K.C.S.E 1999 MATHEMATICS PAPER 121/2 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE METHOD
1. NO | LOG 0.97 | 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	Logs of numbers in numerator for 1.8445 and operators inside brackets M1 Power used
2. $2 \leqslant 3 - x$ $\quad 3 - x < 5$ $-1 \leqslant -x$ $\quad -x < 2$ $1 \geqslant x$ $\quad x > -2$ $-2 < x \leqslant 1$ or $1 \geqslant x > -2$	 B1 2	B1 for inequlities rightly solved
3. a) Mass of maize in 5/8 x 72 = 45 kg (b) Beans in A and B = 8/17 x 170 or maize = 9/17 x 170 = 80 kg = 90 kg mixture B Beans 80 - 27 = 53 kg Maize 90 -45 = 45 kg Ratio 53 : 45 1.1778:1	B1 M1 M1 A1 4	ALT METHOD Let kg of maize in B be y $\frac{45 + y}{170} = \frac{9}{17}$ $\Rightarrow y = 45$ Beans in B 98 - 45 = 53 M1
4. $2^{2x} \times 5^{2x}$ or $(2^{2x} \times 5^{2x})$ $(2 \times 5)^{2x \times \frac{1}{2}} = 10^{x}$	M1 A1	Ratio 53:45
5. Premium = sh. $6750 \times \frac{100}{4.5}$ = 150000 (b) Amount earned = 1/3 x 4.5 x 150000 M1 or 6750 x 2.3 x 90.100 100 x 100 = Sh. 2025	 B1 A1	or $6750 \times {}^{1}/_{3} \times {}^{90}/_{100}$
6. Let $\log_3 x = y$ $y^2 - {}^{1}/_{2}y = 3/2$ $2y^2 - y - 3 = 0$ $(2y - 3)(y + 1) = 0$ $y = 3.2$ or $y = -1$ Log $x = {}^{3}/_{2}$ or log $x = -1$ $x = 3^{\frac{3}{2}}$ or $x = 3^{-1}$ $x = 5.196$ $(3\sqrt{3})$ or $x = 1$	 M1 A1 M1 A1 4	For correct factorization correct sub equivalent Correctly interpreting at least one ans. (✓) for both
7. a) $y = \frac{1}{2}x + 2$ gradient = $^{1}/_{2}$ (b) m x $^{1}/_{2} = -1 \Rightarrow m = -2$ Equation $\frac{y - 2}{x - 1} = -5$	P1 M1 M1	

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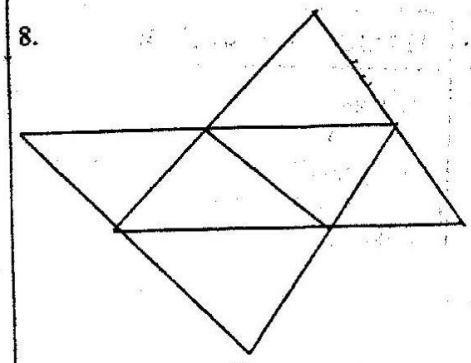
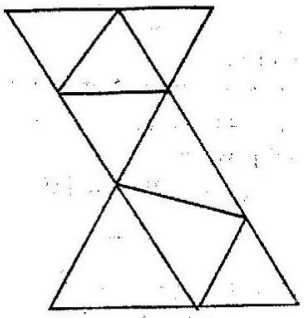
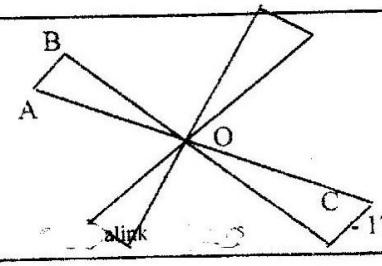
8. 		
Area one = $^1/_2$ x 5 x 5 sin 60° Area of 6 = 6 x $^1/_2$ x 5 x 5 x 0.8660 or $^1/_2$ x 5 x 4.33 x 6 x $^1/_2$ x 5 x 5 3 x 6 = 64.95 or $\frac{\sqrt{75}}{2}$	M1 A1 3	$6\sqrt{7.5(7.5.5)(7.5-5)9-5}$ $\sqrt{8.75} = 4.330$
9. Let dist. covered by bus be x km $\frac{x}{60} = \frac{220 - X + {}^3/_4}{80}$ ml 4x = 3(220 - x) + 3 x 60 4x = 660 - 3x + 180 4x = 660 - 3x + 180 m1 7x = 840 x = 120 Dist. bus covered 1.25 x 60 + 45	ml M1 M1 A1	ALT. METHODS Let time taken when both are moving to be 1 hour 1. 60(t + 3/4) = 220 - 809t M1 = t = 11/4h M1 time bus moving = 11.4 - 3.4 = 21 Dist bus covered = 2 x 60 M1 = 120 2. Relative velocity = 140 .: time taken $\frac{220 - {}^3/_4 \times 60}{140}$ M1 = 1.25 h M1 = 120 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 4 s.f.)	M1 M1 A1 B1 4	Accept for up to all terms For this binomial up to 4 terms correctly (✓) at least one M1 earned.
11. 	B1 B1 B1 3	For line thro') ⊥ BC or ⊥ O0A Any second part drawn Completing the figure

