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Petroleum Engineering
INS 282 Assignment

The ODE of Exponential growth is $y = ky$
 $\frac{dy}{dt} = ky$

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

$$y = e^{k(t+t_0)}$$

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

$y = Ce^{kt}$ is the solution to the ODE

Experiment that commenced with 20 bacteria

$$y_0 = 20$$

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

$$y = 20e^{kt}$$

\therefore since it doubles every 5 hours \therefore

$$40 = 20e^{kt}$$

$$e^{kt} = \frac{40}{20} = 2$$

$$\ln(e^{kt}) = \ln 2$$

$$5k = \ln 2$$

$$k = \frac{\ln 2}{5} = 0.1386$$

$$\therefore y = 20e^{0.1386t}$$

b) Estimating the population of bacteria to, in $1\frac{1}{2}$ days

$$1 \text{ day} = 24 \text{ hours}$$

$$1.5 \text{ day} = 36 \text{ hours}$$

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

$$y = 2937.5$$

The number of bacteria varies but not constantly with time for the three different initial number of bacteria

When the initial number of bacteria is 10, \therefore the final number is 639.435.

When the initial number of bacteria was 30, the final number was 1918.305.

When the initial number of bacteria was 50, the final number was 3197.175

