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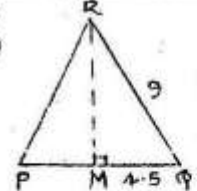
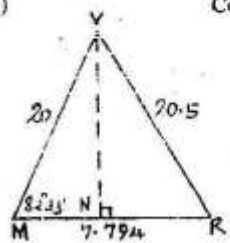
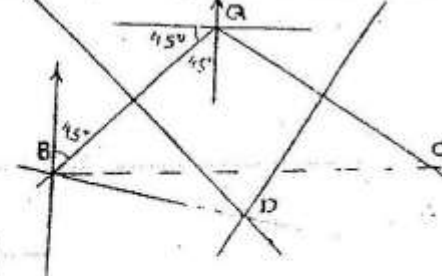
K.C.S.E 2002 MATHEMATICS 121/2 MARKING SCHEME

SOLUTION	MARKS	COMMENTS																														
<p>1. <math>\log</math></p> <table style="border-collapse: collapse; margin-left: 20px;"> <tr> <td style="padding-right: 10px;">0.0056</td> <td style="padding-right: 10px;">→</td> <td style="padding-right: 10px;"><math>\frac{1}{2}</math></td> <td style="padding-right: 10px;">→</td> <td><math>\frac{1}{3.7482} + 2 = 2.8741</math></td> </tr> <tr> <td>1.38</td> <td>→</td> <td></td> <td>→</td> <td>0.1399</td> </tr> <tr> <td>27.42</td> <td>→</td> <td></td> <td>→</td> <td>1.4381</td> </tr> <tr> <td colspan="4"></td> <td style="text-align: right;">} += 1.5780</td> </tr> <tr> <td colspan="4"></td> <td style="text-align: right;">(8) ← 3.2961</td> </tr> <tr> <td colspan="4"></td> <td style="text-align: right;">← 0.001977</td> </tr> </table>	0.0056	→	$\frac{1}{2}$	→	$\frac{1}{3.7482} + 2 = 2.8741$	1.38	→		→	0.1399	27.42	→		→	1.4381					} += 1.5780					(8) ← 3.2961					← 0.001977	<p>M1</p> <p>M1</p> <p>A1</p> <p>3 marks</p>	<p>✓ logs (all)</p> <p>✓ operations including</p> <p>✓ attempt to divide by 2</p> <p>accept std. form or 0.001978</p>
0.0056	→	$\frac{1}{2}$	→	$\frac{1}{3.7482} + 2 = 2.8741$																												
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				} += 1.5780																												
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				← 0.001977																												
<p>2. Fraction of work done in 1 hour by:</p> <p>Kipketer: <math>\frac{1}{7}</math>    Wanjiki: <math>\frac{1}{5}</math></p> <p>Both <math>\frac{1}{7} + \frac{1}{5} = \frac{12}{35}</math></p> <p>Time taken = <math>\frac{35}{12} = 2\frac{11}{12}</math> hours</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>3 marks</p>	<p>Allow both: <math>\frac{\text{product}}{\text{sum}} = \frac{7 \times 5}{5 + 7} = \frac{35}{12}</math></p> <p>Or 2.917 hr of 2 hours 55 minutes (if 2.55 - D0)</p>																														
<p>3. <math>\frac{1}{2} \times 14 \times 8 \sin \theta = 28</math>    <math>\sin \theta = \frac{28}{56} = \frac{1}{2}</math></p> <p><math>\theta = 30^\circ</math> or <math>150^\circ</math></p>	<p>M1</p> <p>A1</p> <p>2 marks</p>	<p>Both values must be given</p>																														
<p>4. Det T = (-1) (1) = (2) (1) = -3</p> $T^{-1} = -\frac{1}{3} \begin{pmatrix} -1 & -2 \\ -1 & 1 \end{pmatrix} = \begin{pmatrix} \frac{1}{3} & \frac{2}{3} \\ \frac{1}{3} & -\frac{1}{3} \end{pmatrix}$ $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \frac{1}{3} & \frac{2}{3} \\ \frac{1}{3} & -\frac{1}{3} \end{pmatrix} \begin{pmatrix} 7 \\ 1 \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ <p>Coordinates (3, 2)</p>	<p>M1, A1</p> <p>M1, A1</p> <p>4 marks</p>	<p>If a different M0 A0 Method used M0 A0 may be implied</p> <p>Accept X by <math>-\frac{1}{3} \begin{pmatrix} -1 &amp; -2 \\ -1 &amp; 1 \end{pmatrix}</math></p> <p>C.A.O</p>																														
<p>5. Cost of beans in mixture = <math>\frac{3}{5} \times 2100</math></p> <p>Cost of maize in mixture = <math>\frac{2}{5} \times 1200</math></p> <p>Cost of mixture per bag = <math>\frac{3}{5} \times 2100 + \frac{2}{5} \times 1200 = \text{Sh. } 1740</math></p>	<p>M1</p> <p>M1</p> <p>A1</p> <p>3 marks</p>	<p>Alternative</p> <table style="border-collapse: collapse;"> <tr> <td style="padding-right: 10px;"><math>3 \times 2100 = 6300</math></td> <td style="padding-right: 10px;">}</td> <td>M1</td> </tr> <tr> <td style="padding-right: 10px;"><math>2 \times 1200 = 2400</math></td> <td style="padding-right: 10px;">}</td> <td></td> </tr> <tr> <td style="padding-right: 10px;"><math>\frac{6300 + 2400}{5} = 1740</math></td> <td></td> <td>M1 Or equivalent</td> </tr> <tr> <td></td> <td></td> <td>A1</td> </tr> </table>	$3 \times 2100 = 6300$	}	M1	$2 \times 1200 = 2400$	}		$\frac{6300 + 2400}{5} = 1740$		M1 Or equivalent			A1																		
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	<p>B1</p> <p>B1</p> <p>2 marks</p>	<p>✓ Sketch of the net of the solid (not free hand) base must be square, other lengths must be within</p> <p>✓ labeling of all verticals with the path ✓ by shown</p> <p>AB and DA may be shown once</p> <p>Accept any other possible ne</p>																														
<p>7. <math>\frac{(3^4)^{2x} \times (3^2)^x}{(3^2)^x} = 3^6</math></p> $8x + 3x - 2x = 6$ $9x = 6$ $x = \frac{2}{3}$	<p>M1</p> <p>A1</p> <p>3 marks</p>	<p>Expression written</p> <p>Or equivalent (equation powers)</p> <p>When laws used ✓ logs - M1 ✓ multiplication - M1</p>																														

