Assignments for Algebra 2
Unit 12: Logarithmic Functions

Day 1 – Evaluate Logarithms

Objectives: SWBAT Evaluate Logarithms

Logarithm– A logarithm answers the question "How many of a specific number to we need to multiply by itself to get another number?

$2^{?} = 8$

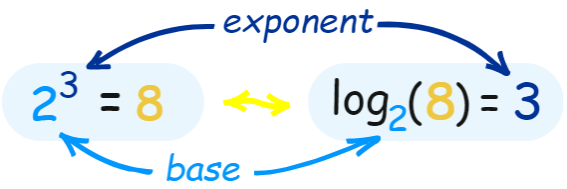
DEFINITION OF LOGARITHM WITH BASE *b*

Let b and y be positive numbers with $b \neq 1$.
The logarithm of y with base b is denoted by $\log_b y$ is defined as follows:

$2^3 = 8$

$\log_b y =$ _____ if and only if $b^x =$ _____

The expression $\log_b y$ is read as "log base b of y."



Common logarithm– logarithm with base 10, and written as log

Natural logarithm– logarithm with base *e*, and written as ln

Rewrite the logarithmic equations as exponential equations.

1. $\log_2 32 = 5$

2. $\log_7 1 = 0$

3. $\log_{13} 13 = 1$

4. $\log_{1/2} 2 = -1$

5. $\log_3 243 = 5$

6. $\log_2 64 = 6$

Evaluate logarithms.

7. $\log_3 81 =$

8. $\log_4 0.25 =$

9. $\log_{1/4} 256 =$

10. $\log_{49} 7 =$

11. $\log_{1/3} 9 =$

12. $\log_{16} 4 =$

Inverse Rule / Common Base Rule of Logarithms– $log_b b^x = x \ \ and \ b^{log_b(x)} = x$

Use inverse properties of logarithms to simplify the following expressions.

13. $10^{\log 6.7}$ **14.** $\log_2 16^x$ **15.** $e^{\ln 7x}$ **16.** $\log_3 27^x$

Use a calculator to evaluate the following logarithms.

17. $\log 26$ **18.** $\ln 0.45$

Day 2 – Graph Logarithmic Functions

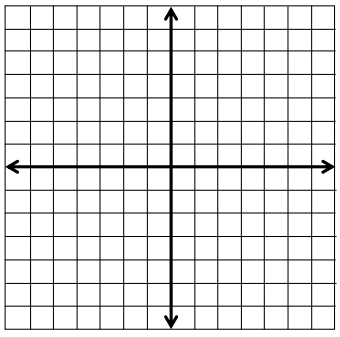
Objectives: SWBAT Graph Logarithmic Functions:

Find the inverse of the following functions.

1. $y = \log_{3/2} x$ **2.** $y = e^{(x-4)}$ **3.** $y = \log_7 x$ **4.** $y = \ln(x+6)$

PARENT FUNCTION FOR LOGARITHMIC FUNCTIONS

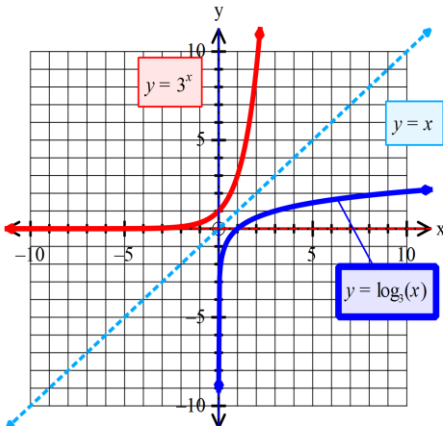
$y = \log_b x$ For this graph we will use b = 3.



- Notice that the graph is similar to an _____
- What would happen if the b was greater than zero but smaller than 1?
- The y-axis is an _____ of the graph.
- The domain of the parent function is _____.
- The range of the parent function is _____ .

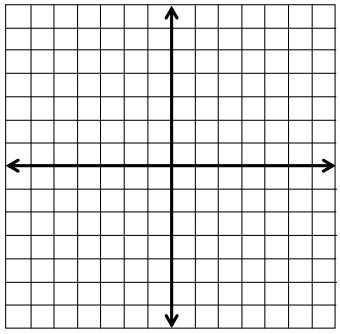
Steps to graphing a logarithmic function.

