Quiz 7.1-7.2 Fri.

Algebra 2 7.3

Evaluate logarithmic expressions

Graph logarithmic functions

inverse function

- $x + 2$ $x-2$
- $2x$ $\frac{x}{2}$
- x^2 $\sqrt{x}$
- 2^x

$10^2 = 100$

$\log_{10} 100 = 2$

base

exponent

logarithm opp. of exponent

$7^{1/3}$ or $\sqrt[3]{7}$

b^{-2} or $1/b^2$

Do they mean the same thing?

Why do we need both?

Logarithm (log) is inverse of exponential
Base Log=exp (number is called antilog)

KeyConcept Logarithm with Base *b*

Words	Let b and x be positive numbers, $b \neq 1$. The *logarithm of x with base b* is denoted $\log_b x$ and is defined as the exponent y that makes the equation $b^y = x$ true.
Symbols	antilogarithm "answer"
Example	If $\log_3 27 = y$, then $3^y = 27$.

base ^{exp}=number
$\log_{base}$number=exponent

Where is the base in each expression?
Where is the exponent?
Where is the number/answer/antilogarithm?

Example 1 Logarithmic to Exponential Form

Write each equation in exponential form.

a. $\log_2 8 = 3$

b. $\log_4 \frac{1}{256} = -4$

$2^3 = 8$

$4^{-4} = \frac{1}{256}$

1. What is the base?
2. exponent?
3. number? (antilog)
4. re-format

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1A. $\log_4 16 = 2$

$4^2 = 16$

1B. $\log_3 729 = 6$

$3^6 = 729$

Example 2 Exponential to Logarithmic Form

Write each equation in logarithmic form.

a. $15^3 = 3375$

b. $4^{\frac{1}{2}} = 2$

$\log_{15} 3375 = 3$

$\log_4 2 = \frac{1}{2}$

write in log form

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2A. $4^3 = 64$

2B. $125^{\frac{1}{3}} = 5$

$\log_4 64 = 3$

Example 3 Evaluate Logarithmic Expressions

Evaluate $\log_{16} 4 = y$

$16^{?} = 4$

$16^{x} = 4$

$(4^2)^{x} = 4^{1}$

$\frac{2x}{2} = \frac{1}{2}$

$x = \frac{1}{2}$

remember log=exponent

What exponent is needed?

what is the exponent needed?

Evaluate each expression.

3A. $\log_3 81 = x$

$3^x = 81$

$3^x = 3^4$

$x = 4$

3B. $\log_{\frac{1}{2}} 256 = x$

$\left(\frac{1}{2}\right)^x = 256$

$(2^{-1})^x = 2^8$

$-x = 8$

$x = -8$

Remember: log is just inverse of exp function!

