Suppose the number of bacteria in a sample grows exponentially and increases from 3000 to 3500 in 2 hours. Determine the value of k, the growth rate. How long does it take for the number of bacteria to triple?

- We must use the exponential growth equation: $A(t) = A_0 e^{kt}$
- For this problem we have $A_0 = 3000$.
- Since $A(2) = 3000\, e^{k(2)} = 3500$, we can solve for k.

$$3000\, e^{2k} = 3500 \Rightarrow e^{2k} = \frac{3500}{3000} = \frac{7}{6} \Rightarrow \ln\left(e^{2k}\right) = \ln\frac{7}{6} \Rightarrow$$

$$2k = .15415 \Rightarrow k = .0771$$

- To determine how long it takes to triple, we must solve the equation $9000 = 3000\, e^{.0771t}$ for t.
- $9000 = 3000\, e^{.0771t} \Rightarrow \frac{9000}{3000} = 3 = e^{.0771t} \Rightarrow$
- $3 = e^{.0771t} \Rightarrow \ln 3 = \ln\left(e^{.0771t}\right) \Rightarrow .0771\, t = 1.0986 \Rightarrow t = 14.25$ *hours*