- Identify the parent function and write in exponential form.
- Find your two crucial points, by using $y = 0$, and $y = 1$.
- Translate the crucial points if needed.
- Sketch the logarithmic function.



Graph the following logs.

1. $y = \log_2 x$



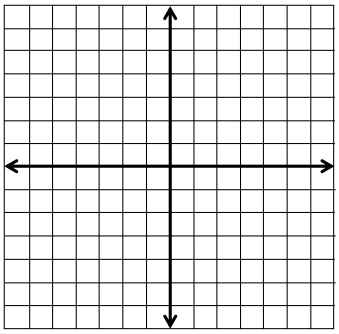
Domain:

Range:

Asym:

(_____, **−1**) (, _____, **0**) (_____, **1**)

2. $f(x) = \log_{1/3} x$



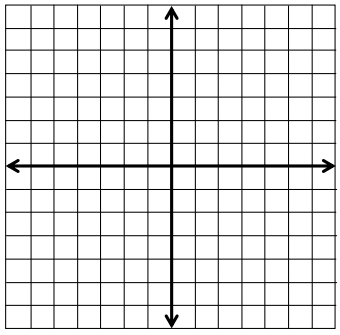
Domain:

Range:

Asym:

(_____, **−1**) (, _____, **0**) (_____, **1**)

3. $y = \log_3(x-1)+2$



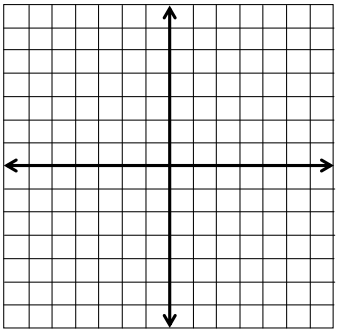
Domain:

Range:

Asym:

(_____, **−1**) (, _____, **0**) (_____, **1**)

4. $f(x) = \log_{1/2} x - 3$



Domain:

Range:

Asym:

(_____, **−1**) (, _____, **0**) (_____, **1**)

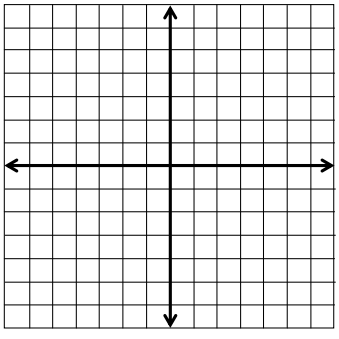
Use a calculator to graph the following natural logs.

5. $y = \ln(x)+2$

Domain:

Range:

Asym:



(_____, **−1**) (, _____, **0**) (_____, **1**)

Day 3 – Apply Properties of Logarithms

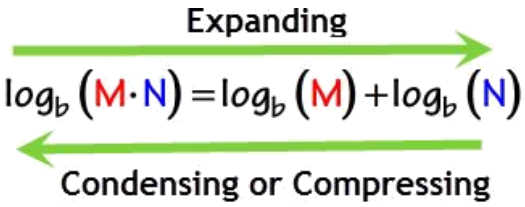
Objectives: SWBAT use and apply the properties of logs

Use exponential form to evaluate the following logarithms.

1. $\log_5 1$ **2.** $\ln 0$ **3.** $\log_6(-3)$ **4.** $\log_3 27$

PROPERTIES OF LOGARITHMS

Let *b*, *m*, and *n* be positive numbers such that $b \neq 1$.



Product Property: $\log_b mn = \log_b m$ ____ $\log_b n$

Quotient Property: $\log_b \frac{m}{n} = \log_b m$ ____ $\log_b n$

Power Property: $\log_b m^n =$ _____

Use properties of logarithms and the following values to evaluate the following logarithms.

$\log_5 4 \approx 0.861$ and $\log_5 9 \approx 1.365$

5. $\log_5 \frac{4}{9}$ **6.** $\log_5 36$ **7.** $\log_5 81$

Use properties of logarithms to expand the following logarithmic expressions.

