

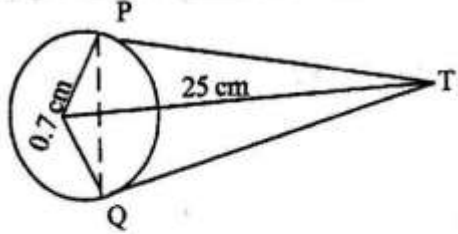
K.C.S.E 2004 MATHEMATICS PAPER 121/1 MARKING SCHEME

SOLUTION	MARKS	ALTERNATIVE METHOD
1. $\frac{0.015 + 0.45 + 1.5}{4.9 \times 0.2 + 0.07}$ $= \frac{0.015 + 0.3 + 0.3}{0.98 + 0.07}$ $= \frac{0.315}{1.05}$ $= 0.3$	M1 M1 A1 2	for operations
2. $(180^\circ - 156^\circ)n = 360$ $24n = 360$ $n = \frac{360}{24}$ $= 15$	M1 A1 2	for 360 24
3. $\frac{(2a + b)(a - 2b)}{(2a + b)(2a - b)}$ $\frac{a - 2b}{2a - b}$	M1 M1 A1 3	for factorisation of num for factorisation of deno
4. $\underline{OB} - \underline{OA} = (4\mathbf{i} + \mathbf{j} - 3\mathbf{k}) - (3\mathbf{i} - 2\mathbf{j} + \mathbf{k})$ $= 4\mathbf{i} + \mathbf{j} - 3\mathbf{k} - 3\mathbf{i} + 2\mathbf{j} - \mathbf{k}$ $\underline{AB} = \mathbf{i} + 3\mathbf{j} - 4\mathbf{k}$ Accept column vectors $= \sqrt{1^2 - 3^2 + (-4)^2}$ $= \sqrt{1 + 9 + 16}$ $= \sqrt{26}$ $= 5.099$ $= 5.10$ to 2 d places	M1 A1 2	$(3\mathbf{j} - 2\mathbf{j} + \mathbf{k}) - (4\mathbf{i} - \mathbf{j}) - 3\mathbf{k}$ $3\mathbf{j} - 2\mathbf{j} - \mathbf{k} - 4\mathbf{i} - \mathbf{j} + 3\mathbf{k}$ $\underline{BA} = -\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$ $\underline{BA} = \sqrt{(-1)^2 + (-3)^2 + 4^2}$ $= \sqrt{1 + 9 + 16}$ $= \sqrt{26}$ $= 5.099$ $= 5.10$ A1
5. $A = 10t - 12$ $= 10 \times 2 - 12$ $= 8 \text{ ms}^{-2}$	M1 M1 A1 3	Sub of t = 2

SOLUTION	MARKS	ALTERNATIVE METHOD
<p>6.</p>	3	<ul style="list-style-type: none"> * Division of AE into 5 equal parts B1 * Joining BD and drawing a line through E parallel to BD B1 * identification of point C or Equivalent proc. Construction marks must be seen
<p>7. $\frac{30 \times 1.8 \times 10^6}{100} = 540000$</p> <p>$\frac{120\,000 \times 540\,000}{1800\,000 \times 1800\,000}$</p> <p>= 1/50 or 0.02 or 2%</p>	<p>M1</p> <p>M1</p> <p>A1</p>	<p>$\frac{30 \times 120\,000}{100 \times 180\,000}$ M1 M</p> <p>= 1/50 or 0.02 or 2</p>
<p>8. $3 \times 1.485 + 13 \times 6.410$</p> <p>= 4.455 + 83.33</p> <p>= 87.785</p>	<p>M1</p> <p>M1</p> <p>A1</p>	<p>Reciprocals seen adding the product</p> <p>130 + 130</p> <p>0.735 1.56</p> <p>30 x 0.1485 + 130 x 0.641</p> <p>4.655 + 83.33 M1</p> <p>= 87.785 A1</p>
<p>9. $8(1 - \cos 2x) + 2 \cos x - 5 = 0$</p> <p>$8 \cos^2 x - 2 \cos x - 3 = 0$</p> <p>$(2 \cos x + 1)(4 \cos x - 3) = 0$</p> <p>$\cos x = 3/4$</p> <p>$\tan x = \frac{\sqrt{7}}{3}$</p> <p>$(\tan 41.41) = 0.8519$</p> <p>$(\tan 41.4) = 0.9316$</p>	<p>M1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>4</p>	<p>(substitution)</p> <p>or $(2p + 1)(4p - 3) = 0$ M1</p> <p>Disqualify $\cos x = -1/2$</p> <p>$x = 41.412$</p> <p>41.4 or 41.42 or 41</p> <p>$\tan x = 0.8819$ B1</p> <p>$\tan 41.42 = 0.8822$</p> <p>$\tan 41^\circ.25' = 0.8821$</p>

