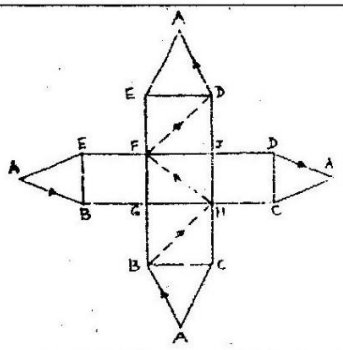
K.C.S.E 2002 MATHEMATICS 121/2 MARKING SCHEME

	SOLUTION	MARKS	COMMENTS
1.	No → log 0.0056 → $\bar{3}.7482 + 2 = \bar{2}.8741$ 1.38 → 0.1399 27.42 → 1.4381 + = 1.5780 0.001977 ← $\bar{3}.2961$	M1 M1 A1 3 marks	✓ logs (all) ✓ operations including ✓ attempt to divide by 2 accept std. form or 0.001978
2.	Fraction of work done in 1 hour by: Kipketer $\frac{1}{7}$ Wanjiku $\frac{1}{5}$ Both $\frac{1}{7}+\frac{1}{5}=\frac{12}{35}$ Time taken = $\frac{35}{12}$ = $2\frac{11}{12}$ hours	B1 B1 B1 3 marks	Allow both ✓ $\frac{\text{product}}{\text{sum}} = \frac{7\times5}{5+7} = \frac{35}{12}$ Or 2.917 hr of 2hours 55 minutes (If 2 : 55 – B0)
3.	$\frac{1}{2}\times 14 \times 8 \sin\theta = 28$ $\sin\theta = \frac{28}{56} = \frac{1}{2}$ $\theta = 30^0$ or 150^0	M1 A1 2 marks	Both values must be given
4.	Det T = (-1) (1) = (2) (1) = -3 $T^{-1} = -\frac{1}{3}\begin{pmatrix}-1 & -2\\ -1 & 1\end{pmatrix} = \begin{pmatrix}\frac{1}{3} & \frac{2}{3}\\ \frac{1}{3} & -\frac{1}{3}\end{pmatrix}$ $\begin{pmatrix}x\\ y\end{pmatrix} = \begin{pmatrix}\frac{1}{3} & \frac{2}{3}\\ \frac{1}{3} & -\frac{1}{3}\end{pmatrix}\begin{pmatrix}7\\ 1\end{pmatrix} = \begin{pmatrix}3\\ 2\end{pmatrix}$ Coordinates (3, 2)	M1, A1 M1, A1 4 marks	If a different M0 A0 Method used M0 A0 may be implied Accept X by $-\frac{1}{3}\begin{pmatrix}-1 & -2\\ -1 & 1\end{pmatrix}$ C.A.O
5.	Cost of beans in mixture = $\frac{3}{5}\times 2100$ Cost of maize in mixture = $\frac{2}{5}\times 1200$ Cost of mixture per bag = $\frac{3}{5}\times 2100 + \frac{2}{5}\times 1200$ = Sh. 1740	M1 M1 A1 3 marks	Alternative $3\times 2100 = 6300$ $2\times 1200 = 2400$ M1 $\frac{6300+2400}{5}$ M1 Or equivalent = 1740 A1
6.		B1 B1 2 marks	✓ Sketch of the net of the solid (not free hand) base must be square, other lengths must be within ✓ labeling of all verticals with the path ✓ ly shown AB and DA may be shown once Accept any other possible ne
7.	$\frac{(3^4)^{2x}\times(3^3)^x}{(3^2)^x} = 3^6$ $8x + 3x - \ldots = 6$ $9x = 6$ $x = \frac{2}{3}$	M1 A1 3 marks	Expression written in ✓ ... form Or equivalent (equating powers) When logs used ✓ logs - M1 ✓ simplification -M1 x ... A1

