AGENDA

Objective:SWBAT Graph exponential and Logarithmic Functions

Language Objective: SWBAT answer reflection questions in writing in order to compare the graphs of exponential and logarithmic functions.

1) Take out HW to be checked/DO NOW
2) HW Questions
3) Discover Logarithmic graphs
4) Concept Review
5) Exit Ticket

HW: "Logs worksheet #5"

Exponential and Logarithmic Graphs

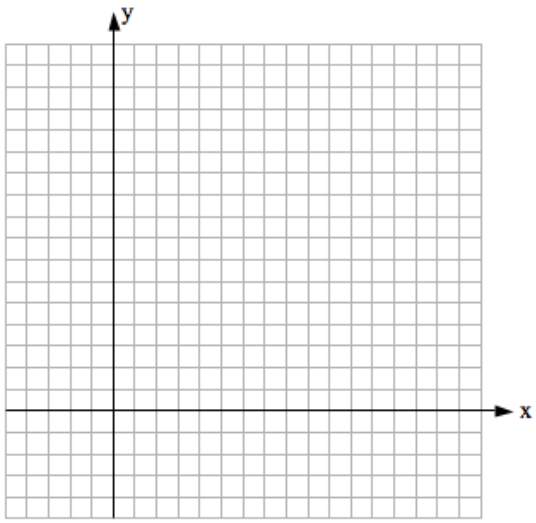
I. Complete the table of values below. Then use the table of values to graph $y = 2^x$ and $y = \log_2 x$ on the grid below.

$y = 2^x$

x	y
-3	
-2	
-1	
0	
1	
2	
3	
4	

$y = \log_2 x$

x	y
1/8	
1/4	
1/2	
1	
2	
4	
8	
16	



1. Are both graphs above functions? How do you know?

2. Identify the following for the graph of $y = 2^x$:

   the y-intercept:

   the x-intercept(s):

   as x decreases to negative infinity, what happens to the y-values?

   as x increases to infinity, what happens to the y-values?

3. Identify the following for the graph of $y = \log_2 x$:

   the y-intercept:

   the x-intercept(s):

   as x decreases, what happens to the y-values?

   as x increases to infinity, what happens to the y-values?

   does x decrease to infinity?

What is the relationship between $y = 2^x$ and $y = \log_2(x)$?

Exponential and Logarithmic Graphs

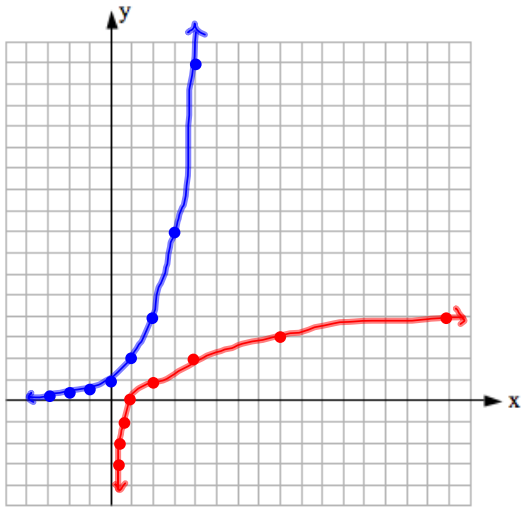
I. Complete the table of values below. Then use the table of values to graph $y = 2^x$ and $y = \log_2 x$ on the grid below.