SOLUTION	MARKS	ALTERNATIVE METHOD										
<p>10. $480\,000 \times \frac{100}{96} = 500\,000$</p> <p>$800\,000 (1 - \frac{r}{100}) = 500\,000$</p> <p>$(1 - \frac{r}{100})^5 = \frac{5}{8} = 0.625$</p> <p>$1 - \frac{r}{100} = \sqrt[5]{0.625}$</p> <p>$= 9.103 \times 10^{-1}$</p> <p>$\frac{r}{100} = 1 - 0.9103$</p> <p>$= 0.0897$</p> <p>$r = 8.97\%$</p>	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>4</p>	<p>$A = 480\,000 \frac{(100)}{96}$ M1</p> <p>$800\,000 (1 - r)^5 = 480\,000 \times \frac{100}{96}$</p> <p>$(1 - r)^5 = \frac{480\,000 \times 100}{800\,000 \times 96}$</p> <p>$\frac{1-r}{100} = 5 \log \frac{5}{8}$ M</p> <p>$\frac{r}{100} = 8.97\%$ A1</p> <p>T. $\frac{7959}{5} = 1.95918$</p> <p>if $480\,000 \times \frac{100}{96}$</p> <p>$\log \frac{5}{8} = 5 \log (1 - \frac{r}{100})$ M</p> <p>T. $7959 = 5 \log (1 - \frac{r}{100})$</p> <p>$0.9103 = 1 - \frac{r}{100}$</p> <p>$r = (1 - 0.9103) \times 100$</p> <p>$= (1 - 0.9103) \times 100$</p> <p>$= 0.0887 \times 100$</p> <p>$= 8.87\%$ A1</p>										
<p>11. (a) <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>x</td> <td>1/2</td> <td>2 1/2</td> <td>4 1/2</td> <td>5 1/2</td> </tr> <tr> <td>y</td> <td>3 1/4</td> <td>9 1/4</td> <td>23 1/4</td> <td>33 1/4</td> </tr> </table></p> <p>(b) M1 ordinates 31/4, 51/4, 91/4, 151/4, 231/4, 331/4</p> <p>Area = $1 (3 1/4 : 5 1/4 - 9 1/4 + 15 1/4 - 23 1/4 - 33) = 89 1/2$</p>	x	1/2	2 1/2	4 1/2	5 1/2	y	3 1/4	9 1/4	23 1/4	33 1/4	<p>M1</p> <p>M1</p> <p>A1</p> <p>4</p>	<p>Can be implied</p> <p>If BO is legitimate than M1 M1 then M1 M1 AO</p>
x	1/2	2 1/2	4 1/2	5 1/2								
y	3 1/4	9 1/4	23 1/4	33 1/4								
<p>12. </p> <p>$(5 + x)^2 + h^2 = (8)^2$</p> <p>$25 + 10x + x^2 + h^2 = 64$</p> <p>$x^2 + h^2 = 16$</p> <p>$25 + 10x + 16 = 64$</p> <p>$10x = 64 - 11$</p> <p>$10x = 23$</p> <p>$x = 2.3$</p>	<p>(b) Area of PQS</p> <p>$= 1/2 \times 10 \times 3.273$ M1</p> <p>$= 5 \times 3.273$</p> <p>$= 16.365 \text{ cm}^2$ A1</p> <p>Q 12</p> <p>(a) $\tan \frac{1}{2} \theta = \frac{(8 - 5 - 5)(8.5 - 8)}{8.5(8.5 - 4)}$</p> <p>$= \frac{3.5}{8.5 \times 4.5}$</p> <p>$= \frac{3.5}{38.25}$</p> <p>$= \frac{3.5}{76.5}$</p>											