8. Absolute error $= 0.5 + 0.5 + 0.5 = 1.5$

$\%\text{ error} = \frac{1.5}{33} \times 100\%$

$= 4.55\%$ (to 2d.p)

$\approx 4.54\%$ (if logs used)

M1 M1 A1 — 3 marks

9. $(a-b)^6 = a^6 - 6a^5b + 15a^4b^2 - 20a^3b^3 + 15a^2b^4 - 6ab^5 + b^6$

$1.98 = 2 - 0.02$

$1.98^6 \approx 2^6 - 6(2)^5(0.02) + 15(2)^4(0.02)^2$

$= 64 - 3.84 + 0.096$

$= 60.256$

B1 B1 M1 A1 — 4 marks

With all terms given ✓ ly

May be implied

10. $QP = \begin{pmatrix} -8 \\ -2 \end{pmatrix}$

$\frac{1}{2}QR = \frac{1}{2}\begin{pmatrix} -3 \\ -4 \end{pmatrix} = \begin{pmatrix} -1\frac{1}{2} \\ -2 \end{pmatrix}$

$OT = \begin{pmatrix} -8 \\ -2 \end{pmatrix} + \begin{pmatrix} -1\frac{1}{2} \\ -2 \end{pmatrix} - \begin{pmatrix} -9\frac{1}{2} \\ -4 \end{pmatrix}$

Coordinates of T $(-9\frac{1}{2}, -4)$

B1 B1 B1 — 3 marks

11. $4x^2 - y^2 = (2x + y)(2x - y)$

$2x^2 - 7xy + 3y^2 = (x - 3y)(2x - y)$

$\therefore \frac{(2x+y)(2x-y)}{(x-3y)(2x-y)} = \frac{2x+y}{x-3y}$

M1 M1 A1 — 3 marks

Numerator ✓ ly factorise

Denominator ✓ ly factorise

Allow $\frac{(2x+y)(2x-y)}{(x-3y)(2x-y)}$

12. Dividends $\frac{5}{15} \times 81000 = 27000$

Atieno's: $\frac{5}{9} \times 27000$

$= \text{Sh } 15000$

M1 M1 A1 — 3 marks

13. a) $\angle ECA = 28^0$

$\angle AEG = 28^0$

b) $\angle CAE = 60^0$ or $\angle CEG = 120^0$ or $\angle EAG = 120^0$

$\angle ABC = 88^0$

B1 B1 B1 B1 — 4 marks

All angels may be marked on the diagram

14. a) $T_{40} = 500 + (40 - 1)\,50$

$= 500 + 1950$

$= 2450$

b) $S_{40} = \frac{40}{2}[500 \times 2 + (40-1)50]$

$= 20\,(1000 + 1950)$

$= 59000$

M1 A1 M1 A1 — 4 marks

15. a) $\angle AEB = \angle DEC$, vertically opp. $\angle$s

$\angle ABE = \angle EDC$, alternate $\angle$s

$\angle EAB = \angle ECD$, alternate $\angle$s

Δ ABE is similar to Δ CDE (AAA)

