SOLUTION	MARKS	ALTERNATIVE
21.(a) (i) $AB = \underline{b} - \underline{a}$	B1	0w – 1
(ii) $AP = {}^{3}/_{8}(\underline{b} - \underline{a})$	B1	Vector sign missing
(iii) $BP = {}^{5}/_{8}(\underline{a} - \underline{b})$	B1	
(iv) OP = OA + AP or OB + BP		
$= \underline{a} = {}^{5}/_{8}(\underline{b} - \underline{a})$	M1	Direct use of ratio theorem
$= {}^{5}/_{8}\underline{a} + {}^{5}/_{8}\underline{b}$	A1	$OP = {}^{5}/_{8}\underline{a} + {}^{1}/_{8}\underline{b}$ M1 A1
(b) $OP = {}^{5}/_{8}\underline{a} + {}^{5}/_{8}\underline{b}$		
$OQ = \underline{a} - {}^{5}/_{8}\underline{a} + {}^{9}/_{40}\underline{b}$	M1	OQ or OP or AQ
$= {}^{3}/_{8}\underline{a} + {}^{9}/_{40}\underline{b}$		
		$QP = {}^{2}/_{8}\underline{a} + {}^{6}/_{40}\underline{b}$
$OQ : OP = {}^{3}/_{8}\underline{a} + {}^{9}/_{40}\underline{b} : {}^{5}/_{8}\underline{a} + {}^{3}/_{8}\underline{b}$		$OQ:QP = {}^{3}/_{8}\underline{a} + {}^{9}/_{40}\underline{b} : {}^{2}/_{8}\underline{a} + {}^{6}/_{40}\underline{b}$
$= {}^{3}/_{8}(\underline{a} + {}^{3}/_{5}\underline{b}) : {}^{5}/_{8}(\underline{a} + {}^{3}/_{5}\underline{b})$		$= {}^{3}/_{8}(\underline{a} + {}^{3}/_{5}\underline{b}) : {}^{2}/_{8}\underline{a} + {}^{3}/_{5}\underline{b}$
$= 3 : 5$		$= 3 : 2$
$OQ : QP = 3 : 2$	M1 A1	
	8 marks	
$OQ = a - {}^{5}/_{8}\underline{a} + {}^{9}/_{40}\underline{b}$		(b1)
$= {}^{3}/_{8}\underline{a} + {}^{9}/_{40}\underline{b}$		$OQ = OP + BP + PQ$
$OQ + kOP = K({}^{5}/_{8}\underline{a} + {}^{3}/_{8}\underline{b})$		$OP = QA + AP$
${}^{5}/_{8}\underline{a} + {}^{9}/_{40}\underline{b} = K\,{}^{5}/_{8}\underline{a} + {}^{3}/_{8}\underline{b}$		$OP = QA + AP$
$3({}^{5}/_{40}\underline{a} + {}^{3}/_{40}\underline{b}) = 5k({}^{5}/_{40}\underline{a} + {}^{3}/_{40}\underline{b})$		$= {}^{5}/_{8}\underline{a} + {}^{9}/_{40}\underline{b}$
$3 = 5k$		$OQ:QP = {}^{5}/_{8}\underline{a} + {}^{9}/_{40}\underline{b} : {}^{2}/_{8}\underline{a} + {}^{6}/_{40}\underline{b}$
$k = {}^{3}/_{5}$		$= 3 : 2$
$OQ : QP = 3 : 2$		(b2)
		$OA = QA + AO/PQ + PA + AQ$
		$OQ = {}^{3}/_{8}(\underline{b} - \underline{a})\ {}^{5}/_{8}\underline{a} + {}^{9}/_{40}\underline{b}$
		$= -{}^{3}/_{8}\underline{b} + {}^{3}/_{5}\underline{a} - {}^{5}/_{8}\underline{a} + {}^{9}/_{40}\underline{b}$
		$= -{}^{1}/_{4}\underline{a} + {}^{6}/_{40}\underline{b}$
		$= -{}^{1}/_{4}(\underline{a} + {}^{3}/_{5}\underline{b})$
		$OQ:QP = {}^{3}/_{8}(\underline{a} + {}^{3}/_{5}\underline{b}) : {}^{1}/_{4}(\underline{a} + {}^{3}/_{5}\underline{b})$
		$= 3 : 2$
22.(a) (i) $(x+y)^2 = x^2 + 2xy = y + y^2 = 3^2$	B1	
$\therefore x^2 + 2xy + y^2 = 9$		
(ii) $2xy = 9 - (x^2 + y^2)$	B1	
$= 9 - 29$		
$= -20$		
(iii) $(x - y)^2 = x2 + y^2 - 2xy$	B1	
$= 29 - -20$		
$= 49$		When x or y is substituted
		$x^2 + y^2 = 29$ ..... (1)
(iv) $x - y = \pm\sqrt{49}$	B1	$x = y = 3$.....(2)
$= +$ or -7	B1	$y = 3 - x$ or $x = 3$
(b) $x + y = 3$ $\quad x + y = 3$	B1	$x = 5$ when $y = 2$
$x - y = 7$ $\quad x - y = -7$		$x = 5$ when $y = -2$
$2x = 10$ $\quad 2x = -4$	B1	22(b) can be done at a (1)
$x = 5$ $\quad x = -2$		
$y = -2$ $\quad y = 5$	8 marks	