SOLUTION	MARKS	ALTERNATIVE METHOD
$h = 16 - x^2$ $= 16 - (2.6)^2$ $= 16 - 5.251$ $= 10.71$ $= 3.273$ <p>(a) $\tan \theta = 3.273$</p> $\frac{7.3}{8} = 0.4484$ $\theta = 24.15^\circ \text{ A1}$ $\theta = 24.15^\circ$ <p>or $\cos \theta = \frac{7.3}{8} = 0.9125$</p> $\frac{8}{8} = 1$ <p>or $\sin \theta = \frac{3.273}{8} = 0.409$</p> $= 24.15^\circ$		$\tan^{-1} 3.273 = 0.94575$ $= 0.2139$ $\frac{1}{2} = \tan^{-1} (0.2139)$ $= 12.07 \times 2 \quad \text{M1}$ $= 24.14^\circ \quad \text{A}$ (24.13°) (24.15°)
<p>12. (a) Let $\angle QSE = \theta$</p> $42 = 52 + 82 - 2 \times 5 \times 8 \cos \theta$ $\cos \theta = \frac{89 - 16}{80} = \frac{73}{80} = 0.9125$ $\theta = 24^\circ 9'$ $24^\circ 8'$ 24.10 $24^\circ 10'$ 16.38 cm^2 <p>(b) Area of PQS</p> $= \frac{1}{2} \times 8 \times 10 \sin 24^\circ 9'$ $= 40 \times 0.4091$ $= 10.825 \text{ cm}^2$ $= 16.36 \text{ cm}^2$	<p>M1</p> <p>A1</p>	<p>(a) $S = \frac{1}{2} (5 + 8 + 4) = 8.5$</p> $\text{Area} = 8.5 (3.5) (0.5) (4.5)$ $\frac{1}{2} \times 5 \times 8 \sin \theta = 8.5 (3.5)(0.5)(4.5)$ 24.15° 24.13° 24.14 24.15° $\sin 24^\circ 8'$ 40×0.4089 $= 16.36 \text{ cm}^2$ $= 16.364 \text{ cm}^2$
<p>13. Area of equilateral</p> $= \frac{1}{2} \times 5 \times 5 \sin 60^\circ$ $= \frac{1}{2} \times 5 \times 5 \times 0.866$ $= 10.825 \text{ cm}^2$ <p>x - section area</p> $= 6 \times 10.825$ $= 64.95 \text{ cm}^2$ <p>Volume of the prism</p> $= 64.95 \times 20$ $= 1299 \text{ cm}^3$	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>Logs used 10.82</p> 6×10.82 $= 64.92 \text{ cm}^2$ $64.92 \times 20 \quad \text{M1}$ $1298.4 \text{ cm}^3 \quad \text{A1}$ <p>if logs used then $V = 13000$ (2 marks)</p>

