PC 4-6b – Growth and Decay Models

I can model populations using exponential growth and decay equations

Uninhibited Growth Model:

$$N(t) = N_0 e^{kt}, k > 0$$

Define each piece of the equation below:

N_0 - Initial Population

$e \sim 2.71828$ (A constant)

K - Growth Rate $K > 0$

t - time

The number N of bacteria present in a culture at time t (in hours) obeys the equation

$$N = 1000e^{0.01t}$$

a) After how many hours will the population equal 1500?

b) Using a graphing utility, graph the relation between N and t. Verify your answer in (a) using INTERSECT.

a) How many hours? → I need to find t (time)

$$\frac{1500}{1000} = \frac{1000e^{0.01t}}{1000}$$

$$1.5 = e^{0.01t}$$

$$\frac{\ln 1.5}{0.01} = \frac{0.01t}{0.01}$$

$$40.547 = t$$

In ~40.547 hours

b) Use a graphing Device

Uninhibited Decay Model:

$$A = A_0 e^{kt} \quad , k < 0$$

Define each piece of the equation below:

A_0 - Initial Population

$e \sim 2.71828$

K - Decay rate $K < 0$

t - time

Iodine-131 is a radioactive material that decays according to the equation $A = A_0 e^{-0.087t}$, where A_0 is the initial amount present and A is the amount present at time t (in days). What is the **half-life** of iodine-131?

Half-life is the amount of time it takes for half of the element to decay. If you start with A_0, how long until $\frac{1}{2}A_0$ remains?

$$\frac{\frac{1}{2}A_0}{A_0} = \frac{A_0 e^{-0.087t}}{A_0}$$

$$\frac{1}{2} = e^{-0.087t}$$

$$\frac{\ln \frac{1}{2}}{-0.087} = \frac{-0.087t}{-0.087}$$

$$7.967 = t$$

The half life of iodine-131 is about 7.967 days