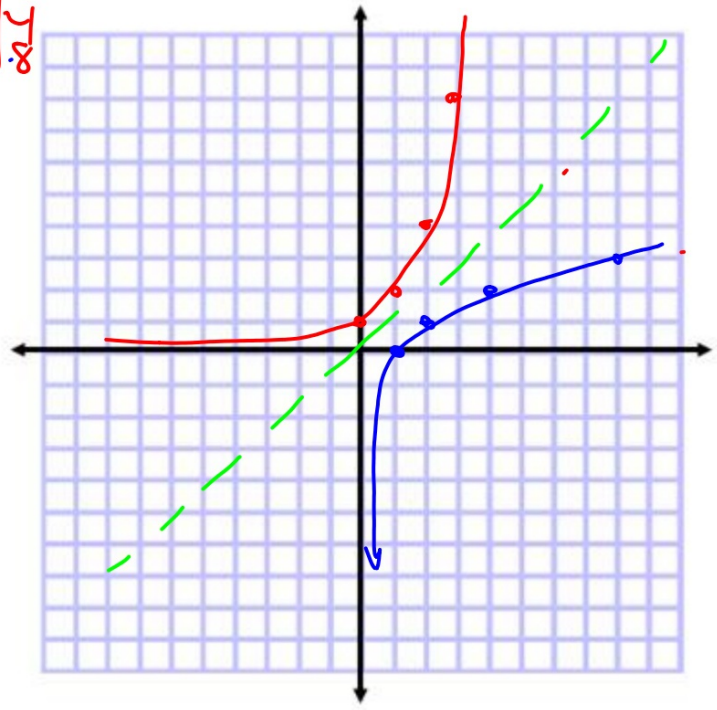
Line of symmetry y=x

$y = x^2$ $y = \pm\sqrt{x}$

$y = 2^x$

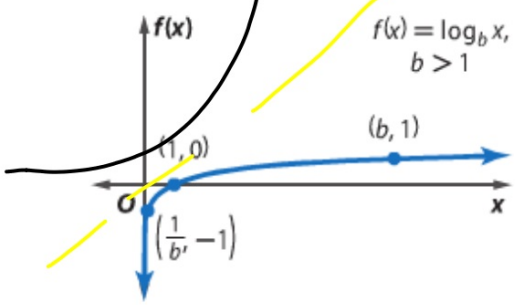
x	y
0	1
1	2
2	4
3	8

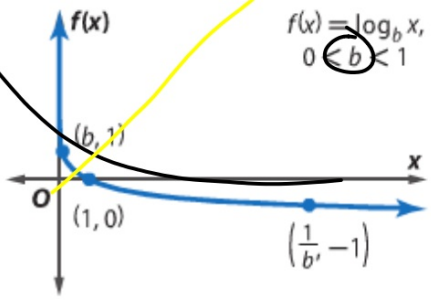
$y = \log_2 x$



KeyConcept Parent Function of Logarithmic Functions

Parent function:	$f(x) = \log_b x$	**Type of graph:**	continuous, one-to-one
Domain:	all positive real numbers	**Range:**	all real numbers
Asymptote:	$f(x)$-axis	**Intercept:**	(1, 0)





What is the procedure when we graph $y = 2x+3$
(Using table of values)

	$2x+3$	
2	$2 \cdot 2 + 3$	7
-1	$2 \cdot -1 + 3$	1
0	$2 \cdot 0 + 3$	3
3	$2 \cdot 3 + 3$	9

Hint: Solved for y so we choose...

Usually easier to graph if re-write in exp form

$y = \log_5 x$ $\quad 5^y = x$ $\quad x = 5^{1/2}$

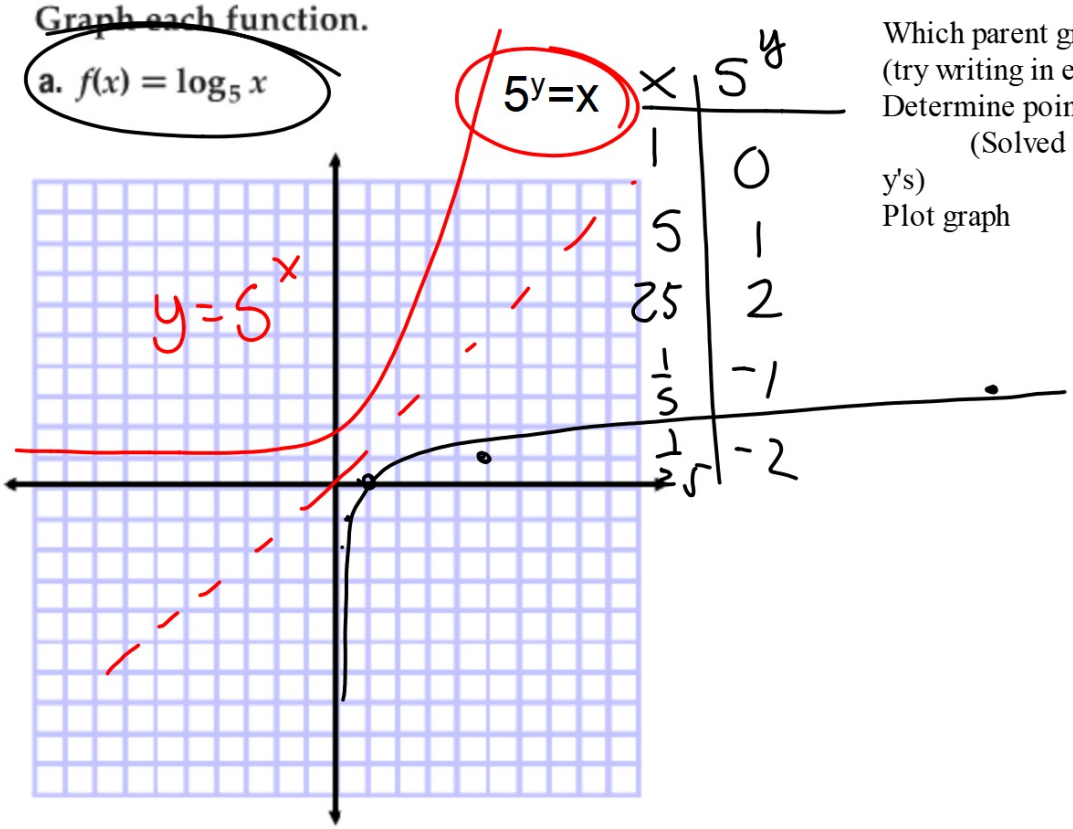
Example 4 Graph Logarithmic Functions

Graph each function.

