Final Prep

- Inequalities and Graphing
- Pages: 78-82

Solve and Graph on a numberline.

$$3x^2 - 4x + 2 \le x^2 + x + 6$$

$-8x^2$

$-5x$

$3x^2-4x+2=x^2+x+6$

$2x^2-5x-4=0$

$$x=\frac{+5\pm\sqrt{(-5)^2-4(2)(-4)}}{2(2)}$$

$$x=\frac{5\pm\sqrt{57}}{4}$$

$x\approx3.13$ $\quad$ $x\approx-.637$

Test: -1 ✗

$3(-1)^2-4(-1)+2\overset{?}{\le}(-1)^2+(-1)+6$

Test: 0

$3(0)-4(0)+2\overset{?}{\le}(0)^2+(0)+6$ ✓

Test: 4 ✗

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Solve and Graph on a numberline.

$$2x^2 - 5x < 12$$

	$2x$	$+3$
-4	$-8x$	-12
x	$2x^2$	$3x$

$-24x^2$

$-8x \quad 3x$

$-5x$

$2x^2 - 5x = 12$

$2x^2 - 5x - 12 = 0$

$(2x+3)(x-4) = 0$

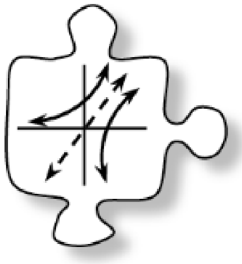
$2x+3=0 \qquad x-4=0$

$x = -\frac{3}{2} \qquad x = 4$

Test: -2	Test: 0	Test: 5
$2(-2)^2 - 5(-2) \overset{?}{<} 12$	$2(0)^2 - 5(0) \overset{?}{<} 12$	$2(5)^2 - 5(5) \overset{?}{<} 12$
No	Yes	No
$8 - (-10) < 12$		

5.2.2 What is a logarithm?

Defining the Inverse of an Exponential Function



P: 72-73

You have learned how to "undo" many different functions. However, the exponential function has posed some difficulty. In this lesson, you will learn more about the inverse exponential function. In particular, you will learn how to write an inverse exponential function in $y =$ form.

5-54. AN ANCIENT PUZZLE

Parts (a) through (f) below are similar to a puzzle that is more than 2100 years old. Mathematicians first created the puzzle in ancient India in the 2nd century BCE. More recently, about 700 years ago, Muslim mathematicians created the first tables allowing them to locate answers to this type of puzzle quickly. Tables similar to them appeared in school math books until recently.

Here are some clues to help you figure out how the puzzle works:

$\log_2(8) = 3$ $\qquad$ $\log_3(27) = 3$

$\log_5(25) = 2$ $\qquad$ $\log_{10}(10{,}000) = 4$

Use the clues to determine the missing pieces of the puzzles below:

a. $\log_2(16) = ?$ 4

b. $\log_2(32) = ?$ 5

c. $\log_?(100) = 2$ 10

d. $\log_5(?) = 3$ 125

e. $\log_?(81) = 4$ 3

f. $\log_{100}(10) = ?$ $\frac{1}{2}$

x	8	32	$\frac{1}{2}$	1	16	4	3	64	2	0	0.25	-1	$\sqrt{2}$	0.2	$\frac{1}{8}$
$g(x)$	3	5	-1		4	2		6							

5-63. SILENT BOARD GAME

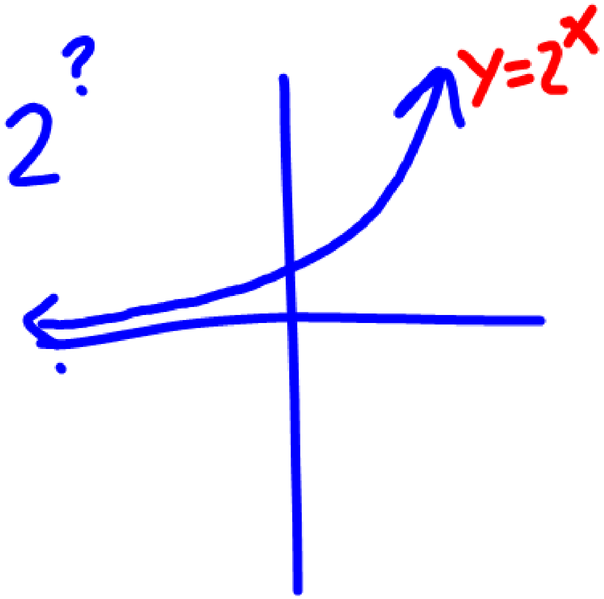
Your teacher will display a table that the whole class will work together to complete. The table will be like the one below. See which values you can fill in.

x	8	32	$\frac{1}{2}$	1	16	4	3	64	2	0	0.25	−1	$\sqrt{2}$	0.2	$\frac{1}{8}$
$g(x)$	3	5	−1	0	4	2	≈1.6	6	1	?	−2	?	$\frac{1}{2}$	≈−2.3	−3

a. Describe an equation that relates x and $g(x)$. $x = 2^{g(x)}$ $g(x) = \log_2(x)$

b. Look back at the Ancient Puzzle in problem 5-54. If you have not already done so, use the idea of the Ancient Puzzle to write an equation for $g(x)$.

c. Why is it difficult to think of an output for the input of 0 or −1? $0 = 2^?$



d. What is the output for $x = 25$, to the nearest hundredth?