SOLUTION	MARKS	ALTERNATIVE METHOD
 <p> $\cos \theta = \frac{7}{25}$ $= 73^\circ 44$ or 73.74 $PQ = 7 \times 2 \cdot \sin 73^\circ 44$ $= 14 \times 0.9600$ $= 13.44 \text{ cm}$ </p>	<p>M1</p> <p>M1</p> <p>A1</p>	<p>Alt $\sin \theta = \frac{24}{25} \Rightarrow \theta = 73.74$</p> <p>$\frac{PQ}{\sin \theta} = \frac{7}{\sin(180 - 2\theta)}$</p> <p>$\frac{PQ}{\sin \theta} = \frac{7}{\cos 2\theta}$</p> <p>$PQ = \frac{7 \sin 2\theta}{\cos 2\theta} = 7 \tan 2\theta$</p> <p>$\cos \theta = 0.28$</p> <p>Accept equivalent</p> <p>$\tan \theta = \frac{24}{7} \Rightarrow \sin \theta = \frac{24}{25}$ until $\sin \theta = \frac{24}{25}$</p> <p>If logs used follow thro</p> <p>Alt $PT = \sqrt{(25)^2 - (7)^2}$</p> <p>$= \sqrt{625 - 49} = 24$</p> <p>$\cos \theta = \frac{24}{25}$ M1 $PM = 6.75$</p> <p>$PQ = 2 \text{ pm} = 2 \times 6.75 = 13.5$</p>
<p>15.</p> <p>Bisecting exterior angles or one external angle at x escribed circle</p> <p>Bisecting $\angle Xy$ and any external \angle circle to YZ</p>	<p>B1 B1</p>	<p>Not radius = 4.6 cm</p> <p>construction are a Must be seen</p>
<p>16. Grad. $PQ = \frac{-4+2}{5+1} = -\frac{1}{3}$</p> <p>Midpoint of $PQ = (\frac{5+1}{2}, \frac{-4+2}{2})$</p> <p>$= (2, -3)$</p> <p>$\frac{y+3}{x-2} = -\frac{1}{3}$</p> <p>$y+3 = -\frac{1}{3}(x-2)$</p> <p>$y = -\frac{1}{3}x - \frac{8}{3}$</p>	<p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>4</p>	<p>$y = mx + c$</p> <p>$-3 = 3 \times 2 + c$ M1</p> <p>$-9 = c$</p> <p>$y = 3x - 9$ A1</p>

SOLUTION	MARKS	ALTERNATIVE METHOD														
<p>SECTION II (48 MARKS)</p>																
<p>17(a) Total monthly income sh (20600 + 1200 + 2880 + 340) =sh 35820</p>	M1	$\frac{35820}{20} = -1791$														
<p>(b) 1st 9680: $\frac{10}{100} \times 9680 = 968$</p>	A1	<p>- If monthly income wrongly calculator the (m marks) are</p> <p>- Not scored if a m is lost.</p>														
<p>2nd 9120: $\frac{15}{100} \times 9120 = 1368$</p>	M1															
<p>3rd 9120: $\frac{20}{100} \times 9120 = 1824$</p>	M1															
<p>4th 7900: $\frac{25}{100} \times 7900 = 1975$</p>	M1															
<p>Total tax 6135</p>	A1															
<p>Less relief - 1056</p>	8															
<p>Monthly tax paid sh 5079</p>																
<p>18.(a) Turning points $\frac{d}{dx} 3x^2 + 8x$ $3x^2 + 8x = 0$ $x(3x + 8) = 0$ $x = 0$ or $-\frac{8}{3}$ $x = 0 + -7.667$ turning points are (0 - 2) and (-2.7, 7.5)</p>	M1															
<p>(b)</p> <table border="1" data-bbox="289 1470 730 1575"> <tr> <td>x</td> <td>-4</td> <td>-3</td> <td>-2</td> <td>-1</td> <td>0</td> <td></td> </tr> <tr> <td>y</td> <td></td> <td>7</td> <td></td> <td></td> <td>-2</td> <td>3</td> </tr> </table>	x	-4	-3	-2	-1	0		y		7			-2	3	A1	$x = \frac{0, -2.2}{3}$ <p>- 2.7 used in substitute gives y = 7.477 or 7. apply PA -1</p>
x	-4	-3	-2	-1	0											
y		7			-2	3										
	B1															
	B1															