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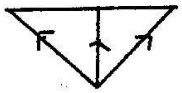
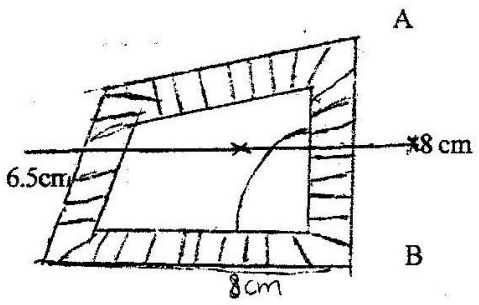
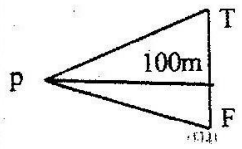
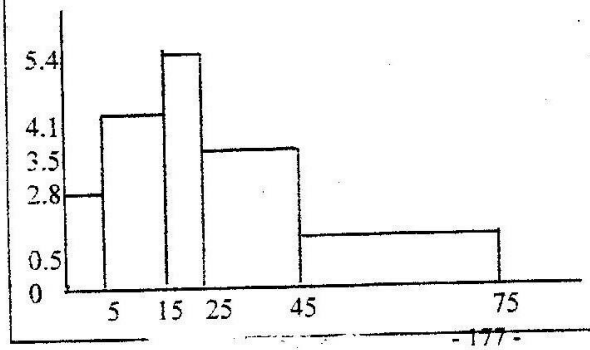
12. $8s^2 + 2S - 3 = (4s + 3)(2S - 1) = 0$ $S = -3/4$ OR $s = 1/2$ sINE $= 1/2 = \theta = 30^o$ OR 150^o For all θ + ve no ow -1	M1 A1 4	for both ✓| apply ✓| for ✓ us of his values S 2. OW - 1 if values of btw 180o & 360o inclusive
13. No of people $= {}^{360}/_{144} \times 1080 = 2700$ No of children $= 2700 - (510 + 1080)$ 1110 L of children $\frac{1110 \times 360}{2700}$ 148^o	M1 M1 A1	ALT METHOD 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 $= 68$ 2 Q 1 R For children 216 - 68 M1 $= 148o$
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✓	 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 $T_2 = {}^1/_3 \div {}^1/_{10}$ $3{}^1/_3$ days	M1 M1 A1	
16. $(x^2 + 1)(x - 2) = x^3 - 2x^2 + x - 2$ $dy/dx = 3x^2 - 4x + 1$ When $x = 2$ ${}^{dy}/_{dx} = 5$ $y = 0$ $\frac{y - 0}{x - 2} = 5$ $y = 5x - 10$	M1 M1 A1	

SOLUTION	MARKS	ALTERNATIVE METHOD
20.(a) $n/2\,(4 + 20) = 252$ $n = 504/24 = 21$ $21/2\{2x4 + (21-1)d\} = 252$ $21(8 + 20d) = 504$ $d = 16/20 = 4/5$ b) $50 \times 1.8^n = \frac{12000\,000}{50}$ $n \times 0.2553 = 4.3802$ $n = \frac{4.3802}{0.2553}$ $= 17.16$ Time taken 17.16×20 $= 343.2$ minutes (5.72h)	M1 A1 M1 A1 M1 M1 A1 B1	 ✓ Allow $50 \times 1.8 = 1200000$ $(n-1) \times 0.2553 = 4.3802$ Allow if sum of GP used $n - 1 = 17.16$ (✓)
21. Bisector of AB drawn interpretation of the scale path 1-0.1 cm wide all round There are 3.5 0.1 cm from B d n five points 1 cm apart on bisector of AB  	B1 B1 B2 B1 B2	 may be implied (✓) allow B1 2 Allow B1 for 3 points shown Apply all-1 for p tree in wrong region.

SOLUTION	MARKS	ALTERNATIVE METHOD
17. (a) B.P. per Kg $= \frac{40 \times 65 + 60 \times 27.50}{100}$ $= \text{Sh. } 42.50$	M1 A1	
(b) S.P. $= \frac{85 \times 120}{100}$ Sh. 102 per pkt	M1 A1	(✓)
(ii) New S.P $= 102 \times {}^{90}/_{100}$ $= \text{Sh. } 91.80$	B1	Depends on the 1st M or 2nd M or 2nd M mark earned
(iii) Total realised so far 8x 102 ÷ 1285.20 - 2101.20 816 ÷ 1285.20 - 2101.20 Original total S.P. 102 x 50 $= 5100$	M1	or 42.50 x 1.2 x 100
New price per packet $= \frac{5100 - 2101.20}{28}$		18 in 1 sin PQT $= \frac{1005 \text{ in } 60°}{88.88}$ $= 100 \times 0.866 = \frac{0.9743}{88.88}$ <PQT = 76.59°
Sh. 107.10	A1 8	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 = 28.54 m	M1 M1 A1	
b) $PQ^2 = 100^2 + 70^2 - 2 \times 100 \times \cos 60°$ $= 100^2 + 70^2 - 2 \times 100 \times 70 \times 0.5$ $PQ = \sqrt{7900} = 88.88$ m	M1 A1	
19.		

