1. Simplify the expression:

   a. $\ln e^{2x-1}$

   b. $e^{\ln x^2}$

   c. $1-\ln e^{2x}$

   d. $2\log 10^{x-3}$

   e. $8^{\log_8 25}$

   f. $\log_4 4^{3x}$

2. Given $\log_a 2 \approx 0.356$, $\log_a 3 \approx 0.565$, *and* $\log_a 5 \approx 0.827$, *use the properties of logarithms to evaluate the following:*

   a. $\log_a 18$

   b. $\log_a \dfrac{6}{5}$

   c. $\log_a 30$

   d. $\log_a 27$

   e. $\log_a \dfrac{5}{3}$

   f. $\log_a 60$

3. Use the properties of logarithms to write the expression in terms of ln2 and ln3.

   a. $\ln 12$

   b. $\ln\left(\frac{3}{4}\right)$

4. Expand the expression (write as a sum or difference of logarithms). Simplify if possible.

   a. $\log_3 3x$

   b. $\log_6\left(\dfrac{2x}{y^2}\right)$

   c. $\log_9\left(\dfrac{x+1}{9}\right)$

   d. $\log_6 \dfrac{x(x-3)^2}{\sqrt{x-5}}$

5. *Condense the expression (write as a single logarithm).*

    a. $\ln 4 + 3\ln y + \ln z$
                                                    b. $3\ln(x+1) - 2\ln y + \ln 2$

    c. $\log 3 + \frac{1}{2}\log x - \log 5$
                                                 d. $\log_5(x-1) + 2\log_5 x - \frac{1}{2}\log_5(x+2)$

6. *Use a calculator to evaluate the logarithm. Round to 3 decimal places.*

    a. $\log 129$
                    b. $\log_2 500$
                    c. $\ln(0.579)$
                    d. $\log_5 1.25$

Use the following formulas for 7 - 9:
                $A = P\left(1 + \dfrac{r}{n}\right)^{nt}$
                $A = Pe^{rt}$

Must show set up and all work.

7. You invested $2,500 in an account paying 4.25% compounded continuously. How much will be in the account 10 years later?

8. You want to have $4,000 in your savings account after 4 years. Find the amount you should deposit if the account pays 3.5% annual interest compounded quarterly.

9. Joel wants to have $10,000 in an account in 15 years. How much should he put into the account if it pays 3% compounded continuously?

Solve the following equations algebraically. Check for extraneous solutions where needed. Round approximate answers to 3 decimal places.

10. $2e^{3x} = 5$

11. $\ln x + \ln 2 = 4.1$

12. $4^{x+2} = \frac{1}{16}$

13. $3\log_4(x-1) = 2$

14. $\log_2(x-1) + \log_2(x-3) = 3$

15. $3 \cdot 4^{x-1} + 11 = 32$

16. $\log_4(2x+7) = \log_4(5x-5)$

17. $7^x = 54$

18. $e^{-6-3x} = e^{x^2+4x}$

19. $\log x + \log 3 = 2$

20. $14^{7x} + 8 = 39$

21. $2\ln x = x^2 - 2$ (Solve Graphically)

22.   The radioactive isotope Actinium-227 has a half-life of 22 years.
       a. Use the half-life to find the value of k. (Hint: use the model $y = Ce^{kt}$)

       b. A sample contains 32 grams of Actinium-227. How much actinium-227 remains after 18 years?
       Round answer to the nearest gram.

23.   On the Richter scale, the magnitude R of an earthquake of intensity I (in joules) is modeled by $R = \log I$.
       Find the intensity of an earthquake that measures R = 5.8 on the Richter scale. Round to the nearest
       joule.

24.   Chemists use the pH scale to test acidity. The equation is: $pH = -\log[H^+]$.

       a. The hydrogen ion concentration of a vinegar (acetic acid) solution is about 1.5×10^{-5}. Find its pH.

       b. Seawater has a pH of 8.5. Find the hydrogen ion concentration of seawater.

       c. A grape has a pH of 3.5. Find the hydrogen ion concentration of a grape.