

Name: _____ MA2 Exponential and Logarithmic Applications Sheet 2

- 1) After the discovery of a rich natural gas deposit, a community's population increased quickly and could be approximated by the function $f(x) = 2000\ln(x^2 + 1) + 5000$, where x is the number of years after the discovery.
 - (a) What was the population at the time of the discovery?
 - (b) What was the population 2 years after the discovery?
 - (c) Find $f'(2)$ and interpret the result.

- 2) Suppose that the number of units of a commodity that are sold after spending x hundred dollars on advertising is given by the function $f(x) = 300 + 200\ln(2x)$, $x \geq 1$.
 - (a) How many units are sold if \$100 is spent on advertising? Round to the nearest integer.
 - (b) How many units are sold if \$1000 is spent on advertising? Round to the nearest integer.
 - (c) Find $f'(x)$.
 - (d) Find $f'(6)$ and interpret the result.
 - (e) Find $f'(60)$ and interpret the result.
 - (f) Explain why $f'(60) < f'(6)$.
 - (g) Does $f'(x)$ have any local extrema? Explain.

- 3) Open garbage attracts rodents. Suppose that the number of mice in a neighborhood t weeks after a strike by garbage collectors can be approximated by the function $P(t) = 20e^{0.2t}$.
 - (a) How many mice are initially in the neighborhood?
 - (b) How long does it take for the population of mice to quadruple?
 - (c) How many mice are in the neighborhood after 5 weeks?
 - (d) How long does it take until there are 1000 mice?
 - (e) Find $P'(5)$ and interpret the result.

- 4) Suppose that the temperature of a cup of coffee in degrees Celsius t minutes after it is poured is given by the function $T(t) = 80e^{-0.1t} + 20$.
 - (a) What was the initial temperature of the coffee?
 - (b) When was the coffee 80°C ?
 - (c) What was the temperature after 11 minutes?
 - (d) Find $T'(t)$.
 - (e) Find $T'(5)$ and interpret the result.
 - (f) Find $\lim_{t \rightarrow \infty} T(t)$ and interpret the result.

- 5) After t years, a motorcycle manufacturer has sold a total of y thousand units where $y = 15(1 - e^{kt})$. If 1500 units were sold after 1 year, find
 - a) the value of k .
 - b) how many units were sold after 5 years.
 - c) $y'(t)$
 - d) $y'(6)$ and interpret the result.