$y = 2^x$

x	y
-3	1/8
-2	1/4
-1	1/2
0	1
1	2
2	4
3	8
4	16

$y = \log_2 x$

x	y
1/8	-3
1/4	-2
1/2	-1
1	0
2	1
4	2
8	3
16	4



1. Are both graphs above functions? How do you know?
   Yes. For each x value, there is only one y-value.
   Each pass the vertical line test.
2. Identify the following for the graph of $y = 2^x$:
   the y-intercept: (0, 1)

   the x-intercept(s): None

   as x decreases to negative infinity, what happens to the y-values?
   The y value gets approaches 0 as it gets smaller & smaller, but never hits 0.
   as x increases to infinity, what happens to the y-values?
   The y value gets bigger and bigger as it approaches infinity.
3. Identify the following for the graph of $y = \log_2 x$:
   the y-intercept: None

   the x-intercept(s): (0, 1)

   as x decreases, what happens to the y-values?
   The y-value gets smaller and smaller as it approaches negative infinity.
   as x increases to infinity, what happens to the y-values?
   The y-value gets bigger as it goes from negative numbers and approaches 0.
   does x decrease to infinity?
   No, x must be greater than 0 because x represents
   the powers of 2, all of which are positive!

What is the relationship between $y = 2^x$ and $y = \log_2(x)$?

$y = 2^x$ and $y = \log_2(x)$ are INVERSE functions.

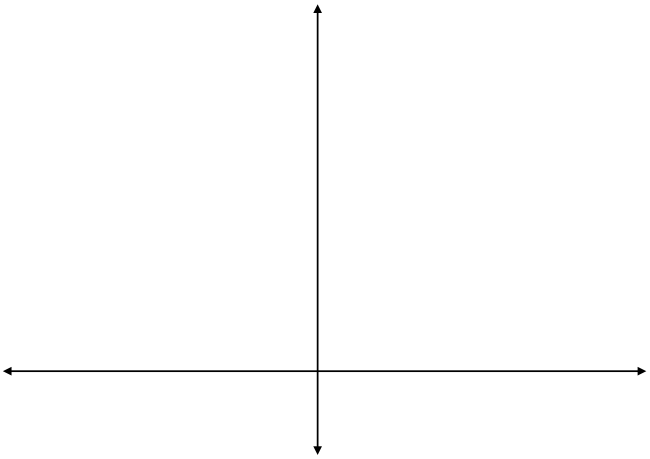
1) Sketch the graph of $f(x) = 3^x$

a. Domain:

b. Range:

c. y- intercept:

d. x –intercept:



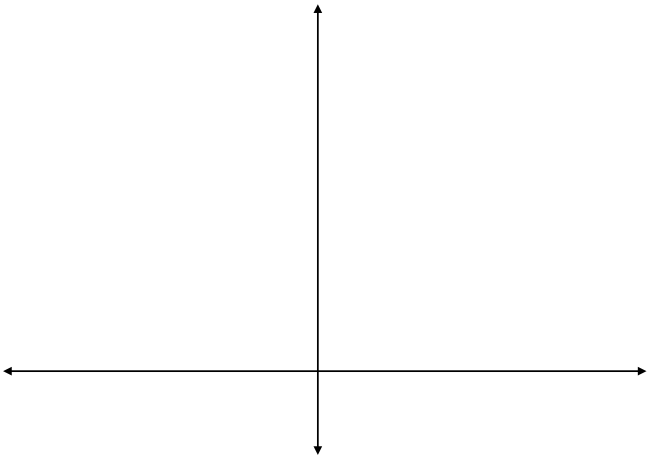
2) Sketch the graph of $f(x) = \left(\frac{1}{3}\right)^x$

a. Domain:

b. Range:

c. y- intercept:

d. x –intercept:



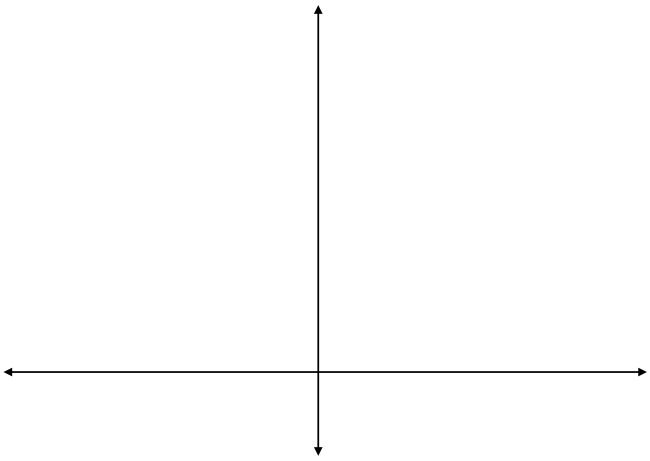
3) Sketch the graph of f(x) = $log_3(x)$

a) Domain:

b) Range:

c) y – intercept:

d) x – intercept:



