1. The stray-cat population in a small town grows exponentially. In 1999, the town had 30 stray cats and the relative growth rate was 15% per year.

(a) Find a function that models the stray-cat population after $t$ years.

(b) Find the projected population after 4 years. (Round to nearest whole unit).

(c) Find the number of years required for the stray-cat population to reach 500. (Round to two decimal places).

2. A sum of $5,000 is invested at an interest rate of $8\frac{1}{2}\%$ per year, compounded quarterly.

(a) Find the amount of the investment after 2 years. (Round to two decimal places).

(b) After what period of time will the investment amount to $7,500? (Round to two decimal places).

3. How much should parents invest today at 4.5%, compounded continuously, in order to have $150,000 for their child’s education 18 years from now? (Round to two decimal places).

4. Solve for $x$.

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

(b) $\ln 2 + \ln x = \ln(7 + x) - \ln(x - 2)$

(c) $3 - \log_2(x - 2) = \log_2 7$

5. Solve for $x$. Give both the exact answer and a decimal approximation, accurate to four decimal places.

(a) $4 \left(1 + e^{3x}\right) = 20$

(b) $5^{4x-2} = 7$

(c) $3e^{4x} - 11e^{2x} + 10 = 0$
6. Write the equation \( \log_{6} 37 = y \) in exponential form.

7. Write the equation \( 2^{6} = 64 \) in logarithmic form.

8. Rewrite the following expression as a single logarithm.

\[
7 \ln x - 2 [3 \ln(z + 1) - 4 \ln y]
\]

9. Use the Laws of Logarithms to rewrite the expression in a form with no logarithm of a product, quotient, or power where possible.

\[
\ln \left( \frac{x^{2}(x^{2} + 5)^{3}}{\sqrt[3]{x - 6}} \right)^{2}
\]

10. Use the Change of Base Formula and a calculator to evaluate \( \log_{9} 14 \) correct to four decimal places.

11. Evaluate. **Exact answers only – no decimals**

   (a) \( \log_{4} 32 = \)

   (b) \( \log_{5} \frac{1}{625} = \)

12. Use the definition of the logarithmic functions to solve for the variable. Exact answers only.

   (a) \( \log_{a} 8 = \frac{3}{4} \)

   (b) \( \ln x = 7 \)
ANSWERS

1. (a) \( P = 30e^{0.15t} \)
   (b) 55 cats
   (c) 18.76 years

2. (a) $5915.98
   (b) 4.82 years

3. $66,728.71

4. (a) \( x = 3 \quad (x = -4 \text{ does not check}) \)
   (b) \( x = \frac{7}{2} \quad (x = -1 \text{ does not check}) \)
   (c) \( x = \frac{22}{7} \)

5. (a) \( x = \frac{\ln 4}{3} \approx 0.4621 \)
   (b) \( x = \frac{2 \log 5 + \log 7}{4 \log 5} \approx 0.8023 \)
   (c) \( x = \frac{\ln 5 - \ln 3}{2} \approx 0.2554, \quad x = \frac{\ln 2}{2} \approx 0.3466 \)

6. \( 37 = 6^y \)

7. \( \log_2 64 = 6 \)

8. \( \ln \left( \frac{x^7 y^8}{(z + 1)^9} \right) \)

9. \( 4 \ln x + 6 \ln(x^2 + 5) - \frac{2}{3} \ln(x - 6) \)

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11. (a) \( \frac{5}{2} \)
    (b) -4

12. (a) 16
    (b) \( e^7 \)