SOLUTION	MARKS	ALTERNATIVE METHOD
<p>19 (a) area of hemispherical part $= 1/2 \times 4\pi R^2$ $= 2 \times 22/7 \times 35 \times 35$ $= 7700\text{cm}^2$</p> <p>(b) Slant height for original /zone $L = \frac{35}{14}$ $L = 100 \text{ cm}$</p> <p>(c) Surface area of frustum $= \pi RL - \pi r^2$ $Ni = \frac{22 \times 35 \times 100}{7} - \frac{22 \times 14 \times 40}{7}$ $= 11000 - 1760$ $= 9240\text{cm}^2$ Total surface area $= 7700 + 9240 + \frac{22}{7} \times 14^2$ $= 7700 + 9240 + 616$ $= 17556\text{cm}^2$</p>	<p>M1 A1 M1 A1 M1 M1 A1 M1 A1</p>	<p>follow thru logs used $7698\text{cm}^2 - 755$ Smaller zone $\frac{x}{14} = \frac{x+60}{35}$ $35x = 14x + 840$ $x = 40$ original zone is $60 + 40 = 100\text{cm}$</p> <p>(c) L.S.F. = 28570 A.SF = 4:25 asf = 21:25 or 21.54 S.A of frustum = $\frac{21 \times 22 \times 35 \times 100\text{m}}{25 \times 7}$ or $21/4 \times 22/7 \times 14 \times 40 = 29240$</p> <p>M. for 22×14 $\frac{A1}{8}$ for sum M1 A1 $-3 (i) + 4p = 5$ M1 $Y = 2$ A1</p>
<p>20 (a) $-3(1) + 4P = 5$ $P = 2$ $q(1)^2 - 5(1)(2) + (2)^2 = 0$ $q - 10 + 4 = 0$ $q = 6$</p> <p>(b) $6x^2 - 5x \frac{(3x+5)}{4} + \frac{(3x+5)^2}{4} = 0$ $6x^2 - 5x \frac{(3x+5)}{4} + \frac{(3x+5)^2}{4} = 0$ $96x - 20x(3x+5) + (3x+5)^2 = 0$ $65x^2 - 7x + 25 = 0$ $9x^2 - 14x + 5 = 0$ $(9x-5)(x-1) = 0$ $x = \frac{5}{9}$ and $y = 1 \frac{2}{3}$</p>	<p>M1 M1 M1 A1 8</p>	<p>(b) $6x^2 - 5xy + y^2 = 0$ $(3x-y)(2x-y) = 0$ $x = 1/3y$ or $x = 1y$ from eq (1) $y = \frac{5+3}{4}$ $x + \frac{1(5+3x)}{3 \cdot 4}$ Mimimi $x = \frac{5}{9}, y = 1 \frac{2}{3}$ A1</p>

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SOLUTION	MARKS	ALTERNATIVE METHOD
21 (a) $AB = DC$		
$\begin{pmatrix} 4 \\ 0 \end{pmatrix} - \begin{pmatrix} 2 \\ -4 \end{pmatrix} = \begin{pmatrix} 1 \\ 5 \end{pmatrix} - \begin{pmatrix} x \\ y \end{pmatrix}$	MI	
$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 \\ 5 \end{pmatrix} - \begin{pmatrix} 2 \\ -4 \end{pmatrix}$	MI	
D (-1, 2)	AI	
(b)	BI	
(i) $PR = \frac{3q - 1p}{2} - p$		
$= \frac{3q - 3p}{2}$	BI	
(ii) $RQ = \frac{q - 3q + 1p}{2}$	BI	
$= -\frac{1q}{2} + \frac{1p}{2}$	BI) share same duration and R or Q in a common.
$PR = \frac{3}{2}(q - p)$		
$RQ = -\frac{1}{2}(q - p)$		
$PR = 3 QR$		
$PR \parallel QR \text{ and R is a common point}$		
$\text{Hence P, Q, R are collinear}$	BI	
(iii) $PQ = q - p$	BI	
$QR = \frac{1q - 1p}{2}$	5	
in PQ, OR = 2 : 1		

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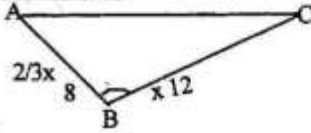