<p>8. Absolute error = <math>0.5 + 0.5 + 0.5 = 1.5</math>  <math>\% \text{ error} = \frac{1.5}{33} \times 100\%</math>  <math>= 4.55\%</math> (to 2d.p)  <math>= 4.54\%</math> (if logs used)</p>	<p>MI MI  AI</p>	
<p>9. <math>(a-b)^6 = a^6 - 6a^5b + 15a^4b^2 - 20a^3b^3 + 15a^2b^4 - 6ab^5 + b^6</math>  <math>1.98 = 2 - 0.02</math>   <math>\log^6 \approx 2^6 - 6(2)^5(0.02) + 15(2)^4(0.02)^2</math>  <math>= 64 - 3.84 + 0.096</math>  <math>= 60.256</math></p>	<p>B1 B1  MI  AI</p>	<p>With all terms given ✓ ly May be implied</p>
<p>10. <math>QP = \begin{pmatrix} -8 \\ -2 \end{pmatrix}</math>   <math>\frac{1}{2}QR = \frac{1}{2} \begin{pmatrix} -3 \\ -4 \end{pmatrix} = \begin{pmatrix} -1.5 \\ -2 \end{pmatrix}</math>   <math>OT = \begin{pmatrix} -8 \\ -2 \end{pmatrix} + \begin{pmatrix} -1.5 \\ -2 \end{pmatrix} = \begin{pmatrix} -9.5 \\ -4 \end{pmatrix}</math>   Coordinates of T <math>(-9.5, -4)</math></p>	<p>B1  D1  B1</p>	
<p>11. <math>\frac{4x^2 - y^2}{2x^2 - 7xy + 3y^2} = \frac{(2x+y)(2x-y)}{(x-3y)(2x-y)} = \frac{2x+y}{x-3y}</math></p>	<p>MI MI  AI</p>	<p>Numerator ✓ ly factorise Denominator ✓ ly factorise Allow <math>\frac{(2x+y)(2x-y)}{(x-3y)(2x-y)}</math></p>
<p>12. Dividends <math>\frac{5}{15} \times 81000 = 27000</math>   Attieno's: <math>\frac{5}{9} \times 27000 = \text{Sh } 15000</math></p>	<p>MI  MI  AI</p>	
<p>13. a) <math>\angle ECA = 28^\circ</math> <math>\angle AEG = 28^\circ</math>   b) <math>\angle CAE = 60^\circ</math> or <math>\angle CEG = 120^\circ</math> or <math>\angle EAG = 120^\circ</math> <math>\angle ABC = 88^\circ</math></p>	<p>B1 B1  B1 B1</p>	<p>All angles may be marked on the diagram</p>
<p>14. a) <math>T_{40} = 500 + (40-1)50</math> <math>= 500 + 1950</math> <math>= 2450</math>   b) <math>S_{40} = \frac{40}{2} [500 \times 2 + (40-1)50]</math> <math>= 20 (1000 + 1950)</math> <math>= 59000</math></p>	<p>MI  AI  MI  AI</p>	
<p>15. a) <math>\angle AEB = \angle DEC</math>, vertically opp. <math>\angle</math>s <math>\angle ABE = \angle EDC</math>, alternate <math>\angle</math>s <math>\angle EAB = \angle ECD</math>, alternate <math>\angle</math>s <math>\Delta ABE</math> is similar to <math>\Delta CDE</math> (AAA)   b) <math>BE = 3ED</math> DB: EB = 4:3</p>	<p>B1 B1  B1 B1</p>	<p>Accept any two Apply 0W - 1 if reasons are not given Allow <math>\angle AEB = \angle DEC</math> <math>\angle ABD = \angle BDC</math> <math>\angle CAB = \angle ACD</math></p>