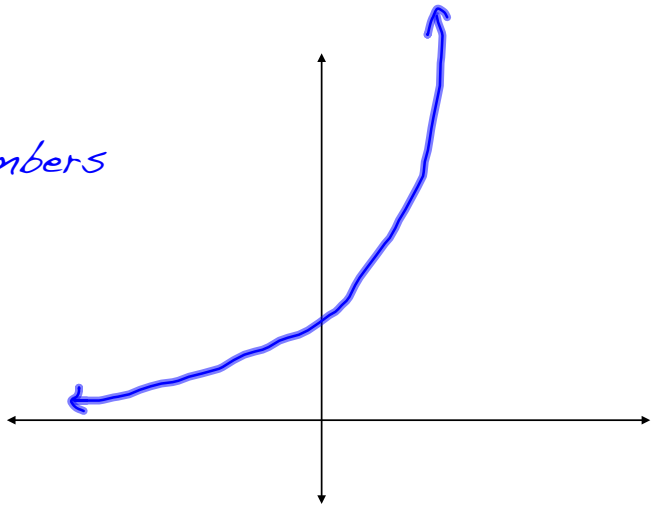
1) Sketch the graph of $f(x) = 3^x$

a. Domain: x = all real numbers

b. Range: $y > 0$

c. y- intercept: $(0, 1)$

d. x –intercept: None



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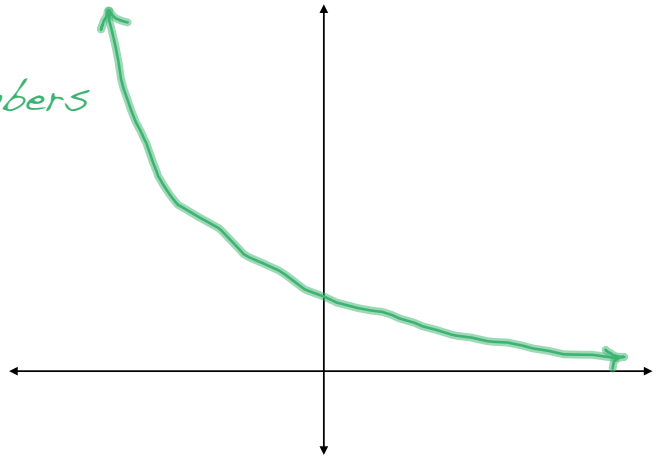


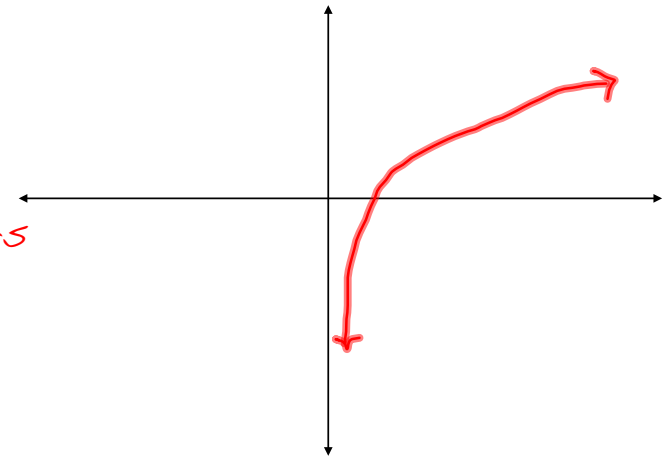
3) Sketch the graph of f(x) = $log_3(x)$

