Applications of Exponential and Logarithmic Functions

1. The number V of computers infected by a computer virus increases according to the model $V(t) = 100e^{4.6052t}$, where t is the time in hours.
Find (a) $V(1)$, (b) $V(1.5)$ and (c) $V(2)$.

2. Let Q represent a mass of radioactive radium (^{226}Ra) (in grams), whose half-life is 1599 years. The quantity of radium present after t years is $Q = 25\left(\frac{1}{2}\right)^{t/1599}$.
(a) Determine the initial quantity (when t = 0).
(b) Determine the quantity present after 1000 years.

3. The relationship between the number of decibels β and the intensity of a sound I in watts per square meter is $\beta = 10\log\left(\frac{I}{10^{-12}}\right)$.
(a) Determine the number of decibels of a sound with an intensity of 1 watt per square meter.
(b) Determine the number of decibels of sound with an intensity of 10^{-2} watt per square meter.

4. \$2500 is invested in an account at interest rate of 8.5%, compounded continuously. Fin the time required for the amount to (a) double and (b) triple.

5. Students participating in a psychology experiment attended several lectures and were given an exam. Every month for a year after the exam, the students were retested to see how much of the material they remembered. The average scores for the group can be modeled by the human memory model $f(t) = 90 - 15\log(t+1), \quad 0 \le t \le 12$ where t is time in months.
(a) Use the properties of logarithms to write the function in another form.
(b) What was the average score on the original exam?
(c) What was the average score after 6 months?

6. Determine the principal P that must be invested at an interest rate of $7\frac{1}{2}\%$, compounded monthly, so that \$500,000 will be available for retirement in 20 years.

7. Determine the time necessary for \$1,000 to double if it is invested at an interest rate of 11% compounded (a) annually, (b) monthly, (c) daily, and (d) continuously.

8. The population P (in thousands) of Pittsburgh, Pennsylvania from 2000 to 2003 can be modeled by $P = 243e^{-0.0029t}$, where t represents the year, with t = 0 corresponding to 2000.
(a) According to the model, was the population of Pittsburgh increasing or decreasing from 2000 to 2003? Explain your answer.
(b) What was the population in Pittsburgh in 2000 and 2003?
(c) According to the model , when will the population be approximately 2.3 million?