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Mechatronics

ENG282: Engineering Mathematics (II)

### Assignment

$$a \quad \frac{dy}{dt} = kY$$

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

$$\ln Y = kt + C$$

$$Y = e^{(kt+C)}$$

$$Y = e^{kt} \cdot e^C$$

$$Y = Ce^{kt}$$

$$\text{at } Y(0) = 20$$

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

$$20 = C$$

$$\therefore Y = 20e^{kt}$$

Since the bacteria doubles after 5hrs

$$0\text{hr} = 20$$

$$5\text{hrs} = 40$$

$$\therefore Y(5) = 40$$



$$40 = 20e^{k(5)}$$

$$\frac{40}{20} = \frac{20e^{5k}}{20}$$

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

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Multiply both sides by  $\ln$

$$\ln 2 = 5k$$

$$k = 0.1386$$

$$Y = 20e^{0.1386t}$$

b After  $1\frac{1}{2}$  days =  $24 + 12 = 36$  hrs

$$Y = 20e^{0.1386 \times 36}$$

$$Y = 2936$$

d) For  $Y_{(10)} = 10e^{0.1386t}$

ii  $Y_{(30)} = 30e^{0.1386t}$

$$Y_{(50)} = 50e^{0.1386t}$$

e The higher the initial amount of bacteria the faster the growth of bacteria.