b) BE = 3ED

DB: EB = 4:3

B1 B1 B1 B1 — 4 marks

Accept any two

Apply 0W – 1 if reasons are not given

Allow $\angle AEB = \angle DEC$

$\angle ABD = \angle BDC$

$\angle CAB = \angle ACD$

16. $x^2 + 4x + y^2 - 5 = 0$

$x^2 + 4x + 4 + y^2 = 5 + 4$

$(x + 2)^2 + (y + 0)^2 = 9$

Radius $= \sqrt{9} = 3$

B1 LHS ✓ ly factorised

B1 Allow $(x + 2)^2 + y$

B1 RHS ✓ ly simplified

B1 Must be in correct form

4 marks

Alternative

M1 $(x - a)^2 + (y - b)^2 = r^2$

$x^2 - 2ax + y^2 - 2by + a^2 + b^2 - r^2 = 0$

$2ax = 4x$ & $-2by = 0 \longrightarrow$ B1

M1 A1 $a = 2$, $b = 0$

Centre $= (-2, 0) \longrightarrow$ B1

M1 $a^2 + b^2 - r^2 = -5$

$r^2 = 5 + 4 + 0 = 9 \longrightarrow$ B1

Radius $= \sqrt{9} = 3 \longrightarrow$ B1

4 marks

17. a) $\frac{d}{50} - \frac{d}{80} = 3$

$\frac{8d - 5d}{400} = 3$ $\quad 3d = 1200$ $d = 400$km

b) (i) $400 \times 0.35 + 400 \times 0.3 = 260$lit.

(ii) Total time

$\frac{400}{50} + \frac{400}{80} = 13$hr

Average consumption $\frac{260}{13} = 20$lit/hr

M1

M1 A1

M1

M1

M1, A1

8 marks

17. Alternative

$\frac{d}{t} = 80$ & $\frac{d}{t+13} = 50$

$80t = 50(t + 13)$ $\quad t = 5$

$d = 5 \times 80 = 400$

18. a) $\frac{16510 \times 12}{20} = 9906$

b) Taxation: $4512 \times 2 = 9024$

$4512 \times 3 = 13536$

$(9906 - 9024) = 882 \times 4 = 3528$

$\frac{9024 + 13536 + 3528}{12} = 26088 \div 12$

$= 2174$

c) Tax due: $2174 - 960 = 1214$

M1 A1

M1

M1

A1

M1, A1

8 marks

1st slab ✓ ly taxed

all other slabs ✓ ly taxed

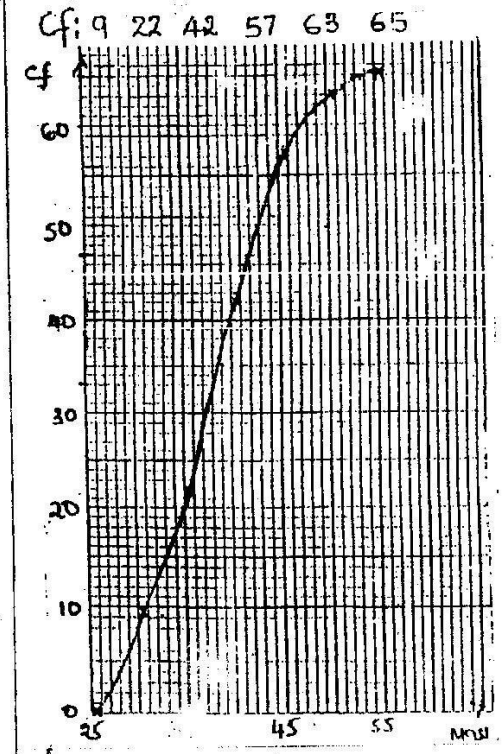
$(9024 + 13536 + 3528) - 960 \times 12$

$= 26088 - 11520$

$= 14568$

$14568 \div 12 = 1214$ (allow MR if housing is involved)

19.



B1 May be implied

P1 Plotting of against upper class limits

C1 ✓ 0 give

B1 ✓ median = 38kg ± at 32.5th (33rd)

B1 Q1 = 33kg – at 16.25th (16.5th)

OR

Q3 = 43kg – at 48.75th (49.5th)

Range: $Q_3 - Q_1$

B1 ✓ = 43-33 = 10kg

Q_1, Q_3 read from ✓ positions

M1

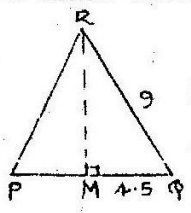
A1 $\frac{65 - 47}{65}\% = \frac{18}{65} \times 100\%$

$= 27.69\%$

Allow $\frac{19}{65} \times 100 = 29.23\%$

20. a)

(i)