8. $\log 5x^7$ **9.** $\log_3 \frac{7x^2}{y}$

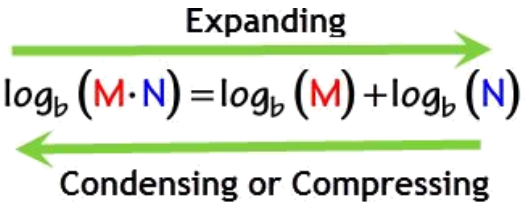
10. $\log_4 \frac{(16x)^2}{3\sqrt{y}}$ **11.** $\ln \frac{7y^3}{4x^2}$

Day 4 – More Applying Properties of Logarithms

Objectives: SWBAT use and apply the properties of logs

PROPERTIES OF LOGARITHMS

Let *b*, *m*, and *n* be positive numbers such that $b \neq 1$.



Product Property: $\log_b mn = \log_b m$ ____ $\log_b n$

Quotient Property: $\log_b \frac{m}{n} = \log_b m$ ____ $\log_b n$

Power Property: $\log_b m^n =$ _____

Use properties of logarithms to condense the following logarithmic expressions.

1. $\log 2 + 3\log 3 - \log 9$

2. $\ln 3 + 2\ln x - \ln y$

3. $\log_5 3 + \frac{1}{2}\log_5 x - \log_5 7$

4. $\log 4 - (3\log x + \log y)$

5. $2\ln x - \ln 3 + \ln 6$

6. $3\log_4 x + \log_4 3 - \log_4 x - \log_4 6$

CHANGE OF BASE FORMULA:

If a, b, and c are positive numbers with $b \neq 1$ and $c \neq 1$, then $\log_c a = \frac{\log_b a}{\log_b c}$

In particular $\log_c a =$ _____ and $\log_c a =$ _____.

Use the change of base formula to evaluate the following logarithms.

7. $\log_6 11$

8. $\log_{16} 26$

9. $\log_5 13$

Day 5 – Solve Exponential Equations

Objectives: SWBAT solve equations with where the variable is in the exponent.

Exponential equation– an equation where the variable is in the exponent. $d = b^x$

Solve the following equations by taking the logarithm of each side.

1. $6^x = 27$

2. $8^{3x+2} - 6 = 5$

3. $6e^{0.25x} + 8 = 20$

4. $5^x = 72$

5. $3e^{0.5x} + 2 = 5$

PROPERTY OF EQUALITY FOR EXPONENTIAL EQUATIONS:

If b is a positive number other than one then…

$b^x = b^y$ if and only if _____

So if $5^x = 5^4$, then x = _____.

Solve the following equations by equating exponents.

6. $64^x = 16^{x+1}$

7. $3^{7x-3} = 9^{2x}$

8. An important application of exponential equations is Newton's Law of Cooling. This law states that for a cooling substance with initial temperature T_0, the temperature T after t minutes can be modeled by the equation $T = (T_0 - T_R)e^{-rt} + T_R$, where T_R is the surrounding temperature and r is the substances cooling rate. So if CSI Brodie finds a body that is currently $86^\circ F$ in a hotel room that is $73^\circ F$ and the cooling rate of a human corpse is 0.0033, how long ago did this John Doe die?

Day 6 – Solve Logarithmic Equations

Logarithmic equation: an equation where the variable is inside the logarithm $d = log_b(x)$

PROPERTY OF EQUAILITY FOR LOGARITHMIC EQUATIONS

If *b*, *x*, and *y* are positive numbers with b ≠ 1then…

$\log_b(x) = \log_b(y)$ if and only if _____ So if, $\log_3 x = \log_3 8$ then x = _____.

Solve a logarithmic equation.

1. $\log_7(6x-16) = \log_7(x-1)$

2. $\ln(7x-13) = \ln(2x+17)$

Exponentiate each side of an equation to solve the following logarithmic equations.

3. $\log_5(3x-8) = 2$

4. $\log_4(10x+624) = 5$

5. $\log 5x + \log(x-1) = 2$

6. $\log_3(2x+9) = 3$

7. $\log_6(x-9) + \log_6 x = 2$