Question 9

a/(i) $CB^2 = 1^2 + 1^2 - 2(1)\cos 3\pi/5$

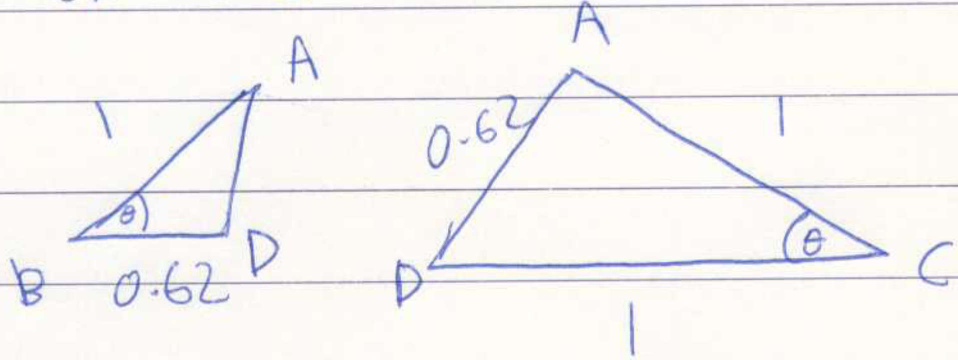
$\therefore CB = 1.61803398 9$

$= 1.62$ (2dp)

$CB = CD + BD$

$\therefore BD = 1.62 - 1$

$\therefore BD = 0.62$



$\theta = \frac{\pi}{5}$

$AD^2 = 1^2 + 1^2 - 2(1)\cos \pi/5$

$AD = 0.618033988$

$\therefore AD = 0.62$ (2dp)

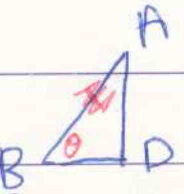
$\therefore AD = BD$ (both 0.62)

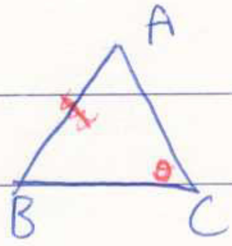
$1^2 = (0.62)^2 + 1^2 - 2(0.62)\cos \angle ADC$

$\therefore \angle ADC = 1.256$ (3dp)

$\theta = \pi/5 = 0.628$

$\therefore 2\theta = 1.256$ $\therefore \angle ADC = 2\theta$





~~$\Delta DBA \mid\mid\mid \Delta ABC$~~

~~$\angle ABD = \angle ACD$ (given)~~

$2\theta = \frac{2\pi}{5} = 72^\circ$

$\angle ADC + \angle ADB = 180$ (supp $\angle$s)

$\therefore \angle ADB = 108$

$= \frac{3\pi}{5}$ $\therefore \angle ADB = \angle BAC$ (both $3\pi/5$)

~~In $\Delta DBA \mid\mid\mid \Delta ABC$~~

~~$\angle ABD = \angle ACB$ (given)~~

~~$\angle ADB = \angle BAC$ (proven above, both $3\pi/5$)~~

AD = BD (proven page before, both 0·62)

$\therefore \Delta ADB$ is isosceles (2 equal sides plus one other).

~~If $\angle ABD = \angle ACB$ $\therefore \angle DAB = \angle$~~

In $\Delta DBA \mid\mid\mid \Delta ABC$

$\angle ABD = \angle ABC$ (common $\angle$)

$\angle ADB = \angle BAC$ (proven above, both $3\pi/5$)

$\angle BAD = \angle ACB$ ($\angle$ sum of Δ)

$\therefore \Delta DBA \mid\mid\mid \Delta ABC$ (equiangular)

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iii/ $\cancel{\frac{30}{3}\left(\frac{5\times\frac{3\pi}{8}}{x}\right) = \frac{5\times\frac{3\pi}{5}}{1}}$

$\cancel{x=1.}$

$1^2 = x^2 + 1 - 2(x)\cos \pi/5$

$1 = x^2 + 1 - 2x\cos \pi/5$

$x^2 -$

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b/ $dV/dt = 2e^t + 2e^{-t}$

i/ initially $\Rightarrow t=0$

$dV/dt = 2e^0 + 2e^0$

$= 4$ litres/hour

ii/ $\int dV/dt = \int 2e^t + 2e^{-t}\, dt$

$\therefore V = 2e^t - 2e^{-t} + C$

at $t=0$ $V=0$

$V = 2e^0 - 2e^0 + C$

$\therefore C = 0$

$\therefore V = 2e^t - 2e^{-t}$

iii/ $3 = 2e^t - 2e^{-t}$

iv/ $2e^{2t} - 3e^t - 2 = 0$ let $x = e^t$

$2x^2 - 3x - 2 = 0$ $\times -4$

$\underline{(2x-4)(2x+1)} = 0$ $+ -3$

$\therefore x = 2$ $x = -\frac{1}{2}$

when $x = 2$ $e^t = 2$

$t = \ln 2$

Q9.

iv/continued.

when $x=2$ $e^t=2$ $\therefore$ ~~t = ln 2~~

~~when x = -1/2 e~~

$t\cancel{\ln e}' = \ln 2$

$\therefore t = \ln 2$

when $x=-\frac{1}{2}$ $e^t=-\frac{1}{2}$

$t\cancel{\ln e}' = \ln -\frac{1}{2}$

$\therefore t = \ln -\frac{1}{2}$ NOT A SOLUTION

$\therefore t = \ln 2$

$= 41$ minutes (to the nearest minute)