Logarithmic and Exponential Function Applications

Name:_____

Math 150 (Sections 3.1, 3.2, 3.5)
Ms. Meier

1) A research assistant in biology finds in an experiment that at low temperatures the growth of a certain bacteria can be modeled by:
   $$f(t) = 750 + 12Lnt \qquad t \geq 1$$
   Where t represents the number of hours since the start of the experiment and f(t) represents the number of bacteria present.

   a) Determine $f'(t)$

   b) Evaluate and interpret f(12) and f '(12)

2) Prescription drug companies of the new drug Vectrum have found that the popularity of the new drug has dwindled and can be modeled by:
   $$f(x) = 150 + 5Lnx \qquad x \geq 1$$
   Where x represents the number of years the drug has been on the market and f(x) represents the number of prescriptions written for the drug annually in thousands.

   a) Determine $f'(t)$

   b) Evaluate f '(2) and f '(10) and interpret each.

3) The life expectancy for African-American females in the United States can be modeled by:
   $$f(x) = 68.41 + 1.75Lnx \qquad 1 \leq x \leq 26$$
   Where x represents the birth year since 1969 and f(x) represents the life expectancy in years. (Source: U.S. National Health Center for Health Statistics)

   a) Determine f '(x)

   b) Evaluate and Interpret f(3) and f '(3)

4) A veterinarian finds that when a lab animal specimen is exposed to a new pesticide, the growth of a tumor in the specimen can be modeled by:
   $$f(t) = 2.1 \ e^{0.2t} \qquad t > 0$$
   Where t represents the number of days since exposure to the pesticide and f(t) represents the diameter of the tumor in millimeters.

   a) Determine f '(t)

   b) Evaluate and Interpret f '(3)

5) The average salary of players in the National basketball Association (NBA) can be
modeled by: $f(x) = 280.8e^{0.16x}$ $1 \le x \le 14$
Where x represents the number of years since 1984, and f(x) represents the average
salary in thousands of dollars. (Source: U.S. Statistical Abstract)

a) Determine f '(x)

b) Evaluate and Interpret f '(3) and compare to f '(13)

6) A manufacturer can produce VCRs at a cost of $125 apiece and estimates if the are
sold for x dollars apiece, consumers will buy $1000e^{-0.02x}$ each week.

a) Express the Profit as a function of x (remember x is the price!)

b) At what price should manufacturers sell the VCRs to maximize profit?

Answers:

1) a. $\dfrac{12}{t}$ b) 12 hours after the start of the experiment there are about 780 bacteria and
the number is growing at a rate of about 1 bacteria/hour.

2) a. $\dfrac{5}{x}$ b. the rate of growth after 2 years is about 2.5 thousand prescriptions/year
while the growth rate after 10 years is .5 thousand prescriptions/year. (or 2500/year
and 500/year)

3) a. $\dfrac{1.75}{x}$ b. In 1972 the life expectancy of African American females is about
70.33 years, and is increasing at a rate of about .58 years/birth year

4) a. $0.42e^{0.2t}$ b. three days after exposure the tumor is growing at a rate of about
0.765 mm/day

5) a. $44.928e^{0.16x}$ b. In 1987 the average player salary was increasing at a rate of about
$72,607/year, while in 1997 it was increasing at a rat of $359,625/year. (Yikees!!)

6) a. $P(x) = 1,000e^{-.002x}(x - 125)$ b. $175