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CHEMICAL ENGINEERING.
MATHEMATICS ENG 282.

1a) $\frac{dy}{y} = dt \cdot k$

$\ln y = kt + c$

$y = e^{kt+c}$

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

Let $e^{c} = y_0$

$y = y_0 \cdot e^{kt}$ (General Solution).

Let y_0 be the initial population of bacteria and $y(t)$ be the population of bacteria at any instant time.

$y(t) = 2y_0$.

$t = 5$ hours.

$2\cancel{y_0} = \cancel{y_0} \cdot e^{k(5)}$

$2 = e^{5k}$

$\ln 2 = 5k$.

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

$k = 0.1386$.

$y = y_0 \cdot e^{0.1386t}$

$y = 20$

$t = 0$ hours

$y = y_0 \cdot e^{0.1386(0)}$

$y = y_0$.

$20 = y_0 \cdot e^{0.1386(0)}$

$20 = y_0 \cdot 1$

$y_0 = 20$.

$y(t) = 20 \cdot e^{0.1386t}$ (Particular Solution).

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(b) $t = 1\frac{1}{2}$ days

1 day = 24 hours

$\frac{1}{2}$ day = $\frac{1}{2} \times 24 = 12$ hours

$\therefore 1\frac{1}{2}$ days $= 24 + 12 = 36$ hours.

$y(t) = 20 \cdot e^{0.1386(t)}$

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

$y(t) = 20 \times 147.033$

$y(t) = 2937.55$

$y(t) \approx 2938$

$\therefore$ The population of bacteria at 36 hours is 2938.

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