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ENG 281

Solu

$$\frac{dy}{dt} = ky$$

$$\int \frac{1}{y} dy = \int k dt$$

$$\ln y = \int k dt$$

$$\ln y = kt + c$$

$$\ln y = k + \ln e + d \ln e$$

$$\ln y = \ln e^{kt} + \ln e^c$$

$$\ln y = \ln (e^{kt} + e^c)$$

$$y = e^{kt} \cdot e^c$$

$$y = ce^{kt}$$

At the beginning of the experiment

$$t = 0 \text{ and } y = 20$$

$$20 = ce^{k(0)}$$

$$20 = c \quad \text{--- (1)}$$

$$\text{At } t = 5 \text{ hrs}$$

$$y = 40$$

$$y = 2 \times 20 = 40 \quad \text{--- (2)}$$

Inputting the value of c into y in eqn (1)

$$40 = 20e^{kt}$$

$$\frac{40}{20} = e^{kt}$$

$$2 = e^{5k}$$

$$\ln 2 = 5k$$

$$0.6931 = 5k$$

$$k = \frac{0.6931}{5} = 0.13863$$

5

$$\text{model } y = 20e^{0.13863t}$$