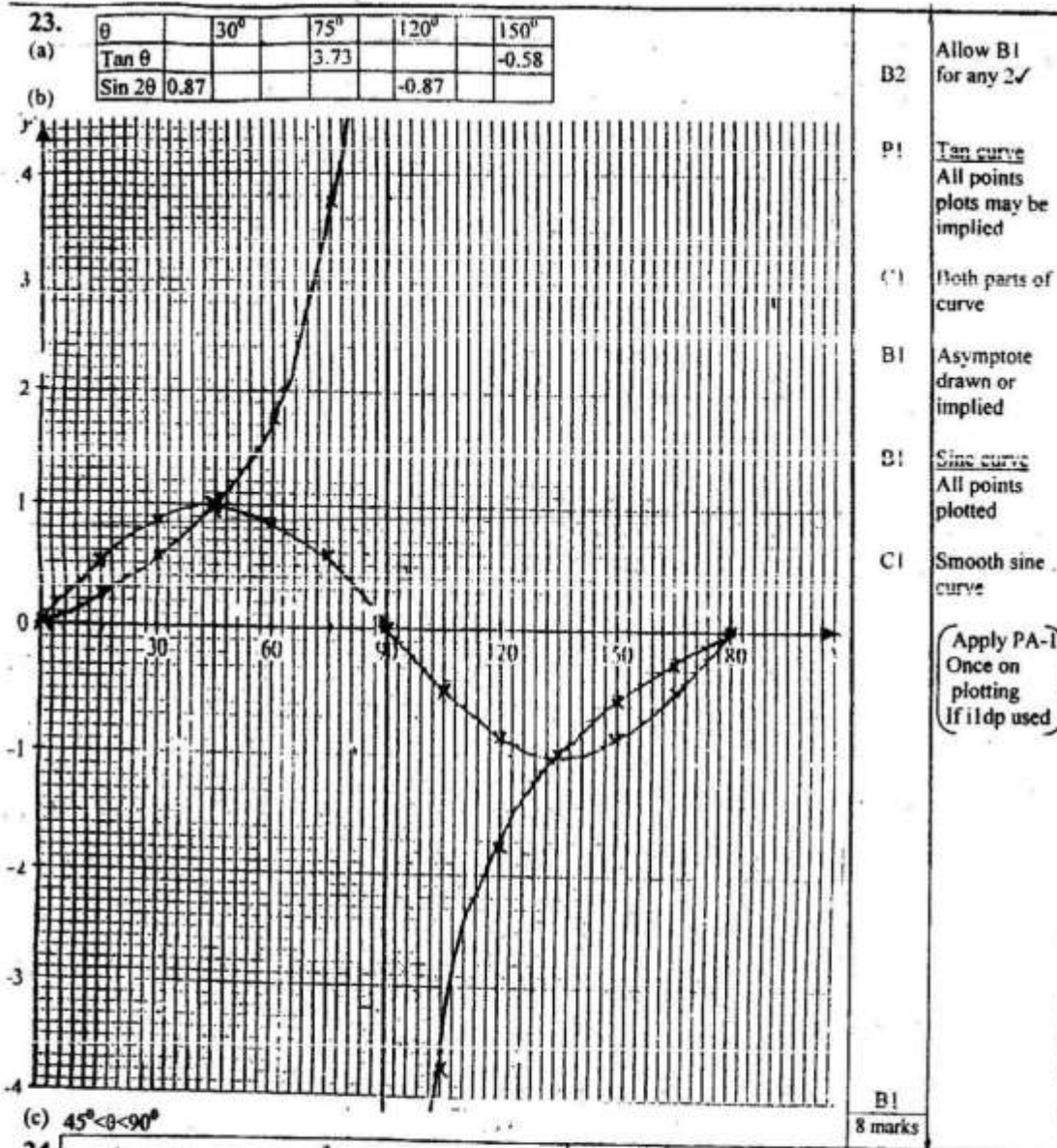
<p>16. <math>x^2 + 4x + y^2 - 5 = 0</math>  <math>x^2 + 4x + 4 + y^2 = 5 + 4</math>  <math>(x + 2)^2 + (y + 0)^2 = 9</math>                      Radius = <math>\sqrt{9} = 3</math></p>	<p>B1                      B1                      B1                      B1</p>	<p>LHS ✓ ly factorised                      Allow <math>(x + 2)^2 + y^2</math>                      RHS ✓ ly simplified                      Must be in correct form</p>
<p>17. a) <math>\frac{d}{50} - \frac{d}{80} = 3</math>  <math>\frac{8d - 5d}{400} = 3</math>     <math>3d = 1200</math> <math>d = 400\text{km}</math></p> <p>b) (i) <math>400 \times 0.25 + 400 \times 0.3 = 260\text{lit}</math>                      (ii) Total time  <math>\frac{400}{50} + \frac{400}{80} = 13\text{hr}</math>                      Average consumption <math>\frac{260}{13} = 20\text{lit/hr}</math></p>	<p>4 marks                      M1                      M1 A1                      M1                      M1                      M1, A1</p>	<p>Alternative  <math>(x - a)^2 + (y - b)^2 = r^2</math>  <math>x^2 - 2ax + y^2 - 2by + a^2 + b^2 - r^2 = 0</math>  <math>2ax = 4x</math> &amp; <math>-2by = 0 \rightarrow B1</math>  <math>a = 2, b = 0</math>                      Centre = <math>(-2, 0) \rightarrow B1</math>  <math>a^2 + b^2 - r^2 = -5</math>  <math>r^2 = 5 + 4 + 0 = 9 \rightarrow B1</math>                      radius = <math>\sqrt{9} = 3 \rightarrow B1</math></p> <p>17. Alternative  <math>\frac{d}{t} = 80</math> &amp; <math>\frac{d}{t+13} = 50</math>  <math>80t = 50(t+13)</math> <math>t = 5</math>  <math>d = 5 \times 80 = 400</math></p>
<p>18. a) <math>\frac{16510 \times 12}{20} = 9906</math></p> <p>b) Taxation: <math>4512 \times 2 = 9024</math>  <math>4512 \times 3 = 13536</math>  <math>(9906 - 9024) = 882 \times 4 = 3528</math>  <math>\frac{9024 + 13536 + 3528}{12} = 26088 \div 12 = 2174</math></p> <p>c) Tax due: <math>2174 - 960 = 1214</math></p>	<p>M1 A1                      M1                      M1                      M1                      A1                      M1, A1</p>	<p>8 marks                      1<sup>st</sup> slab ✓ ly taxed                      all other slabs ✓ ly taxed  <math>(9024 + 13536 + 3528) - 960 \times 12 = 26088 - 11520 = 14568</math>  <math>14568 \div 12 = 1214</math> (allow MR if housing is involved)</p>
<p>19. Cf: 9 22 42 57 63 65</p>	<p>B1                      P1                      C1                      B1                      D1                      B1                      M1                      A1</p>	<p>May be implied                      Plotting of against upper class limits                      ✓ 0 give                      ✓ median = <math>38\text{kg} \pm</math> at <math>32.5^{\text{th}}</math> (<math>33^{\text{rd}}</math>)  <math>Q_1 = 33\text{kg}</math> - at <math>16.25^{\text{th}}</math> (<math>16.5^{\text{th}}</math>)                      OR  <math>Q_3 = 43\text{kg}</math> - at <math>48.75^{\text{th}}</math> (<math>49.5^{\text{th}}</math>)                      Range: <math>Q_3 - Q_1</math>  <math>\checkmark = 43 - 33 = 10\text{kg}</math>  <math>Q_1, Q_3</math> read from ✓ positions  <math>\frac{65 - 47}{65} \% = \frac{18}{65} \times 100\%</math>  <math>= 27.69\%</math>                      Allow <math>\frac{19}{65} \times 100 = 29.23\%</math></p>



