Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page. **Show all your work.**

Name: _Solution Key_ ID: U _____

1. (10 points) Use the approximate half-life formula to solve the following problem:

A clean-up project is reducing the concentration of a pollutant in the water supply, with a 3.5% decrease per week.

(a) (5 points) What is the half-life of the concentration of the pollutant?

$$T_{half} \approx \frac{70}{3.5} = 20 \text{ week}$$

Alternative Solution

$$T_{half} = -\frac{\log_{10} 2}{\log_{10}(1-0.035)} \approx 19.46 \text{ week}$$

(b) (5 points) What fraction of the original amount of the pollutant will remain when the project ends after 1 year (52 weeks) ?

Amount of pollutant remain $= \left(\frac{1}{2}\right)^{\frac{52}{20}}$

or $\left(\frac{1}{2}\right)^{\frac{52}{19.46}}$

2. (10 points) Compare the doubling times found with the approximate and exact doubling time formulas. Then use the exact doubling time formulas to answer the following question:

A family of 100 termites invades your house and grows at a rate of 20% per week. How many termites will be in your house after 1 year?

Approximate doubling time $= \frac{70}{20}$ weeks $= 3.5$ weeks

$T_{double} \text{ (exact)} = \frac{\log_{10} 2}{\log(1+0.2)} = \frac{\log_{10} 2}{\log 1.2} = 3.8$ weeks

After 1 year number of termites $= 100 \times 2^{\frac{52}{3.8}}$