Bronx High School of Science
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Name: _____ MA2 Exponential and Logarithmic Applications Sheet

1) It is projected that $t$ years from now the population, $P$ (in millions), of a certain country can be represented by the function $P(t) = 50e^{0.02t}$.

   a) At what rate will the population be changing 10 years from now?

   b) At what percentage rate will the population be changing with respect to time?

2) Public health records indicate that $t$ weeks after the outbreak of a certain influenza, approximately $O(t) = \dfrac{80}{4 + 76e^{-1.2t}}$ thousand people had caught the disease.

   a) At what rate was the disease spreading at the end of the second week?

   b) At what rate was the disease spreading at the end of the third week?

3) Assume that the amount of a radioactive substance, in grams, present at time $t$, in years, is given by the function $A(t) = 500e^{-0.25t}$. Find the rate of change of the quantity present when

   a) $t = 4$ b) $t = 6$

4) The consumer demand for a certain camera is $D(p) = 5000e^{-0.02p}$ cameras per month when the market price is $p$ dollars per camera. Determine the market price that will result in the greatest customer expenditure where consumer expenditure $E(p) = p \cdot D(p)$.

5) Suppose that the percentage of alcohol in the bloodstream $t$ hours after consumption is given by $C(t) = 0.2te^{-\frac{t}{2}}$

   a) What is the maximum level of alcohol in the bloodstream?

   b) When does the maximum level of alcohol in the bloodstream occur?

6) The function $f(x) = \dfrac{1}{\sqrt{2\pi}} \cdot e^{-\frac{x^2}{2}}$ is known as the *standard normal probability density function* and plays a vital role in probability and statistics. The graph of this function is the well-known "bell-shaped" curve that is used by physical and social scientists to describe distributions of IQ scores and measurements on large populations of living organisms, the velocity of a molecule in a gas, and numerous other phenomena.

   a) Determine where the function is increasing and where the function is decreasing.

   b) Determine where the function is concave up and where it is concave down.

   c) Find all relative extrema.

   d) Find inflection points.

   e) Sketch *f(x)*.