

1. Completely simplify $\log\left(\frac{x^3}{\sqrt{y}}\right)$.

2. Solve each of the following.

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

(b) $4^x = 5$

(c) $3e^{2x} = 12$

(d) $\log_2 x = 3$

(e) $\ln 3x = 6$

(f) $\log_3(8x + 1) - \log_3(2x + 1) = 1$

(g) $\log_3(x - 4) + \log_3(x + 4) = 2$

3. The number of gallons of ethanol produced in the United State can be estimated by

$$E(t) = 0.18(1.137)^t$$

where $E(t)$ is the annual production, in billions of gallons, t years after 1980. In what year did the United States produce 5 billion gallons of ethanol?

4. A car loan of \$18,000 has monthly payments. If the interest rate is 6%, and the loan will be paid off in 5 years, what are the monthly payments? $L = P \left[\frac{1 - \left(1 + \frac{r}{12}\right)^{-12t}}{\frac{r}{12}} \right]$

5. A bacteria culture doubles in size every 15 hours. What is the exponential growth constant r for this bacteria? Assume that the population grows according to the model $P = P_0e^{rt}$.

6. A roast is taken from the oven and has an internal temperature of 130°F. After 15 minutes, the internal temperature is 115°F. If the room temperature is 68°F, how long will it take the roast to cool to 100°F? $T(t) = M + (T_0 - M)e^{-kt}$