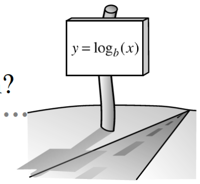
CW#___ Name:______________________________



5.2.1 Do you need a base to have rhythm?

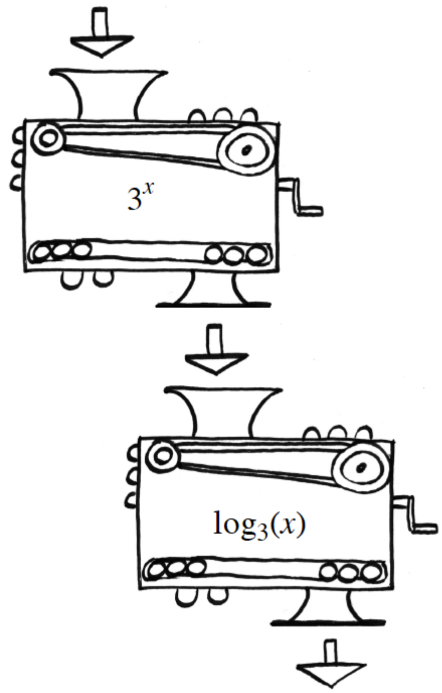
Logarithms

#37 Leoma has hooked up two function machines as shown in the diagram at right.

a. When Leoma puts 4 into the first machine, 81 comes out. Then the 81 goes into the second machine. What comes out?

b. Next Leoma puts a 2 into the first machine. What number comes out of this machine and goes into the second machine? What then comes out of the second machine?

c. If *x* goes into the first machine, what comes out of the second machine?



d. How are functions that are inside the function machines related?

You may recall that a logarithm (called a "log" for short) represents the power to which a fixed number (a base) must be raised to produce a given number. For example, $\log_2(16) = 4$ because $2^4 = 16$. The common logarithm is the logarithm base 10. It is expressed as $\log_{10}(x)$, but more often as $\log(x)$.

#38 Without a calculator, evaluate each of the following logarithmic expressions. Look for and record any patterns or interesting results.

a. $\log_3(9)$	b. $\log\sqrt{10}$	c. $\log_4\left(\frac{1}{16}\right)$	d. $\log(1)$
e. $\log_7(7^5)$	f. $2^{\log_2(16)}$	g. $\log_{0.2}(5)$	h. $10^{\log(n)}$
i. $\log_4(\sqrt{2})^3$	j. $4^{\log_2(9)}$	k. $\log_{\sqrt{b}}(b)^{3/5}$	l. $4^{\log_2(x)}$

#39 Another useful logarithm is the **natural logarithm**, or the logarithm base *e*. It is expressed as $\log_e(x)$, but more often as $\ln(x)$. When speaking, the two letters are stated separately as *"el en x"*.

Without a calculator, evaluate each of the following expressions involving the natural logarithm.

a. $\ln(1)$	b. $\ln(e)$	c. $\ln\sqrt{e}$	d. $e^{\ln(x)}$

40. Can a logarithm have any base? Can you take the logarithm of any number? With your team, investigate the possible values of *n*, *m*, and *b* in the equation below. Record your conclusions and be prepared to share your findings with the class.

$$\log_b(n) = m$$

Solve each of the following equations.

a. $\ln\left(\frac{3}{2}x + 9\right) = 1$	b. $\log(-3) = x$