

Directions: Show all work, and answer each question that is asked. Explanations should be given in complete sentences. All graphs should be drawn accurately on this sheet, and be fully labeled.

1. A certain lake is stocked with 1000 fish. The population is growing according to the logistic curve:

$$P = \frac{10,000}{1 + 9e^{-0.2t}}$$

where  $t$  is measured in months since the lake was initially stocked.

Define the variables:

$t$  :

$P$  :

After how many months will the fish population be 2000? Round to the nearest 0.01 month.

Is there a maximum possible fish population that the lake can sustain?

2. Suppose Matt initially invests \$3000 in an account bearing 4% interest compounded monthly.

Define the variables (make sure to include the letter you are going to use throughout the rest of the problem) :

Independent:

Dependent:

How long will it take for the deposit to double in value? Round to the nearest 0.01 year.

3. The number of people dying from HIV worldwide has been decreasing exponentially over the last few decades. The World Health Organization (WHO) estimates that 2 million people died from HIV in the year 2005, and 1.5 million people died from HIV in the year 2010. Use the given data to create an exponential decay function to model the number of people dying in the year  $t$ , where  $t = 0$  represents the year 2005. The WHO goal is to reduce this number to 500,000 by the year 2020.

Define the variables (make sure to include the letter you are going to use throughout the rest of the problem) :

Independent:

Dependent:

If the decline of deaths from HIV continues according to the same pattern, will the goal be reached?

4. A population of beetles grows according to the model  $A = 500 - 400e^{-0.04t}$ , where  $t$  is measured in weeks.

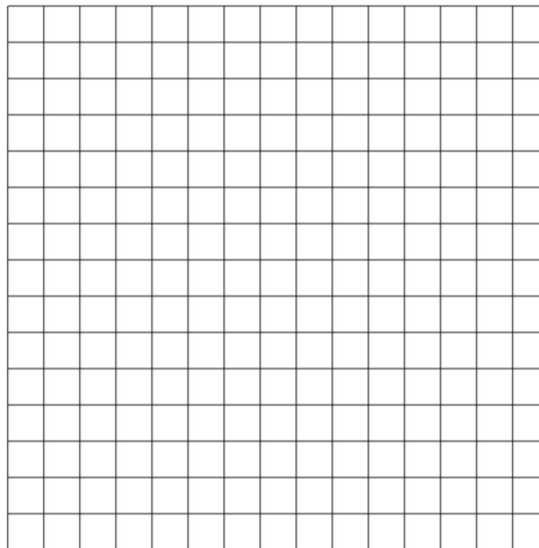
Define the variables:

$t$  :

$A$  :

What is the initial population of beetles?

Graph this function, labeling axes and scales.



Use the graph to determine what happens to the population as time goes by.

At what time will the population reach 300 beetles?