

Esiewodje ovolce vltar

Signature

~~Esiewodje~~

16/ENG-03/026

Chemical Engineering.

1a) For bacteria growth, we use $\frac{dy}{dt} = ky$
Let y = quantity of bacteria
 t = time

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

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

$$\ln y = kt + C$$

$$y = e^{kt+C}$$

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

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

$$y = Ce^{kt}$$

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

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

$$20 = C$$

at $t=5, y=40$

$$40 = Ce^{k \cdot 5}$$

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

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

$$5k = \ln 2$$

$$5k = \ln 2$$

$$5k = 0.6931$$

$$k = 0.1386$$

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

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

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

$$t = 36 \text{ hrs}$$

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

$$y = 20 \times 146.877$$

$$y = 2937.55$$

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

d) At $y=10$ and $t=0$
 $10 = Ce^{kt}$
 $C = 10$

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 $y = 50e^{0.1386t}$