

## Lesson 8.3: Logarithms

Logarithm (Definition):

$$y = b^x \Leftrightarrow \log_b(y) = x$$

*Note:  $b > 0$  and  $b \neq 1$*

Ask:  $b$  to what power ( $x$ ) equals  $y$ ?

Common Log

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

Natural Log

$$\log_e(x) = \ln(x)$$

$$y = \underline{b}^x \Leftrightarrow \log_{\underline{b}}(y) = x$$

Rewrite the exponent to a logarithm

$$7^{-2} = \frac{1}{49}$$

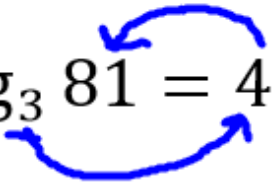
$$\log_7\left(\frac{1}{49}\right) = -2$$

$$2^x = 72$$

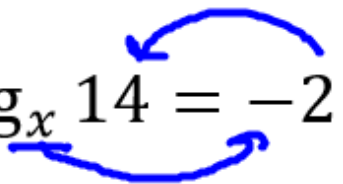
$$\log_2(72) = x$$

$$y = b^x \Leftrightarrow \log_b(y) = x$$

Rewrite the logarithm to an exponent

$$\log_3 81 = 4$$


$$3^4 = 81$$

$$\log_x 14 = -2$$


$$x^{-2} = 14$$

Evaluate

$$\log_4 16 = x = 2$$

$$4^x = 16$$

$$4^x = 4^2$$

$$x = 2$$

$$\log_3 \frac{1}{81} = x = -4$$

$$3^x = \frac{1}{81}$$

$$3^x = 81^{-1}$$

$$3^x = (3^4)^{-1}$$

$$3^x = 3^{-4}$$

$$x = -4$$

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$$\log_5 125 = x$$

$$5^x = 125$$

$$5^x = 5^3$$

$$x = 3$$

$$\log_5 125 = 3$$

$$\log_7 \frac{1}{49} = x = -2$$

$$7^x = \frac{1}{49}$$

$$7^x = 49^{-1}$$

$$7^x = 7^{-2}$$

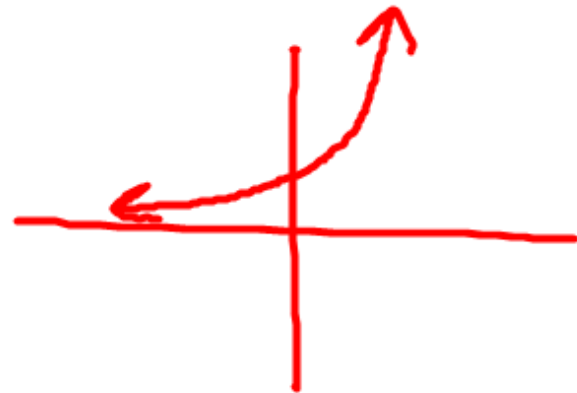
$$x = -2$$

$$\log_2(-32) = x$$

$$2^x = -32$$

$$2^5 = 32$$

$$2^{-5} = \frac{1}{32}$$



No Solution

Solve.

$$\star \log_2(2x + 1) = 5$$

$$2^5 = 2x + 1$$

$$32 = 2x + 1$$

$$31 = 2x$$

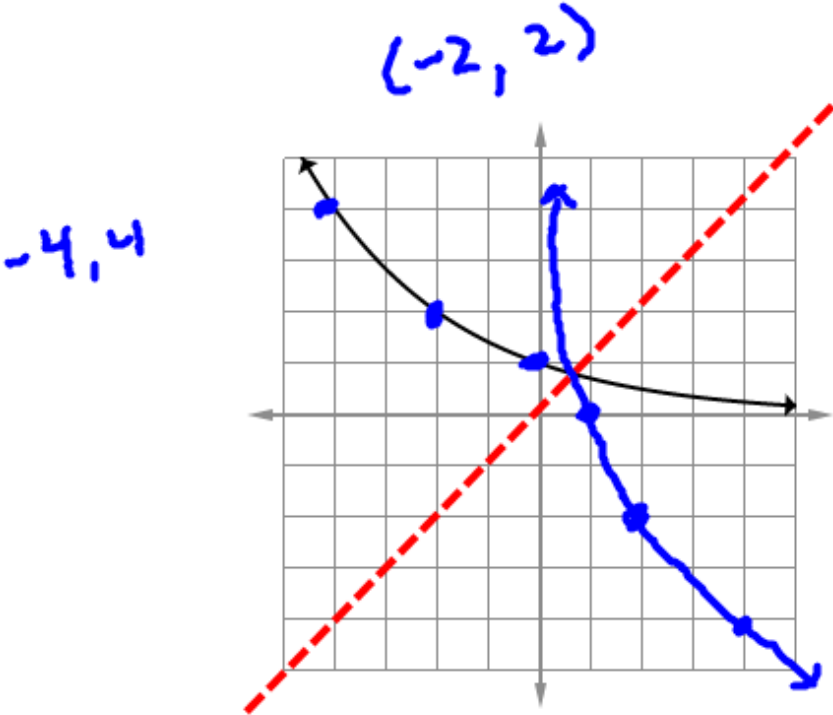
$$x = \frac{31}{2}$$

$$\log_x 16 = 2$$

$$\sqrt{x^2} = \sqrt{16}$$

$$x = 4$$

Graph the Inverse.



Graph and give the equation of the inverse.

$$y = 3^x$$

$$y = \log_3 x$$