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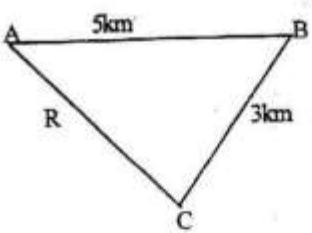
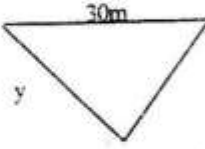
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SOLUTION	MARKS	ALTERNATIVE METHOD
<p>22.(a) $\angle M \angle N = 40^\circ$ Angles subtended by arc MN</p> <p>(b) $\angle OKN = 90^\circ - (40^\circ + 25^\circ)$ $= 25^\circ$ angle subtended by diameter</p> <p>(c) $\angle LNP = 40^\circ = 25^\circ = 65^\circ$ angles in alternate segment</p> <p>(d) $\angle MPN = 180^\circ - 170^\circ$ $= 10^\circ$ angles of triangle KNP.</p>	<p>B1 B1 B1 B1 B1 B1 B1 B1</p>	<p>or equivalent reason</p> <p>base is isosceles D equal, in semicircle</p> <p>$180^\circ - (40^\circ + 65^\circ + 65^\circ) = 10^\circ$</p> <p>$\angle$ at centre is twice \angle at O^e</p> <p>\angle sum of triang = 180</p> <p>Trial and error accepted AB : AC = 4 : 9</p>
<p>23.</p>  <p>(a) Let $BC = x$ $AB = \frac{2}{3}x$ $AC = \frac{1}{2}x, 9 = 1 \frac{1}{2}x$</p> $x + \frac{2x}{3} + \frac{1}{2}x = 38$ $\frac{19x}{6} = 38$ $x = \frac{38 \times 6}{19} = 12m$ <p>(b) (i) $S = \frac{1}{2} \times 38 = 19$ $AB = 8$ and $AC = 18$</p> $\text{area} = \sqrt{19(19-12)(19-18)(19-8)}$ $= \sqrt{19 \times 7 \times 1 \times 11} = \sqrt{1463} = 38.25$ <p>$\frac{1}{2} \times 8 \times 12 \sin \theta = 38.25, \sin \theta = \frac{38.25}{48}$ $\theta = 52.50^\circ$ $\theta = 127^\circ 10'$</p>	<p>M1 M1 A1 B1 M1 A1 M1 A1</p>	$\frac{4AC}{AC} = \frac{9AB}{\frac{9}{4}AB}$ $= \frac{9 \times 2 \times x}{4 \times 3}$ $\frac{3x + 2x + x}{2 \times 3} = 38m$ $9x = 4x + 6x = 228$ $19x = 228$ $x = \frac{228}{19} = 12m$ <p>(b) (ii) $182 = (12)^2 + (98)^2 - 2 \times 12 \times 8$</p> $\cos \theta = \frac{-24 + 144 + 64}{492} = \frac{7}{4}$ $\cos \theta = -0.6042$ $\theta = \cos^{-1}(0.6042)$ $52.83^\circ \quad \theta = \frac{127.17^\circ}{127.17^\circ}$ <p>Revision K.C.S.E Maths 1995-2000</p>

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SOLUTION	MARKS	ALTERNATIVE METHOD
<p>24 (a) </p> <p>(i) $R^2 = 5^2 + 3^2$ $= 25 + 9$ $= 34$ $R = \sqrt{34}$ $= 5.831 \text{ km}$</p> <p>(ii) $\tan \theta = \frac{3}{5} = 0.6$ $\theta = 30^\circ 58 \text{ or } 30.96^\circ$</p> <p></p> <p>(b) $\cos 30.96 = \frac{30}{y}$ $y = \frac{30}{\cos 30.96}$ $= \frac{30}{0.8575}$ $= 34.99 \text{ m}$</p> <p>(c) time = $\frac{34.99 \times 3600}{1000 \times 5.831}$ $= 21.6 \text{ seconds}$</p> <p>(b) alternative (1) Distance Time $5 \text{ km } 60 \times 60 \text{ sec.}$ $0.03 \text{ km } - ?$ $60 \times 60 \times 0.030 = 108 = 21.6$ sec.</p>	<p>M1 expression for radius</p> <p>A1</p> <p>M1 $\tan^{-1} \frac{3}{5} \theta$ M1</p> <p>$\theta = 30.96^\circ$ A1</p> <p>$\theta = 30.97^\circ$ A1</p> <p>M1 $(30.57^\circ) = 30.95$</p> <p>M1 accept 34.98m</p> <p>(C) speed = 5.831 km $= 5.831 \times 1000 \text{ m}$</p> <p>M1 Time expressions 60×60 $= 1.62 \text{ m5}$</p> <p>A1 $D = 34.99$ $T = D = 34.99$ M1 $s \ 1.62$ $= 21.6 \text{ seconds F1}$</p> <p>Speed $\frac{5000 \text{ M1M1}}{60 \times 60}$ $= 13.89$</p> <p>Time = 30 M1 $(25/3) = 21$</p>	

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