

Name: _____ Date: _____

$$A(t) = A_0 e^{kt} \quad u(t) = T + (u_0 - T)e^{kt} \quad P(t) = \frac{c}{1 + ae^{-bt}}$$

1) The function $f(x) = \frac{3}{x^3}$ is one-to-one.

a) Find the domain and range of $f(x) = \frac{3}{x^3}$

b) Find the inverse of the above function.

c) Find the domain and range of the inverse function.

2) Solve the following algebraically:

a) $4^x - 2^x = 0$

b) $e^{x^2} = (e^{3x}) \cdot \frac{1}{e^2}$

c) If $4^x = 7$, what does 4^{-2x} equal?

3) Write each of the following expressions as a sum and / or difference of logarithms. (Express the powers as factors.)

a)
$$\ln \left(\frac{\sqrt[3]{x^2 + 5}}{x^2 - 49} \right)^{\frac{1}{5}}$$

b)
$$\log_a \left(\frac{u^2 v^3}{w^5} \right)$$

- 4) Write the following expression as a single logarithm.

$$\ln\left(\frac{x-1}{x}\right) + \ln\left(\frac{x}{x+1}\right) - \ln(x^2 - 1)$$

- 5) Find the domain of the following logarithmic function

$$\log\left(\frac{x+1}{x-1}\right)$$

- 6) Solve the following equation algebraically.

$$4^x - 2^x - 12 = 0 \square\square$$

7) A fossilized leaf contains 14% of its normal amount of carbon-14. How old is the fossil (to the nearest year)? (Use 5600 years as the half – life of carbon 14)

8) A thermometer reading 79 degrees F is placed inside a cold storage room with a constant temperature of 35 degrees F. If the thermometer reads 74 degrees F in 13 minutes, how long will it take for the thermometer to reach 57 degrees F? Assume the cooling follows Newton's Law of Cooling (and Round your answer to the nearest whole minute)

- 9) The logistic growth model $P(t) = \frac{1240}{1 + 40.33e^{-0.325t}}$ represents the population of a bacterium in a culture tube after t hours. What was the initial amount of bacteria in the population?

- 10) A life insurance company uses the following rate table for annual premiums for women for term life insurance. Use a graphing utility to fit an exponential function to the data. Predict the annual premium for a 70 year old woman. (Hint after using your calculator, write your final equation in the form of $A(t) = A_0e^{kt}$)

Age	35	40	45	50	55	60	65
Premium	\$103	\$133	\$190	\$255	\$360	\$503	\$818

Time, hrs	2	3	4	5	8	10	15
Luminosity	77.4	60.8	54.5	45.8	30	24.3	10.5

11). After introducing an inhibitor into a culture of luminescent bacteria, a scientist monitors the luminosity produced by the culture. Use a graphing utility to fit a logarithmic function to the data. Predict the luminosity after 20 hours

12) A mechanic is testing the cooling system of a boat engine. He measures the engine's temperature over time. Use a graphing utility to fit a logistic function to the data. What is the carrying capacity of the cooling system?

Time (min)	5	10	15	20	25
Temperature Degrees F	100	180	270	300	305