

1. 10 pts. each Let

$$f(x) = (x - 60)^5.$$

- (a) Prove that f is one-to-one.
(b) Find a formula for the inverse of f .

2. 10 pts. Find three examples of functions that are their own inverses; that is, $f = f^{-1}$.

3. 10 pts. Graph the piecewise-defined function

$$f(x) = \begin{cases} e^{-x} - 4, & x < -2 \\ x + 3, & -1 \leq x < 1 \\ x^2, & x \geq 1. \end{cases}$$

4. 10 pts. Convert $\log_t Q = k$ to an exponential equation, and convert $p^k = 3$ to a logarithmic equation.

5. 10 pts. Express

$$\ln \sqrt[3]{ab^2}$$

in terms of sums and differences of logarithms.

6. 10 pts. Express

$$\ln x - 3[\ln(x - 5) + \ln(x + 5)]$$

as a single logarithm.

7. 10 pts. each Solve each equation algebraically.

(a) $4^{3x-5} = 16$

(b) $\log_5(8 - 7x) = 3$

(c) $\log(2x + 1) - \log(x - 2) = 1$

(d) $\frac{e^x + e^{-x}}{e^x - e^{-x}} = 3$

(e) $\sqrt{\ln x} = \ln \sqrt{x}$

8. 15 pts. The population of Haiti has a growth rate of 1.08% per year. In 2015 the population was 9,996,731, and the land area of Haiti is 32,961,561,600 square yards. Assuming that this growth rate continues and is exponential, after how long will there be one person for every square yard of land?

9. 10 pts. Solve the system of equations:

$$\begin{cases} x + 3y = 0 \\ 20x - 15y = 75 \end{cases}$$

10. 15 pts. Solve the system of equations:

$$\begin{cases} x + y + z + w = 2 \\ x + 2y + 2z + 4w = 1 \\ -x + y - z - w = -6 \\ -x + 3y + z - w = -2 \end{cases}$$