

## Honors Precalculus Exponential Growth/Decay

Exponential growth/decay model:  $y = y_0 e^{kt}$

$y_0$  = the initial amount present

$y$  = the amount of the quantity present at time  $t$

$k$  = growth or decay rate in decimal.  $k > 0$  if there is growth and  $k < 0$  if there is decay

Half-life – the amount of time it takes a radioactive substance to decay to half of its original value

$$\text{Half life} = \frac{\ln 2}{k}$$

Newton's Law of Cooling - The rate of heat loss of a body is directly proportional to the difference in the temperatures between the body and its surroundings.

$$T - T_s = (T_0 - T_s)e^{kt}$$

$T$  = Temperature of the object at time  $t$

$T_s$  = Temperature of the surrounding medium

$T_0$  = Original temperature

Examples:

1. In the year 2000 the population of a particular community was 32,000. If the population exponentially at rate of 1.2% each year
  - a. What is the population in the year 2030?
  - b. When will the population be 50,000?



6. A cup of soup that is 85 degrees is left to cool on a counter in a room that is 70 degrees. After 5 minutes the soup is 82 degrees. How much longer will it take for soup to cool to 78 degrees?

Try these:

1. In the year 2000 the population of a particular community was 50,000. If the population exponentially at rate of 3.2% each year
  - a. What is the population in the year 20500?
  - b. When will the population be 75,000?
  
2. The number of bacterial present in a culture grows exponentially at a rate of 2.4% per hour. If there are 50 bacteria present initially
  - a. How many are present after 2 hours?
  - b. When will there be 200 bacterial present?
  
3. The number of deer in a certain population grows exponentially. If after 5 years there are 800 deer and after 20 years there are 1100 deer, how many were present initially?
  
4. The half-life of carbon 14 is 5700 years. If carbon 14 dating is used, how long will it take for 95% of the original amount present to remain?
  
5. The half-life of carbon 14 is 5700 years. If carbon 14 dating is used, how long will it take for 80% of the original amount present to decay?
  
6. A cup of soup that is 87 degrees is left to cool on a counter in a room that is 70 degrees. After 5 minutes the soup is 83 degrees. How much longer will it take for soup to cool to 80 degrees?