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

mean of x $= \frac{4975}{199}$ — M1

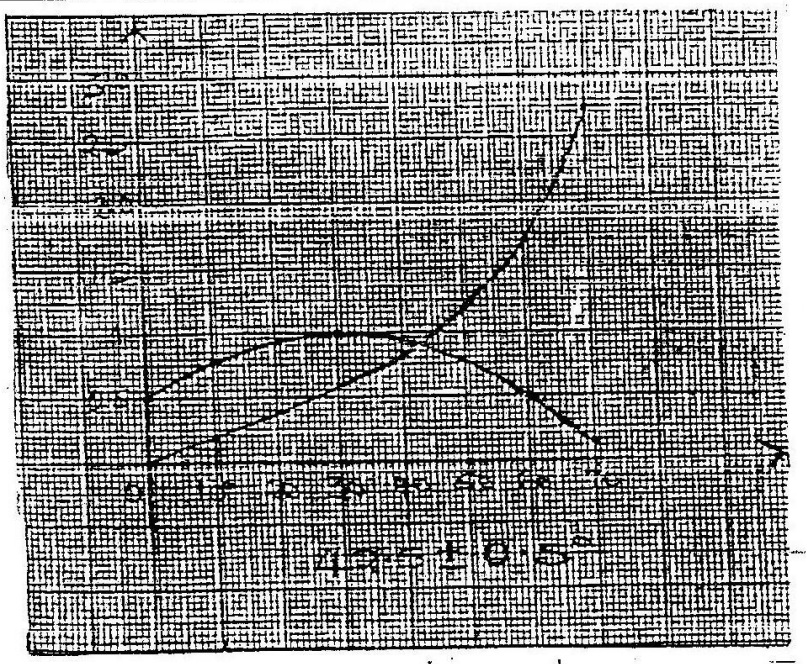


S1 ✓ use of scale
B1 for appropriate height

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

SOLUTION	MARKS	ALTERNATIVE METHOD
22.	B1 B1 S1 P1 C1 B1 8	Apply all -1 if not given to 2 dp ✓ scale used (✓) for sine curve (✓)

x	0	10	20	30	40	50	60	70
10mx	0	0.8	0.36	0.58	0.84	1.19	1.73	2.75
2x+30	30	50	70	90	110	130	150	170
0.50	0.77	0.94	1	0.94	0.77	0.50	0.17	



23. a = 15, 17c = 8, 17b = -8, 17d = 15 $A = \begin{bmatrix} {}^{15}/_{17} & {}^{8}/_{17} \\ {}^{8}/_{17} & {}^{15}/_{17} \end{bmatrix}$	M1	Multiplication and equating
	A1	
(b) $\cos = {}^{15}/_{17} = 0.8824$ (or $\text{Sin} = {}^{8}/_{17}$ or $\tan = {}^{8}/_{15}$ $\therefore$ = 28° 4 (28.07°)	M1	Allow for image and scale drawing (28+ 1°) General matrix for rotation cose -sine sine cose
c) $S(O) = \begin{pmatrix} 3 \\ 6 \end{pmatrix}$ $\begin{bmatrix} {}^{15}/_{17} & {}^{-8}/_{17} \\ {}^{8}/_{17} & {}^{15}/_{17} \end{bmatrix} \begin{pmatrix} 3 \\ 6 \end{pmatrix} = \begin{bmatrix} {}^{83}/_{13} \\ {}^{114}/_{12} \end{bmatrix}$	B1	
	M1	
Image of (1,0) - $({}^{3}/_{17}\ {}^{114}/_{12})$	A1	
	8	

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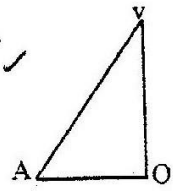
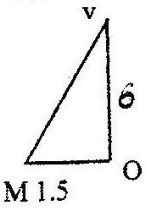
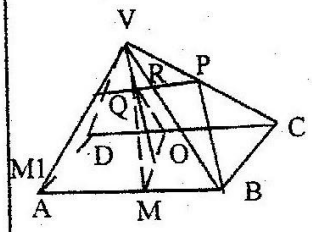
24.(a) OA = $\frac{1}{2}\sqrt{(3^2 + 4^2)}$ ✓ 	M1	Identification or calcution to obtain θA
2.5 ✓  M 1.5 (ii)		
$\tan \alpha = 6/12 = 4$	M1	
$\alpha = 75° 58 (75\ 96)$	A1	
Identification of < VMR		
Tan $\beta = \frac{3}{2^1/_4}$		
$= 1.333$		
$\beta = 53°7$	A1	
$\theta = 75° 58 - 53° 7$		53 ($\frac{3}{2}$)
$= 22° 51'$	B1	(22 $\sqrt{(3)}$ /4)