Work Sheet: word problems involving logarithms

Problem 1
Find the least number of years for an investment to double if interest is compounded annually with the following interest rates: a) 3% b) 6% c) 9%

Problem 2
A new car decreases in value by 11% per year. After how many years is the car worth less than one-half of its original value?

Problem 3
Uranium-235 is a radioactive substance that has a half-life of $2.7 \cdot 10^5$ years.

a) Find the amount remaining from a 1 g sample after 1000 years.

b) How long will it take a 1 g sample to decompose until its mass is for the first time below 700 milligrams (i.e. 0.7 g)? Give the answer in years accurate to the nearest 1000 years.

Problem 4
The stray dog population in a town is growing exponentially with about 18% more stray dogs each year. At the beginning of this year, there were 16 stray dogs.

a) Find the projected population of stray dogs after 5 years.

b) After how many years is number of stray dogs for the first time greater than 70?

Problem 5
The mass m kilograms of a radioactive substance at time t days is given by
$$m(t) = 5e^{-0.13t}.$$
a) What is the initial mass?

b) After how many days is the substance for the first time below 0.5 kg? Give the answer in whole days.

c) Work out the daily decay factor and the daily decay percentage.

Problem 6
Radium decays exponentially and its half-life is 1600 years. If A_0 represents the initial amount of radium in a sample and $A(t)$ represents the amount remaining after t years, then
$$A(t) = A_0 e^{-kt}.$$
a) Find the value of k approximated to four significant figures.

b) Find what percentage of the original amount of radium will be remaining after 4000 years.

Problem 7
An experiment is carried out in which the number n of bacteria in a liquid, is given by the formula $n(t) = 650e^{kt}$, where t is the time in minutes after the beginning of the experiment and k is a constant. The number of bacteria doubles every 20 minutes.

a) Find the exact value of k.

b) Work out the growth percentage per minute.

Problem 8

A car is purchased for $ 40000. The value of the car will be less each year because of depreciation. The car depreciates (loses value) at the rate of 25% per year.

a) Write the depreciation function in the following two forms

Form 1: $V(t) = a \cdot b^t$

Form 2: $V(t) = a \cdot e^{kt}$

b) Give one advantage of the first form.

c) After how many years is the car for the first time worth less than $ 5000?