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16/ENG01/015
Chemical Engr

1ai) For bacteria growth, we use $\frac{dy}{dt} = ky$

Let y = quantity of bacteria

t = time

$\frac{dy}{y} = k\,dt$

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

$\ln y = kt + c$

$y = e^{kt + c}$

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

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

$y = Ce^{kt}$

at initial time $t = 0$, $y = 20$

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

$20 = C$

at $t = 5$, $y = 2(20)$

$t = 5$, $y = 40$

$40 = Ce^{k*5}$

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

$2 = e^{5k}$

$5k = \ln 2$

$5k = 0.6931$

$k = 0.1386$

$y = 20e^{0.1386t}$ (the required model)

1b) At $t = 1\frac{1}{2}$ day

$t = 24 + 12$ (1day = 24hrs , $\frac{1}{2}$ day = 12hrs)

$t = 36$hrs

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

$y = 20 \times 146.877$

$y = 2937.55$

c) The initial amount of bacteria affected the exponential growth of bacteria. The highest initial amount had the highest final amount

d) At $y = 10$ and $t = 0$

$$10 = Ce^{k \cdot 0}$$

$$C = 10$$

at $t = 5$, $y = 20$

$$20 = 10e^{5k}$$

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

$$5k = \ln 2$$

$$k = 0.1386$$

For initial value, 10 we have $y = 10e^{0.1386t}$ for initial value, 30 we have $y = 30e^{0.1386t}$ for initial value, 50 we have $y = 50e^{0.1386t}$