7.5: Properties of Logarithms
"I WILL…
Expand and/or Condense a Logarithm using established properties.

I. Review of Exponent Rules and Properties of Logarithms

	Exponential	Logarithmic
Product	$a^n a^m = a^{\square}$	$\log_b(x) + \log_b(y) = \square$
Quotient	$\frac{a^n}{a^m} = a^{\square}$	$\log_b(x) - \log_b(y) = \square$
Power	$(a^n)^m = a^{\square}$	$\log_b(a^p) = \square$

II. Expanding vs. Condensing
A. **Expanding** Logarithms involves breaking down a simpler component into a complicated expression
B. **Condensing** Logarithms involves breaking down a complicated expression into simpler components

III. Model Problems

Ex 1: Expand $\log_3(4 \cdot 5)$	Ex 2: Expand $\log 3x$	Your Turn: Expand $\log_4 xy$
Ex 3: Expand $\log_5\left(\frac{b}{5}\right)$	Ex 4: Expand $\log_5\left(\frac{b^3}{5}\right)$	
Ex 5: Expand $\log_8\left(\sqrt{xy^3}\right)$	Your Turn: Expand $\log_{20}\left(\frac{\sqrt{x}}{y}\right)$	
Ex 6: Condense $\log_3 x + \log_3 8$	Ex 7: Condense $\log_5 36 - \log_5 4$	Your Turn: Condense and simplify, $\log_2 6 - \log_2 4$

Ex 8: Solve for x, $\log_4 2 - \log_4 x = \log_4(2/3)$	Ex 9: Solve $\frac{10^{\log 10}}{\log 10^{10}}$	Your Turn: Solve for x, $\log_3 16 = x\log_3 2$
Ex 10: Condense $\log_5 100 - 2\log_5 2$	Ex 11: Condense $(1/2)\log_5 36 - (1/3)\log_5 8$	Your Turn: Condense $3\log_4 x - 2\log_4 y + 7\log_4 z$

Ex 12: Using $\log 7 \approx 0.8451$, $\log 9 \approx 0.9542$, approximate $\log 63$	Ex 13: Using $\log 7 \approx 0.8451$, $\log 9 \approx 0.9542$, approximate $\log 9/7$
Ex 14: Using $\log 7 \approx 0.8451$, $\log 9 \approx 0.9542$, approximate $\log 81$	Your Turn: Using $\log 7 \approx 0.8451$, $\log 9 \approx 0.9542$, approximate $\log 81/49$
Ex 15: The Richter magnitude of an earthquake, M, is related to the energy released in ergs, E, by the formula, $\frac{2}{3}\log\left(\frac{E}{10^{11.8}}\right) = M$. Find the energy released by an earthquake of magnitude 4.2.	Your Turn: The Richter magnitude of an earthquake, M, is related to the energy released in ergs, E, by the formula, $\frac{2}{3}\log\left(\frac{E}{10^{11.8}}\right) = M$. Find the energy released by an earthquake of magnitude 6.2.

Assignment: Worksheet