

I. Find the inverse function for each and give the domain and range of the function and its inverse.

$$a) f(x) = \sqrt{x+7} - 3 \quad b) f(x) = \frac{2}{3x+5} \quad c) f(x) = x^2 - 10x \quad x \geq 5$$

$$d) f(x) = 3x^5 \quad e) f(x) = \frac{4}{\sqrt[3]{x}}$$

II. Solve for x .

$$a) 16^x - 2(4^x) - 15 = 0 \quad b) x^2 e^x - x e^x = 0$$

$$c) \frac{e^{x+3}}{e^{2x-3}} = 2 \quad d) \frac{e^{4x+3}}{e^{x+7}} = 2$$

III. Write as a power of x .

$$a) \sqrt[3]{x^2} \quad b) \sqrt[4]{\frac{1}{x}} \quad c) \left(\frac{1}{x}\right)^3$$

$$d) x^2 \sqrt[5]{x} \quad e) (x^2)^3 \quad f) \frac{\sqrt[5]{x^3}}{x}$$

Modified exponential growth and decay problems from *Applied Calculus* by Tan.

1. The growth rate of the bacterium *Escherichia coli* is proportional to its amount. Initially the culture has 100 cells. The size of the culture doubles every 20 minutes.

- Find the quantity of cells in the culture as a function of time in minutes.
- How long will it take for the size of the culture to reach 1 million cells?

2. The world population in 1990 was 5.3 billion growing at about 2% per year.

- Find $Q(t)$, the world population as a function of $t = \#$ years past 1990, and use it to estimate the world population in 2012.

b) According to this model, in how many years does the population triple?

3. If the temperature is constant, then the atmospheric pressure P (in pounds per square inch) varies with the altitude above sea level h according to the law $P = p_0 e^{-kh}$ where p_0 is the pressure at sea level and k is a constant. If the atmospheric pressure is 15 pounds per square inch at sea level and 12.5 pounds per square inch at 4000ft above sea level, what is the atmospheric pressure at 12000 ft?

4. The radioactive isotope Strontium 90, Sr-90, is present in the fallout resulting from nuclear explosions. The half life of Sr-90 is 27 years. If the amount of Sr-90 is 4 times the safe level, how long will it take to reach the safe level?

5. Evaluate without a calculator:

a) $\log_4 24 + \log_4 40 - \log_4 3 - \frac{1}{3} \log_4 125$ b) $\log_2 \frac{1}{8}$ c) $-\log_2 \frac{1}{4}$

6. Find the inverse function and graph the function and its inverse.

a) $f(x) = 5 + 2e^{-x}$ b) $f(x) = \ln\left(\frac{1}{x+1}\right)$ c) $f(x) = 2(x+1)^3$

7. From *Applied Calculus* by Tan The height in feet of a certain kind of tree is approximated by

$h(t) = \frac{160}{1 + 240 e^{-0.2t}}$. At what age will the tree be 80 feet tall?

8. Solve for x :

a) $20 e^{3x} = 400$ b) $20 (5^{3x}) = 400$ c) $\log_2 x + \log_2 (x - 5) - \frac{1}{2} \log_2 9 = 3$

9. Compare the graphs of $y = \ln(x^2) = 2 \ln |x|$ and $y = (\ln |x|)^2$

