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MECHATRONICS ENGINEERING

18/ENG05/012

ENG 282

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1. The tank contains 1200gal of water with dissolved salt
30gal of the solution exits the tank per minute;
30gal/1200gal = 0.025 = 2.5%
Amount of salt present at any time 't' be 'y'
Time rate of change at 'y' = dy/dt = y_{in} = y_{out}
If 50gal of brine enters the tank per minute & 1gal contains (1+sint)lb of salt,
then 't' = 1, (1+sint) = (1+sin1) = 1.02lb

(i). Amount of salt entering the tank is;
50~~gal~~/min x 1.02lb/~~gal~~ = 51lb/min
y_{out} = 2.5% of y
(dy/dt).(lb/min) = 51lb/min – 2.5y. (lb/min)

(ii). dy/dt = 51- 0.025y, dy/dt = -0.025y + 51
dy/dt = -0.025. **(**(-0.025y/-0.025) + (51/-0.025)**)**;
dy/dt = -0.025. (y – 2040)
dy/(y-2040) = -0.025dt; ∫-0.025dt
∫ dy/(y-0.2040) = -0.025. ∫ dt;
⌊n(y-2040) = -0.025t + c
y-2040 = $e^{-0.025+c}$;
y-2040 = $e^{-0.025t}$. e^{c}
y-2040 = $e^{-0.025t}$ y_0;
y-2040 = $y_0e^{-0.025t}$
y = $y_0e^{-0.025t}$ + 2040;

when t = 1, y= 150lb;

∴150= $y_0 e^{-0.025}$ + 2040; 150-2040 = y_0 x 1

y_0 = -1890

y=-1890$e^{-0.025t}$ + 2040

∴y= 2040 - 1890$e^{-0.025t}$