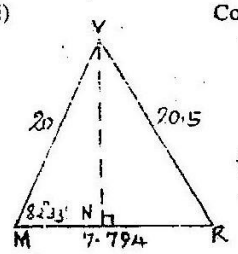


$RM = \sqrt{9^2 - 4.5^2}$ — M1 — 9 × 0.866

$= \sqrt{60.75}$ (3)

$= 7.794$ — A1 (5)

(ii)



$\text{Cos } M = \dfrac{20^2 + 7.794^2 - 20.5^2}{2 \times 20 \times 7.794}$

$= 0.1299$

$\angle M = 82^0\ 33'$

$\angle R = 75^0\ 19'$

M1 — Or equivalent

$VN = 20 \text{ Sin } 82^0\ 33'$

$= 20 \times 0.9915$

$= 19.83$ (4) — A1

(iii) $\text{Volume} = \frac{1}{3} \times \frac{1}{2} \times 9 \times 7.794 \times 19.84$ — M1

$= 231.8$ OR 232 (9) — A1 — Or equivalent (allow if MN = NR assumed) or equivalent

b) Mass (8) — M1, A1

231.8×2.7 $= 625.9g$

OR $= 626.1$ (2) (4) (5) — ✓ or 0.6259 kg

8 marks

21. a) $\frac{\pi}{12}$ used as constant width (or 0.26) — B1

$\frac{1}{2} \times \frac{\pi}{12}[(0 + 0.84) + 2(0.26 + 0.48 + 0.65 + 0.76 + 0.82)]$ — M1 — ✓ substitution in trapezoidal rule

$\frac{\pi}{24}[0.84 + 2(2.97)]$ — M1 — ✓ simplification of inner brackets

$\frac{3.142}{24} \times 6.78 = 0.8875$ (4) (6) — M1, A1 — ✓ simplifying to single term if $\pi = \frac{22}{7}$ or 3.14 apply PA –1

(6) (6)

b) Absolute error: $0.8940 - 0.8875 = 0.0065$ — M1

(4) (4)

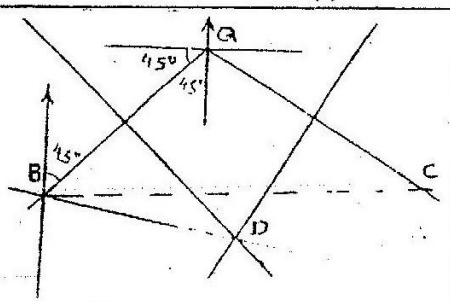
(2) — M1

$\%\text{ error} = \dfrac{0.0065}{0.8940} \times 100\% = 0.73\%$ — A1 — C.A.O

(4)

8 marks

22. a)