<p>20. a)</p> <p>(i) </p> $RM = \sqrt{9^2 - 4.5^2}$ $= \sqrt{60.75}$ $(3)$ $= 7.794$ $(5)$ <p>(ii) </p> $\cos M = \frac{20^2 + 7.794^2 - 20.5^2}{2 \times 20 \times 7.794}$ $= 0.1200$ $\angle M = 82^\circ 33'$ $\angle R = 75^\circ 19'$ $VN = 20 \sin 82^\circ 33'$ $= 20 \times 0.9915$ $= 19.83$ $(4)$ <p>(iii) <math>\text{Volume} = \frac{1}{3} \times \frac{1}{2} \times 9 \times 7.794 \times 19.84</math></p> $= 231.8 \text{ OR } 232$ $(9)$ <p>b) mass (8)</p> $231.8 \times 2.7 = 625.9\text{g}$ <p>OR</p> $= 626.1$ $(2)$ $(4)$ $(5)$	<p>M1 <math>9 \times 0.866</math></p> <p>A1</p> <p>M1 Or equivalent</p> <p>A1</p> <p>M1</p> <p>A1 Or equivalent (allow if MN = NR assumed) or equivalent</p> <p>M1, A1 ✓ or 0.6259 kg</p> <p>8 marks</p>
<p>21. a) <math>\frac{\pi}{12}</math> used as constant width (or 0.26)</p> $\frac{1}{2} \times \frac{\pi}{12} [(0 + 0.84) + 2(0.26 + 0.48 + 0.65 + 0.76 + 0.82)]$ $\frac{\pi}{24} [0.84 + 2(2.97)]$ $\frac{3.142}{24} \times 6.78 = 0.8875 \text{ (4) (6)}$ <p>b) Absolute error: <math>0.8940 - 0.8875 = 0.0065</math></p> $(4) \quad (4)$ $(2)$ $\% \text{ error} = \frac{0.0065}{0.8940} \times 100\% = 0.73\%$ $(4)$	<p>B1</p> <p>M1 ✓ substitution in trapezoidal rule</p> <p>M1 ✓ simplification of inner brackets</p> <p>M1, A1 ✓ simplifying to single term if <math>\pi = \frac{22}{7}</math> or 3.14 apply PA - (</p> <p>M1</p> <p>M1</p> <p>A1 C.A.O</p> <p>8 marks</p>
<p>22. a) </p> <p>✓ Scale used</p> <p>✓ Position of B</p> <p>✓ Position of C</p> <p>✓ Mediator of BQ or QC of BC</p> <p>2<sup>nd</sup> Mediator &amp; D identified</p> <p>b) (i) Distance B to C = <math>73 \pm 1</math> km</p> <p>(ii) North line ✓ at B <math>\pm 2^\circ</math></p> <p>Bearing = <math>102^\circ \pm 1^\circ</math> OR <math>S78^\circ E \pm 1^\circ</math></p>	<p>S1</p> <p>B1 Angles measured within <math>1^\circ</math> and lengths within 0.1cm</p> <p>B1 D must be at the ✓ position</p> <p>B1</p> <p>B1 May be implied if bearing is ✓</p> <p>B1 If <math>\angle BQC = 105^\circ</math> the diagram is correct</p> <p>B1</p> <p>8 marks</p>