a) Domain: $x > 0$

b) Range: y = all real numbers

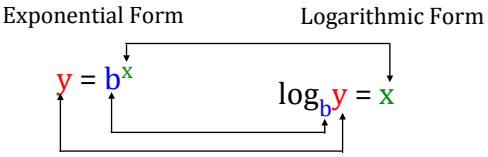
c) y – intercept: None

d) x – intercept: $(1, 0)$



Concept Review

A) Converting Exponential Form to Logarithmic Form and back



Ex.

a) Write in logarithmic form: $4^2=16$

b) Write in exponential form. $\log_5 25 = 2$

B) Calculator Skills

*Remember: Calculator can only assume base 10

No base → assume base 10

$\log_{10}(345) = \log(345)$

***With any base OTHER THAN 10, use Change of Base Formula**

Change of Base Formula

$$\log_b(x) = \frac{\log_{10}(x)}{\log_{10}(b)}$$

1) $\log_9 200$ 2) $\log_4 765$ 3) $\log_{10} 99$ 4) $\log(3000)$

C) Solve for the variable.

Strategy: Change from one form to the other (exponential↔logarithmic)

a) $\log_2 16 = x$ b) $\log_9 n=2$ c) $\log_b 1{,}000{,}000 = 6$ d) $5^{\log_5 3} = x$

D) Know the properties of logarithms

Product Property	$\log_b(m \cdot n) = \log_b m + \log_b n$
Quotient Property	$\log_b\left(\frac{m}{n}\right) = \log_b m - \log_b n$
Power Property	$\log_b(m^p) = p(\log_b m)$

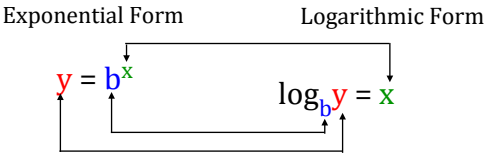
1) $\log_3(45) - \log_3(5) =$ _____ 2) $\log_3(27^{100}) =$ _____

3) $\log_4(4^5) =$ _____ 4) $7 \cdot \log_2 m + 2 \cdot \log_2 n =$ _____

5) $\log_7(3x) - \log_7(9x) + \log_7(6y) =$ _____

Concept Review

A) Converting Exponential Form to Logarithmic Form and back



Ex.

a) Write in logarithmic form: b) Write in exponential form.

$4^2=16$ $\log_5 25 = 2$

$\log_4(16) = 2$ $5^2 = 25$

B) Calculator Skills

*Remember: Calculator can only assume base 10

No base → assume base 10

$\log_{10}(345) = \log(345)$

***With any base OTHER THAN 10, use Change of Base Formula**

Change of Base Formula

$$\log_b(x) = \frac{\log_{10}(x)}{\log_{10}(b)}$$

1) $\log_9 200$ 2) $\log_4 765$ 3) $\log_{10} 99$ 4) $\log(3000)$

2.41 4.79 1.996 3.48

C) Solve for the variable.

Strategy: Change from one form to the other (exponential↔logarithmic)

a) $\log_2 16 = x$ b) $\log_9 n=2$ c) $\log_b 1{,}000{,}000 = 6$ d) $5^{\log_5 3} = x$

$x = 4$ $n = 81$ $b = 10$ $x = 3$

D) Know the properties of logarithms

Product Property	$\log_b(m \cdot n) = \log_b m + \log_b n$
Quotient Property	$\log_b\left(\frac{m}{n}\right) = \log_b m - \log_b n$
Power Property	$\log_b(m^p) = p(\log_b m)$