5-64. ANOTHER ANCIENT PUZZLE

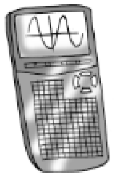
Lynn is supposed to fill in this table for $g(x) = \log_5(x)$. She thinks she can use the log button on her calculator, but when she tries to enter 5, 25, and 125, she does not get the outputs the table below displays. She is fuming over how long it is going to take to guess and check each one when her sister suggests that she does not have to do that for all of them. She can use what she knows about exponents to fill in a couple more and she can use guess and check to fill in the others.

x	$\frac{1}{25}$	$\frac{1}{5}$	$\frac{1}{2}$	1	2	3	4	5	6	7	8	10	25	100	125	625
$g(x)$	-2	−1	-.43	0	.43	.68	.86	1	1.11	1.21	1.29	1.43	2	2.86	3	4

a. Discuss with your team which outputs can be filled in without a calculator. Fill those in and explain how you found those entries.

$x = 5^?$

$x = 5^{g(x)}$



b. With your team, use your calculator and properties of exponents to estimate the remaining values of $g(x)$, to the nearest hundredth. Once you have determined several of the missing outputs, use your knowledge of exponents to write an equation relating x and $g(x)$.

$g(x) = \log_5(x)$

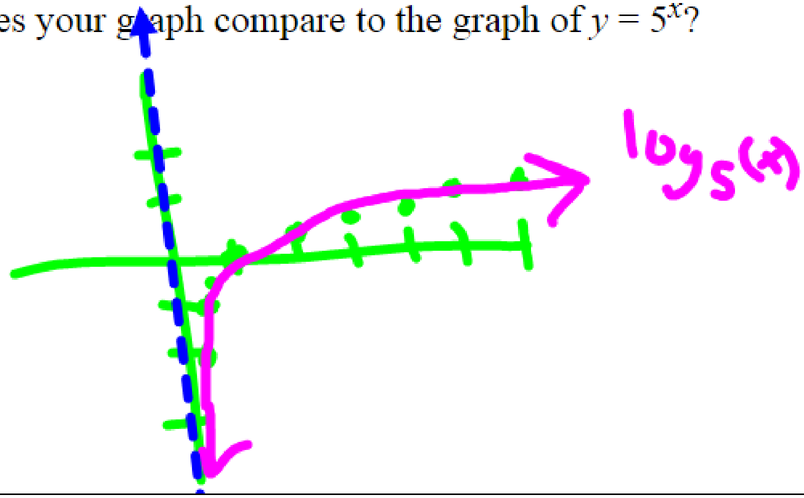
c. What do you notice about the results for $g(x)$ as x increases?

d. Use your table to sketch the graph of $y = \log_5(x)$. How does your graph compare to the graph of $y = 5^x$?

$5^{-3} = \frac{1}{125}$

$5^{-2} = \frac{1}{25}$

$5^{?} = 2$



5-65. Calculate each of the values below, then justify your answers by writing the equivalent exponential form.

a. $\log_2(32) = ?$ 5 $\quad 2^5 = 32$

b. $\log_2\left(\frac{1}{2}\right) = ?$ -1 $\quad 2^{-1} = \frac{1}{2}$

c. $\log_2(4) = ?$

d. $\log_2(0) = ?$

e. $\log_2(?) = 3$

f. $\log_2(?) = \frac{1}{2}$

g. $\log_2\left(\frac{1}{16}\right) = ?$

h. $\log_2(?) = 0$

a. $2^? = 32$

b. $2^? = \frac{1}{2}$

c. $2^? = 4$

d. $2^? = 0$

e. $2^3 = ?$

5-66. While the idea behind the Ancient Puzzle is more than 2100 years old, the symbol log is more recent. It was created by John Napier, who was a Scottish mathematician in the 1600s. The word "log" is short for **logarithm**, and represents the power to which a fixed number (called the base) must be raised to produce a desired number. The log function represents the inverse of an exponential function just as the exponential function represents the inverse of the log function. Use this idea to determine the inverse of each of the following functions. Determine the inverses and write your answers in $y =$ form.

a. $y = \log_9(x)$

b. $y = 10^x$

c. $y = \log_6(x + 1)$

d. $y = 5^{2x}$

5-67. Practice your logarithm fluency by calculating each of the following values, *without changing the expressions to exponential form*. Be ready to explain your thinking.

a. $\log_7(49) = ?$

b. $\log_3(81) = ?$

c. $\log_5(5^7) = ?$

d. $\log_{10}(10^{1.2}) = ?$

e. $\log_2(2^{w+3}) = ?$