

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Write the expression in expanded form.

1)  $\log_x 8yz$

2)  $\log \frac{x^2 z}{y^4}$

3)  $\ln \sqrt{x^7 y}$

Write the expression in condensed form.

4)  $\log_5 (25) - \log_5 (7)$

5)  $\frac{1}{2} \ln x - \ln 8$

6)  $\log_b 2x + 3(\log_b x - \log_b y)$

7)  $2 \ln \sqrt{x^3} - 10 \ln \sqrt[5]{y^4}$

Solve the logarithmic equation.

8)  $\log_9 (x - 5) + \log_9 (x - 5) = 1$

9)  $\log (3 + x) - \log (x - 4) = \log 2$

10)  $\ln x - \ln (x - 7) = \ln 3$

11)  $\log_4 (x + 7) + \log_4 (x - 7) = 1$

Solve the problem.

- 12) A lake is stocked with 570 fish of a new variety. The size of the lake, the availability of food, and the number of other fish restrict growth in the lake to a limiting value of 3562. The population of fish in the lake after time  $t$ , in months, is given by the function,  $P(t) = \frac{3562}{1 + 4.55e^{-0.4t}}$ . After how many months will the population be 2205?

- 13) The marriage rate in a certain country in 1990 was 0.89%, and there were about 439,000 marriages that year. Use the model  $M(t) = M_0(1 + r)^t$ , with a constant marriage rate and  $t = 0$  corresponding to 1990 to estimate the year in which the number of marriages will be 1 million.

- 14) Suppose that  $y = \frac{2 - \log(100 - x)}{0.32}$  can be used to calculate the number of years  $y$  for  $x$  percent of a population of 706 web-footed sparrows to die. Approximate the percentage (to the nearest whole per cent) of web-footed sparrows that died after 1 yr.