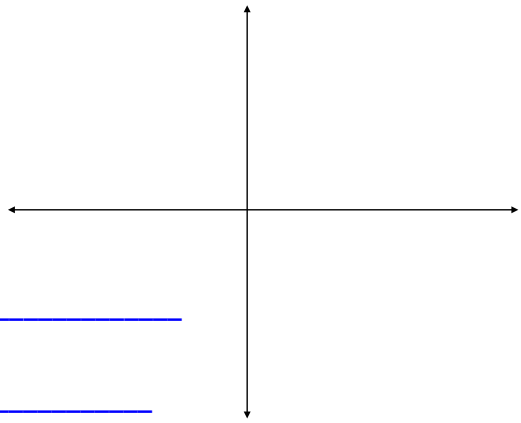
1) $\log_3(45) - \log_3(5) =$ 2 2) $\log_3(27^{100}) =$ 300

3) $\log_4(4^5) =$ 5 4) $7\cdot\log_2 m + 2\cdot\log_2 n =$ $\log_2(m^7n^2)$

5) $\log_7(3x) - \log_7(9x) + \log_7(6y) =$ $\log_7(2y)$

Score: _____/ 8 Name _____

Exit Ticket



1) Sketch $y= 2^x$.

2) Sketch $y= \log_2(x)$

a) what is the domain? _____

b) what is the range? _____

c) What is the x - intercept? _____

d) What is the y - intercept? _____

Score: _____/ 8 Name _____

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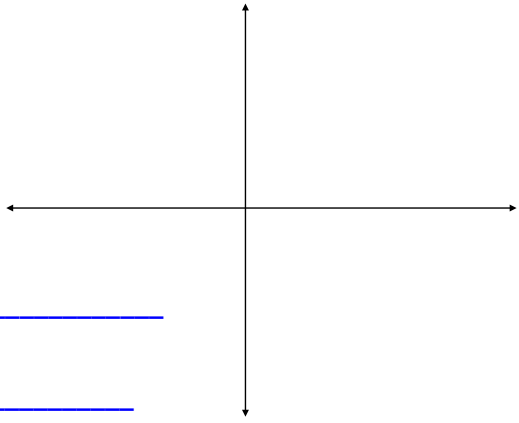

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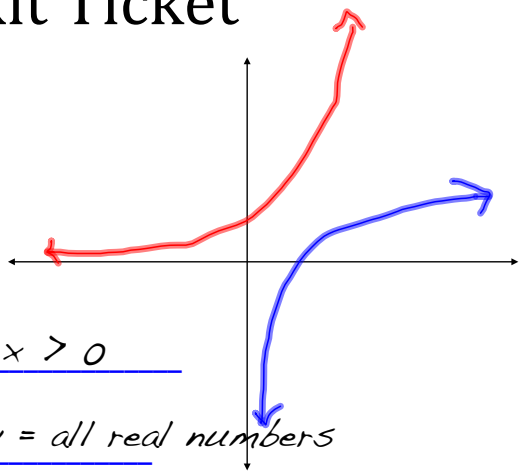
Score: _____/ 8 Name _____

Exit Ticket

1) Sketch $y= 2^x$.



2) Sketch $y= \log_2(x)$

a) what is the domain? $x > 0$

b) what is the range? y = all real numbers

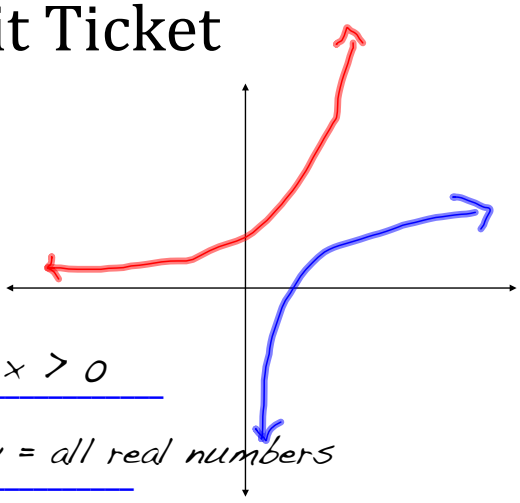
c) What is the x - intercept? (0,1)

d) What is the y - intercept? none

Score: _____/ 8 Name _____

Exit Ticket

1) Sketch $y= 3^x$.