SOLUTION	MARKS	ALTERNATIVE
23.(a) Volume of hemisphere $\frac{1}{2} \times \frac{4}{3} \times \frac{22}{7} \times 5.2^3$ 10.4:10:4: :11: h – H = 3h Big cone V1 $= \frac{1}{3} \times \frac{22}{7} \times \frac{5.2^2}{3} \times h$ V1 – V2 - $\frac{1}{3} \times \frac{22}{7} \times \frac{5.2^2}{3} \times \left(3 - \frac{1}{9}\right) h$ $\therefore \frac{1}{3} \times \frac{22}{7} \times \frac{5.2^2}{3} \times \frac{26}{9} h$ $\frac{26}{9} h = 10.4$ $h = \frac{10.4 \times 9}{26} = 3.6$ therefore height of the frustum = 2h = 7.2cm (b) $L = \sqrt{3.62 + \left[\frac{5.2}{3}\right]^2} = 3.995$ $L = \sqrt{10.8^2 + 5.2^2} = 11.98$ Area $= \Pi r^2 + \Pi RL - \Pi rl$ $= \frac{22}{7} \times 3 + \frac{22}{7} \times 5.2 \times 11.98 - \frac{22}{7} \times \frac{5.2}{3} \times 3.995$ = 9.429 + 195.8 – 21.76 = 183.469 = 183.5cm^2	M1 M1 M1 A1 M1 M1 A1 8 marks	
24.(a) x 2 3 4 5 6 7 8 y 3 5 9 15 23 33 45 (b) $A = 1 \times 1 \times \{(3 + 45) + 2(5 + 9 + 15 + 23 + 33)\}$ $= \frac{1}{2}(48 + 170)$ = 109 (109.25) (c) $\int_2^{-8} (x^2 - 3x + 5) dx$ $= \frac{x^3}{3} - \frac{3x^2 + 5x}{2} \Big\vert_2^8$ $= \left[\frac{8^3}{3} - \frac{3 \times 8^2}{2} + 5 \times 5\right] - \left[\frac{2^3}{3} - \frac{3 \times 2^2}{2} + 5 \times 2\right]$ = 108 (d) It would given an underestimate because the line for the trapezium run below the curve in the region.	B1 M1 M1 A1 M1 M1 A1 B1 8 marks	

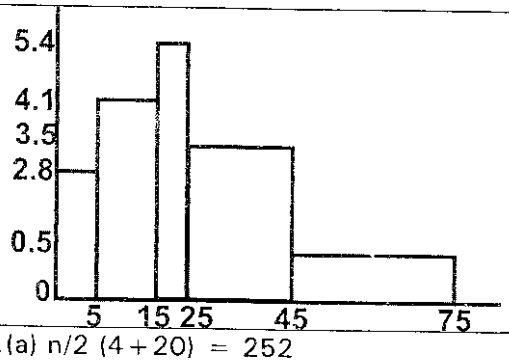
K.C.SE 1999 MATHEMATICS PAPER 121/2 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE
1. NO | LOG 6.79 | 0.8319 0.3911 | $\bar{1}$.5923 + 0.4242 Log 5 = 0.6990 | 1.8445 0.5797 | (0.5797÷4 X 3 | 0.1449 1.7391÷ 4 | X 3 2.721⇐(0.4347) | 0.4347	M1 M1 A1 3 marks	Logs of numbers in numerator for 1.8445 and operators inside brackets M1 Power used
2. $2 \leq 3 - x$ $\quad 3 - x < 5$ $-1 \leq -x \quad -x < 2$ $1 \geq x \quad x > 2$ $-2 < x \leq 1$ or $\geq x > -2$	B1 2 marks	B1 for inequalities rightly solved
3. (a) Mass of maize in $\frac{5}{8}$ x 72 = 45kg (b) Beans in A and B = $\frac{8}{17}$ x 170 = 80 Or maize = $\frac{9}{17}$ x 170 = 90kg Mixture B Beans 80 – 27 = 53kg Maize 90 – 45 = 45kg Ratio 53 : 45 1.1778 : 1	B1 M1 M1 A1 4 marks	Let kg of maize in B be y $\frac{45+y}{170} = \frac{9}{17}$ $\Rightarrow y = 45$ Beans in B 98 – 45 = 53
4. $2^{2x} \times 5^{2x}$ or $(2^{2x} \times 5^{2x})$ $(2 \times 5)^{2x \times \frac{1}{2}} = 10^x$	M1 A1 2 marks	
5. (a) Premium = sh. 6750 x $\frac{100}{4.5}$ = 150000 (b) Amount earned = $\frac{1}{3}$ x 4.5 x 150000 M1 Or 6750 x 2.3 x 90.100 100 x 100 = Sh. 2025	B1 A1 2 marks	Or 6750 x $^1/_3$ x $^{90}/_{100}$
6. Let $\log_3 x = y$ $y^2 - \frac{1}{2}y = {}^3/_2$ $2y^2 - y - 3 = 0$ $(2y - 3)(y + 1) = 0$ $y = {}^3/_2$ or $y = -1$ Log x = $^3/_2$ or log x = -1 $X = 3^{3/2}$ or $x = 3^{-1}$ X = 5.196 $(3\sqrt{3})$ or = $^1/_3$	M1 A1 M1 A1 4 marks	For correct factorization correct sub equivalent Correctly interpreting at least one ans. (✓) for both
7. (a) y = 3 ÷ 2 Gradient = $^1/_5$ (b) m x $^1/_5$ = -1 ⇒ m = 5 Equation $\frac{y-2}{x-1} = -5$ y = -5x + 7	B1 M1 M1 4 marks	

