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MECHANICAL ENGINEERING
ENG 282

An experiment is carried out by a biomedical Engineer using a certain type of bacteria that double in population every 5hrs in growth if the experiment is commenced with 20 bacteria

a) Develop a model for the system.

b) Use the model to estimate the population of the bacteria in 1½ days.

Soln

a)

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

$$\frac{dy}{y} = Kdt$$

$$\ln y = Kt + c$$

$$y = e^{Kt+c}$$

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

$$\therefore \quad e^{c} = y_0$$

Then $y = y_0 e^{Kt}$

but ; $y = 2y_0$, when $t = 5hrs$

$$2y_0 = y_0 e^{Kt}$$

$$\ln 2 = 5K$$

$$K = \frac{\ln 2}{5}$$

$$K = 0.139$$

$$\therefore \quad y = y_0 e^{0.139t}$$

b) Since $24 \text{ hrs} = 1 \text{ day}$

$x = 1.5 \text{ days}$

$\therefore \quad x = 24 \times 1.5$

$x = 36 \text{ hrs}$

$\therefore$ Where $y_0 = 20, \quad t = 36 \text{ hrs}$

$y = y_0 e^{0.139t}$

$y = 20 \times e^{0.139 \times 36}$

$y = 2980.2 \simeq 2980$ bacteria.