D





B2 Allow B1 for any 2✓

P1 Tan curve  
All points plotted may be implied

(1) Both parts of curve

B1 Asymptote drawn or implied

D1 Sine curve  
All points plotted

C1 Smooth sine curve

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

24.

a)  $\frac{ds}{dt} = 3 + 3t - 6t^2$        $\frac{d^2s}{dt^2} = 3 - 12t$   
 $a = 3 - 12(0)$   
 $= 3 \text{ ms}^{-2}$

b) i)  $3 + 3t - 6t^2 = 0$        $(t-1)(2t+1) = 0$   
 $t = 1$  or  $-\frac{1}{2}$        $t = 1$  sec

ii) at  $t = 1$        $S = 3(1) + \frac{3}{2}(1)^2 - 2(1)^2$   
 $= 3 + \frac{3}{2} - 2$        $= 2 \frac{1}{2} \text{ m}$

c)  $3 - 12t = 0$        $= \frac{1}{4}$   
 $V = 3 + 3(\frac{1}{4}) - 6(\frac{1}{4})^2$   
 $= 3 + \frac{3}{4} - \frac{6}{16}$   
 $= 3 \frac{3}{4} \text{ m/s}$

M1  
M1  
A1

M1  
A1

ONLY  $t = 1$  sec

B1

Or 3.375

marks