✓ Scale used — S1

✓ Position of B — B1 — Angles measured within 1^0 and

✓ Position of C — B1 — lengths within 0.1cm

✓ Mediator of BQ or QC of BC — B1 — D must be at the ✓ position

2nd Mediator & D identified — B1

b) (i) Distance B to C = 73 ± 1 km — B1 — May be implied if bearing is ✓

(ii) North line ✓ at B ± 2^0 — B1 — If $\angle BQC = 105^0$ the diagram is

Bearing = $102^0 \pm 1^0$ OR $S78^0E \pm 1^0$ — B1 — correct

8 marks

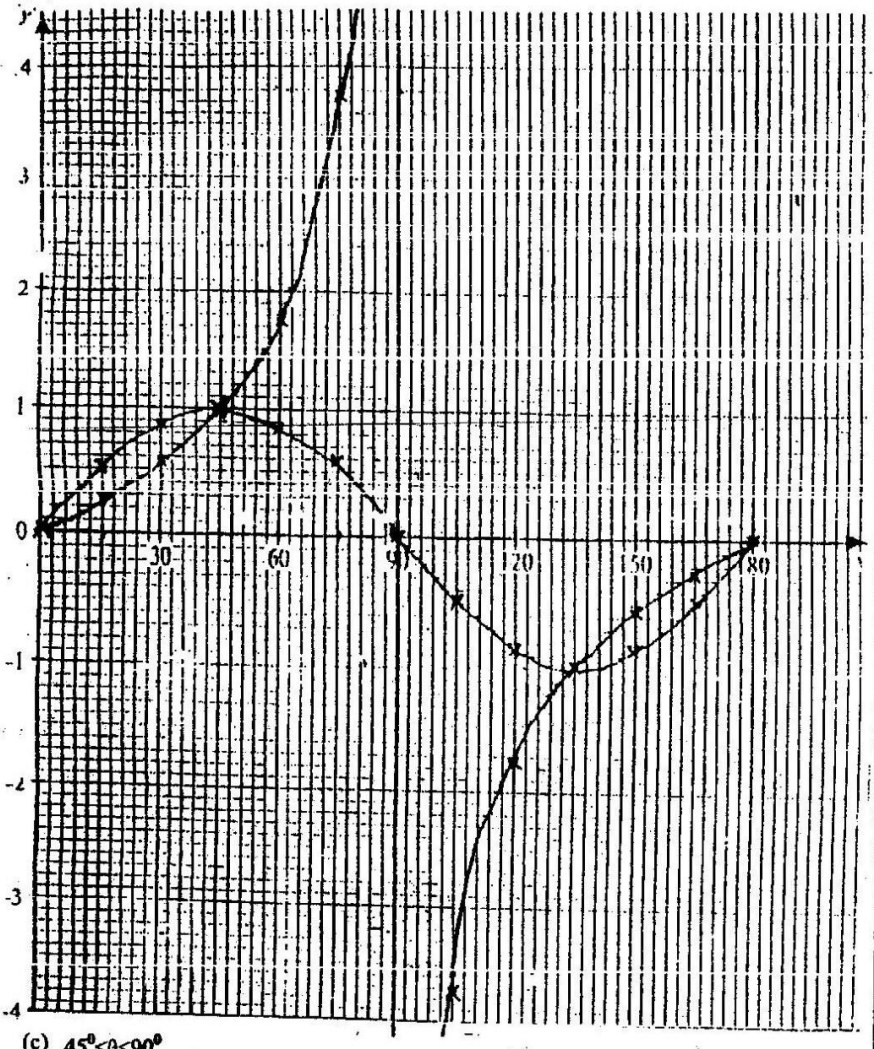
23.

(a)

θ		30^0		75^0		120^0		150^0
Tan θ				3.73				-0.58
Sin 2θ	0.87					-0.87		

B2 — Allow B1 for any 2✓

(b)



P1 — Tan curve: All points plots may be implied

C1 — Both parts of curve

B1 — Asymptote drawn or implied

B1 — Sine curve: All points plotted

C1 — Smooth sine curve

(Apply PA-1 Once on plotting If 1dp used)

(c) $45^0<\theta<90^0$ — B1

8 marks

24.

a) $\frac{ds}{dt} = 3+3t-6t^2$ $\quad \frac{d^2s}{dt_2} = 3-12t$ — M1

$a = 3 - 12\,(0)$ — M1

$= 3ms^{-2}$ — A1

b) i) $3 + 3t - 6t^2 = 0$ $\quad (t-1)(2t+1) = 0$ — M1

$t = 1$ or $-\frac{1}{2}$ $\quad t = 1$ sec — A1

ii) at $t = 1$ $\quad S = 3(1) + \frac{3}{2}(1)^2 - 2(1)^3$ — ONLY $t = 1$ sec

$= 3 + \frac{3}{2} - 2$ $\quad = 2\frac{1}{2}$m — B1

c) $3 - 12t = 0$ $\quad = \frac{1}{4}$

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

$= 3 + \frac{3}{4} - \frac{6}{16}$ — Or 3.375

$= 3\frac{3}{8}$m/s

marks