SOLUTION	MARKS	ALTERNATIVE
8.  Area one = ½ x 5 x 5 x 5 sin 60° Area of 6 = 6 x ½ x 5 x 5 x 0.8660 Or ½ x 5 x 4.33 x 6 x ½ x 5 x 5.3 x 6 Or 64.95 or $\frac{\sqrt{75}}{2}$	M1 A1 3 marks	 $\sqrt[6]{7.5(7.55)(7.5-5)9-5}$ $\sqrt{8.75}$ = 4.330
9. Let distance covered by bus be x km $\frac{x}{60} = \frac{220-x}{80} + {}^{3}/_{4}$ m1 4x = 3(220 – x) + 3 x 60 4x = 660 – 3x + 180 4x = 660 – 3x + 180 m1 7x = 840 X = 120 Distance bus covered 1.25 x 60 + 45	M1 M1 M1 A1 4 marks	Let time taken when both are moving to be 1hour 1. 60(t + ¾) = 220 – 809t M1 = t = 11/4h M1 time bus moving = 11.4-3.4 = 21 Dist bus covered = 2 x 60 = 120 M1 2. Relative velocity = 140 ∴ time take $\frac{220-{}^{3}/_{4}\times 60}{140}$ = 1.25h m1 = 120 M1 A1
10. $(0.96)^5 = (1-0.04)^5$ $= 1+5(-0.04)+10(-0.04)^2+10(-0.04)^3$ = 1 – 0.2 + 0.016 – 0.0000001024) = 0.81536 (0.8153728 or 0.8153726976) = 0.8154 (to 4s.f)	M1 M1 A1 B1 4 marks	Accept for up to all terms For this binomial up to 4 terms correctly (✓) at least one M1 earned
11.  	B1 B1 B1 3 marks	For line thro' 1 BC or 1 OOA Any second part drawn completing the figure
12. $8^2 + 2S - 3 = (4s+3)\ 2S - 1) = 0$ S = -¾ OR S = ½ Sine = ½ = 0 = 30° OR 150° For all 0 +ve no ow -1	M1 A1 4 marks	For both ✓apply✓I for✓ us of his values S 2. OW -1 if values of between 180° & 360° inclusive
13. No of people = $\frac{360}{144}$ x 1080 = 2700 No of children = $\frac{2700}{1110}$ – (510 – 1080) L of children = $\frac{1110}{2700}$ x 360 = 148°	M1 M1 A1 4 marks	1. Let x be no of children $\frac{510+x}{1590+x} = \frac{216}{360}$ m1 X = 1110 2. L for me = $\frac{510 \times 144}{1080}$ m1 = 68 Q 1 R For children 216 – 68 = 148°

