Check Your Understanding – Logarithm Laws and Exponential & Logarithmic Equations

1. Write as a single logarithm. *Show your work.*

   a) $2[\log(2x) - \log y] - (\log 3 + 2\log 5)$

   b) $\log_3 x \cdot \log_3 2$

2. Expand. *Show your work.*

   a) $\log_2 \frac{3x^4}{y^8}$

   b) $\ln(x^2 - y^2)$

   c) $\log_a \sqrt[5]{\frac{2x}{x^2-1}}$

3. Solve each exponential equation using the most appropriate strategy. *Round your answers to the nearest thousandth where appropriate.*

   a) $16^{2x-3} = 32^{x+3}$

   b) $\left(\frac{1}{6}\right)^{3x+2} = 216^{x+1}$

   c) $8^x + 4 = 40$

   d) $7e^{-2x} + 9 = 12$

4. Evaluate without using a calculator. *Show your work.*

   a) $\log_5 100 - \log_5 4$

   b) $\log 2 + \log 10 - \log \frac{1}{5}$

   c) $2\log_4 2 - 2\log_4 4 - \log_4 \frac{1}{4}$

5. Solve each logarithmic equation and identify any extraneous roots. *Round your answers to the nearest thousandth where appropriate.*

   a) $\log_7(2x - 3) = 2$

   b) $2\log_5(x + 3) = \log_5 9$

   c) $\log_4(x + 2) - \log_4(x - 4) = \frac{1}{2}$

   d) $3 + 2\ln\left(\frac{x}{7} + 3\right) = -4$

6. The temperature, in °C, of a cup of hot chocolate, *t* minutes after it is made, is given by the equation $T(t) = 92e^{-0.06t}$.

Determine the temperature of the hot chocolate 8 minutes after it is poured. Round your answer to the nearest tenth of a degree Celsius.

7. The wind speed *s* (in miles per hour) near the center of a tornado is related to the distance *d* (in miles) the tornado travels by the equation $s = 93 \log d + 65$.

On March 18, 1925, a tornado whose wind speed was about 280 miles per hour struck the Midwest. How far did the tornado travel? Round your answer to the nearest hundredth of a mile.

8. The half-life of Palladium-100 is 4 days. After 16 days an initial sample has been reduced to a mass of 0.75 g. Determine the starting mass of the sample. Round your answer to the nearest gram.

9. The number of students in a school t years after the school opens can be modelled by the equation $S = S_o[\log_2(t + 1) + 1]$, where S_o is the original number of students in the school. How many years will it take for the number of students to reach 800 if the original number of students in the school was 200? Round to the nearest tenth of a year.