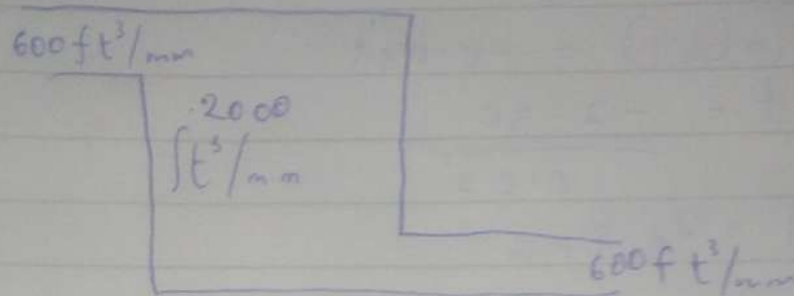


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 Mechanical Engineering
 16/ENGG06/041
 ENG 282



$$\frac{dy}{dt} = y_{in} - y_{out}$$

$$y_{out} = \frac{y_{in}}{200} = 0.005 y$$

$$\frac{dy}{dt} = 600 - 0.005 y$$

$$\frac{dy}{dt} = -0.005 (y - 20000)$$

$$\int \frac{dy}{(y - 20000)} = \int -0.005 dt$$

$$\ln(y - 20000) = -0.005t + C$$

$$y - 20000 = e^{-0.005t + C}$$

$$y - 20000 = y_0 e^{-0.005t}$$

$$y = y_0 e^{-0.005t} + 20000$$

a. @ $t=0$; $y=0$

$$y = y_0 e^{-0.005t} + 20000$$

$$0 = y_0 e^{-0.005(0)} + 20000$$

$$y_0 = -20000$$

$$y = 20000 e^{-0.005t} + 20000$$

$$b. \quad 90\% \times 20000 = 18000$$

$$y = 18000$$
$$18000 = -20000 e^{-0.03t} + 20000$$
$$18000 - 20000 = -20000 e^{-0.03t}$$
$$0.1 = e^{-0.03t}$$

$$\ln(0.1) = -0.03t$$

$$t = \frac{-2.30}{0.03}$$

$$t = 76.8 \text{ min}$$