SOLUTION	MARKS	ALTERNATIVE
14. $OQ = {}^{1}/_{3}(2i+3j+13k) + {}^{2}/_{3}(5i-3j+4k)$ Or $(2i+3j+13k) + {}^{2}/_{3}(3i-6j-9k)$ $= 4j - j + 7k$ $OQ = \sqrt{4^2+(-1)^2+7^2} = \sqrt{66}$ $= 8.124$	M1 A1 B1 3 marks	 PR = (5i-3j+4k) – (2i+3j+3k) = 3i-6j-9k Accept $\begin{pmatrix}4\\-1\\7\end{pmatrix}$
15. Ratio of work = $T_2 = {}^{1}/_{6} - {}^{1}/_{15} = {}^{1}/_{10}$ Time needed by $T_2 = {}^{1}/_{3} \div {}^{1}/_{10}$ $\frac{10}{3} = 3\,{}^{1}/_{3}$ days	M1 M1 A1 3 marks	
16. $(x^2 \div 1)(x-2) = x3 - 2x^2 + x - 2$ $\frac{dy}{dx} 3x2 - 4x + 4$ When $x = 2 \frac{dy}{dx} = 5$ $y = 0$ $\frac{y-0}{x-2} = 5$ $y = 5x - 10$	M1 M1 A1 3 marks	
17. (a) B.P per kg $= \frac{40 \times 65 + 60 \times 27.50}{100}$ = Sh. 42.50 (b) (i) S.P $= \frac{85 \times 120}{100}$ = Sh. 102 per pkt (ii) New S.P = $102 \times {}^{90}/_{100}$ = Sh. 91.80 (iii) Total realized so far $8 \times 102 \div 1285.20 - 2101.20$ $816 \div 1285.20 - 2101.20$ Original total S.P. 102×50 = 5100 New price per packet $= \frac{5100-2101.20}{28}$ = Sh. 107.10	M1 A1 M1 A1 B1 M1 A1 8 marks	(✓) Depends on the 1st M or 2nd M or 2nd M mark earned Or 42.50 x 1.2 x 100 18 in 1 sin PQT = $\frac{1005 \text{ in } 60°}{88.88}$ $= 100 \times 0.866 = \frac{0.9743}{88.88}$ $\angle PQT = 76.59$ P = 360 – (76.5 + 30) Or equivalent
18. (a) 100 tan 15° or 100 tan 1° Height = 100 x 0.2679:100 x 0.0175 = 28.54m (b) $PQ^2 = 100^2 + 702 - 2 \times 100 \times \cos 60°$ $= 100^2 + 70^2 - 2 \times 100 \times 70 \times 0.5$ $PQ = \sqrt{7900} = 88.88$m	M1 M1 A1 M1 A1 5 marks	
19. Mean of x $= \frac{4975}{184} = 22.15$	M1	

Class	x<5	x<15	x<25	x<45	x<75
5	14	20.5	29.5	17.5	2.5
10	28	41	29	35	5
H.f.w	2.8	4.1	5.9	3.5	0.5



SI✓ use of scale
B1 for appropriate height

For complete ✓ histogram
Allow B1 for 3 bars
Apply ✓ if at least 3 heights

20.(a) $n/2\ (4+20) = 252$

$n = \frac{504}{24} = 21$

$2\frac{1}{2}\{(2 \times 4) + (21-1)d\} = 252$

$d = {}^{16}/_{20} = {}^{4}/_{5}$

M1
A1
M1

✓

A1

Allow $50 \times 1.8 = 1200000$

(b) $50 \times 1.8^n = \frac{12000000}{50}$

$n \times 0.2553 = 4.3802$

$n = \frac{4.3802}{0.2553} = 17.16$

time taken 17.16×20

$= 343.2$ minutes

(5.72h)

M1

M1

A1

B1

8 marks

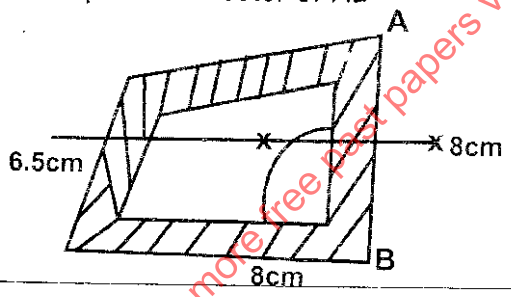
$(n-1) \times 0.2553 = 4.3802$

Allow if sum of GP used

$n - 1 = 17.16$

(✓)

21. Bisector of AB drawn interpretation of the scale path 1-0.1cm wide all round.
There are 3.5 0.1cm from Bd five points 1cm apart on bisector of AB



B1
B1
B1
B1

May be implied
(✓) allow B1 2

Allow B1 for 3 points shown
Apply all -1 for p tree in wrong region.

22.

x	0	10	20	30	40	50	60	70
10mx	0	0.176	0.36	0.58	0.84	1.19	1.73	2.75
2x+30	30	50	70	90	110	130	150	170
Sin(2x+30)	0.5	0.77	0.94	1	0.94	0.77	0.5	0.17

B1
B1
S1
P1
C1
B1

Apply all -1 if not given to 2dp

✓scale used

(✓)

For sine curve
(✓)

8 marks