1. An initial population of 820 quail increases at an annual rate of 23%. Write an exponential function to model the quail population. What will the approximate population be after 3 years?

$820(1.23)^3$ $P(1+\frac{r}{n})^{nt}$

$= 1526$ quail

2. The half-life (base) of a certain radioactive material is 32 days. An initial amount of the material has a mass of 361 kg. Write an exponential function that models the decay of this material. Find how much radioactive material remains after 5 days. Round your answer to the nearest thousandth.

$361(\frac{1}{2})^{5/32}$ y^x or ^

$361(.5)^{.15625} = 323.945$ Kg

3. Evaluate $e^{1.8}$ to four decimal places.

1.8 2nd LN = 6.0496

4. Suppose you invest $1600 at an annual interest rate of 4.6% compounded continuously. How much will you have in the account after 4 years?

$1600e^{(.046)(4)} = 1923.23$

Write the equation in logarithmic form.

5. $2^5 = 32$

$\log_2 32 = 5$

Write the equation in exponential form.

6. $\log_4 \frac{1}{16} = -2$

$4^{-2} = \frac{1}{16}$

Evaluate the logarithm.

7. $\log_5 \frac{1}{625}$

$\frac{\log 1/625}{\log 5} = -4$

8. $\log_3 243$

$\frac{\log 243}{3} = 5$

9. The table shows the location and magnitude of some notable earthquakes. How many times more energy was released by the earthquake in Mexico than by the earthquake in Afghanistan? Use the given equation for comparing earthquake intensity level and magnitude.

$$\log \frac{I_1}{I_2} = M_1 - M_2$$

Earthquake Location	Date	Richter Scale Measure
Italy	October 31, 2002	5.9
El Salvador	February 13, 2001	6.6
Afghanistan	May 30, 1998	6.9
Mexico	January 22, 2003	7.6
Peru	June 23, 2001	8.1

$$\log \frac{I_1}{I_2} = 7.6 - 6.9$$

$$\frac{I_1}{I_2} = 10^{0.7} = 5.01$$

The Mexico earthquake is 5.01 times more powerful than Afghanistan

Write the expression as a single logarithm.

10. $3\log_b q + 6\log_b v$

$\log_b q^3 v^6$

11. $\log_7 50 - \log_7 5$

$\log_7 \frac{50}{5} = \log_7 10$

Expand the logarithmic expression.

12. $\log_3 \frac{d}{12}$

$\log_3 d - \log_3 12$

13. $\log_3 11p^3$

$\log_3 11 + \log_3 p^3$

$\log_3 11 + 3\log p^3$

14. Use the Change of Base Formula to evaluate $\log_3 91$. Round to four decimal places.

$\frac{\log 91}{\log 3}$ 4.1060

Solve the exponential equation.

15. $4^{4x} = 8$

$\log_4 8 = 4x$ = $\frac{\log 8}{\log 4} = 4x$

$1.5 = 4x$ $x = 0.375$

Solve. Round to the nearest hundredth.

16. $6^{4x} = 63$

$\log_6 63 = 4x$ $\frac{\log 63}{\log 6} = 4x$

$x = .58$

Solve the logarithmic equation. Round to the nearest ten-thousandth if necessary.

17. Solve $\log(4x + 10) = 3$.

$4x + 10 = 10^3$

$4x + 10 = 1000$

$4x = 990$

$x = 247.5$

Write the expression as a single natural logarithm.

18. $3 \ln 3 + 3 \ln c$

$\ln 3^3 + \ln c^3$

$\ln 27 + \ln c^3$

$\ln 27c^3$

19. $3 \ln x - 2 \ln c$

$\ln x^3 - \ln c^2$

$\ln \frac{x^3}{c^2}$

20. Solve $\ln(2x-1) = 8$. Round to the nearest thousandth.

$2x-1=e^8$

$2x=e^8+1$

$x=\frac{e^8+1}{2}=1490.979$

Use natural logarithms to solve the equation. Round to the nearest thousandth.

21. $6e^{4x}-2=3$

$6e^{4x}=5$

$e^{4x}=5/6$

$4x=\ln(5/6)$

$x=\frac{\ln(5/6)}{4}=-0.046$

22. $8e^{4x+8}=15$

$e^{4x+8}=\frac{15}{8}$

$4x+8=\ln\left(\frac{15}{8}\right)$

$4x=\ln\left(\frac{15}{8}\right)-8$

$x=\frac{\ln(15/8)-8}{4}$

$=-1.843$

23. The sales of lawn mowers t years after a particular model is introduced is given by the function $y = 5500 \ln(9t + 4)$, where y is the number of mowers sold. How many mowers will be sold 4 years after a model is introduced? Round the answer to the nearest whole number.

$t = 4$

$5500 \ln(9 \cdot 4 + 4)$

$5500 \ln(40)$

20289 mowers will be sold after 4 yrs

$\log_b mn = \log_b m + \log_b n$ - Product

$\log_b \frac{m}{n} = \log m - \log n$

$\log_b m^n = n \log_b m$ - Power