a. $f(x) = \log_5 x$

$5^y = x$

x	5^y
1	0
5	1
25	2
$\frac{1}{5}$	-1
$\frac{1}{\sqrt{5}}$	-2



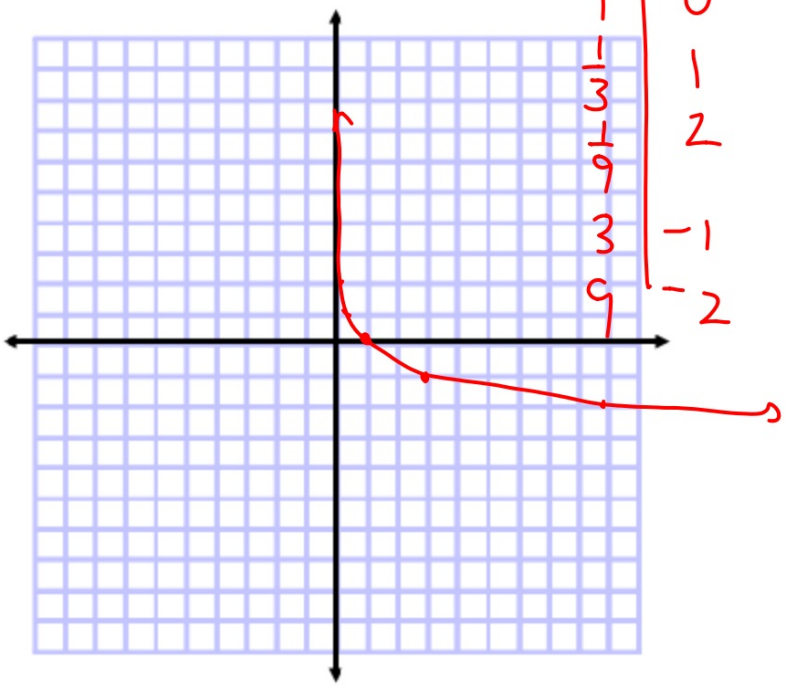
Which parent graph?
(try writing in exp form)
Determine points
(Solved for x so we choose y's)
Plot graph

b. $f(x) = \log_{\frac{1}{3}} x$

$y = \log_{\frac{1}{3}} x$

$\left(\frac{1}{3}\right)^y = x$

$x = \left(\frac{1}{3}\right)^y$



1	0
$\frac{1}{3}$	1
$\frac{1}{9}$	2
3	−1
9	−2

Which parent graph?
(~~try~~ writing in exp form)
Determine points
(Solved for x so we choose y's)
Plot graph

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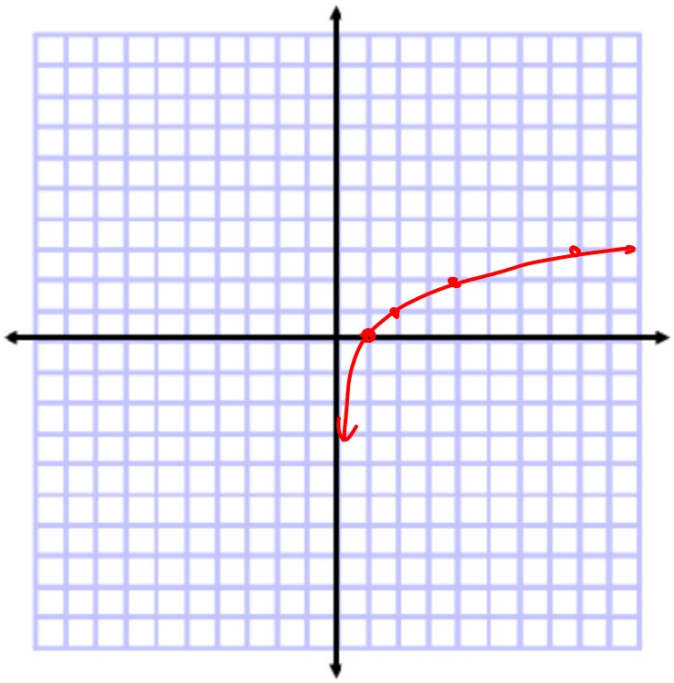
4A. $f(x) = \log_2 x$ y

$2^y = x$



Which parent graph?
(try writing in exp form)
Determine points
(Solved for x so we choose y's)
Plot graph

x	2^y
1	0
2	1
4	2
8	3

4B. $f(x) = \log_{\frac{1}{8}} x$