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c) What is the x - intercept? (0,1)

d) What is the y - intercept? none

HW: "Logs worksheet #5"

***Basic Concepts* Logarithm Practice**

1. Write in logarithmic form.
a) $100 = 10^2$

b) $10^0 = 1$

c) $2^x = 10$

2. Write in exponential form.
a) $\log 1000 = 3$

b) $\log 20 = x$

c) $\log_2 a = 5$

3. Solve for the variable.
a) $\log 10{,}000 = v$

b) $\log_2 a = -2$

c) $\log_3 81 = x$

4. Expand the logarithm completely

$\log 45 =$

5. Expand the logarithm completely.
$\log \frac{x^2}{y^3} =$

6. Write as a single logarithm
$2\log a + \log b - \log 3 =$

7. Write in exponential form and solve.
a) $\log_2 x = -2$

b) $\log_x 128 = 6$

8. If $\log 3 = x$ and $\log 2 = y$, write each logarithm as an expression in x and y.
a) $\log 6$

b) $\log 1.5$

c) $\log 18$

9. Solve. (Round to 2nd decimal.)
a) $4^x = 5$

b) $2^{x+3} = 6$

10. Solve
a) $\log(x+2) + \log(x-1) = 1$

b) $\log_3 x^2 - \log_3 2x = 2$

HW: "Logs worksheet #5"

***Basic Concepts* Logarithm Practice**

1. Write in logarithmic form.

a) $100 = 10^2$ $\log_{10}(100)=2$

b) $10^0 = 1$ $\log_{10}(1)=0$

c) $2^x = 10$ $\log_2(10)=x$

2. Write in exponential form.

a) $\log 1000 = 3$ $10^3=1000$

b) $\log 20 = x$ $10^x=20$

c) $\log_2 a = 5$ $2^5= a$

3. Solve for the variable.

a) $\log 10{,}000 = v$ $v = 6$

b) $\log_2 a = -2$ $a = -4$

c) $\log_3 81 = x$ $x = 4$

4. Expand the logarithm completely

$\log 45 =$

$\log(5) + \log(3) + \log(3)$

5. Expand the logarithm completely.

$\log \frac{x^2}{y^3} =$

$2\cdot\log(x) - 3\cdot\log(y)$

6. Write as a single logarithm

$2\log a + \log b - \log 3 =$

$\log\left(\frac{a^2\cdot b}{3}\right)$

7. Write in exponential form and solve.

a) $\log_2 x = -2$ $x = -4$

b) $\log_x 128 = 6$ $x = 2$

8. If $\log 3 = x$ and $\log 2 = y$, write each logarithm as an expression in x and y.

a) $\log 6$ $\log(3) + \log(2) = x + y$

b) $\log 1.5$ $\log(3) - \log(2) = x - y$

c) $\log 18$ $\log(3) + \log(3) + \log(2) = 2x + y$

9. Solve. (Round to 2nd decimal.)

a) $4^x = 5$ $\log_4(5) = x = 1.16$

b) $2^{x+3} = 6$

$\log_2(6) = x + 3$

$2.585 = x + 3$

$2.585 - 3 = x$

$-0.415 = x$

10. Solve

a) $\log(x+2) + \log(x-1) = 1$

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

$10 = (x+2)(x-1) = x^2 + x - 2$

$0 = x^2 + x - 12 \rightarrow 0 = (x-3)(x-4)$

$x = 3$ or 4

b) $\log_3 x^2 - \log_3 2x = 2$

$\log_3(x/2) = 2$

$3^2 = x/2$

$9 = x/2$

$18 = x$