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a)

$\frac{dy}{dt} \propto Y$

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

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

$\therefore \ln y = kt + c$

$y = e^{kt+c}$

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

let $e^{c} = C$

$y = Ce^{kt}$

$\therefore$ at $t = 0$ & $Y = 20$

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

$20 = C$

$\therefore$ at $t = 5$ & $Y = \cancel{20}\ 40$

$\cancel{20}$ $40 = 20e^{k5}$

$2 = e^{k5}$

$\ln 2 = 5k$

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

$k = 0.1386$

$\therefore$ the Model is therefor

$y = 20e^{0.1386t}$

b. for when $t = 1\frac{1}{2} = 36$hrs

$y = 20e^{0.1386(36)}$

$y = 2936$ bacteria

d.) for initial value of 10 bacteria.

$\therefore$ $y = 10$ $t = 0$

$\therefore$ $10 = Ce^{k(0)}$

$\therefore C = 10$

$y = 10e^{kt}$

to find k

when $t = 5$ $y = 20$

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

$2 = e^{5k}$

$\ln 2 = 5k$

$\therefore k = 0.1386$

$\therefore y = 10e^{0.1386t}$

$\therefore$ the model for 30 will be

$y = 30e^{0.1386t}$

& that of 50 will be

$y = 50e^{0.1386t}$

e.) from the graph obtained it shows that the growth of the bacteria depends directly on the initial value of the bacteria present