$\sqrt{x^2} = \sqrt{25}$

$x = \pm 5$

$x + 5 = 10$

$x = 5$

$\sqrt[x]{2^x} = 32$

Logarithmic Functions

$y = 2^x$

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

x	y
5	32
6	64

$32 = 2^x$

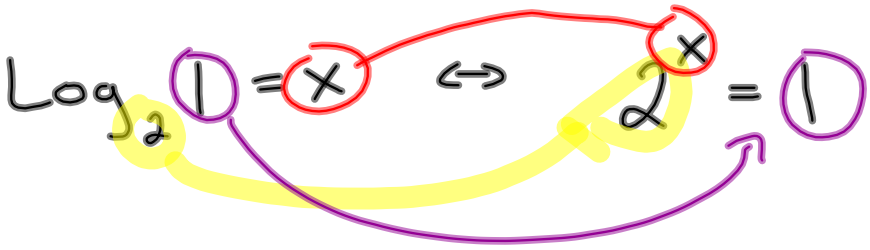
$x = 5$

$50 = 2^x$

$\log_2 32 = x \iff 2^x = 32$

Definition

$\log_a x = m \iff a^m = x$



$\log_5 \frac{1}{8} = x \leftrightarrow 5^x = \frac{1}{8}$

$\text{Log} \rightarrow \text{Log}_{10}$

$\text{Log } 100 = 2$

$\text{Log } .001 = -3$

$10^{-3} = \frac{1}{10^3} = \frac{1}{1000}$

$\log \frac{15}{8} = .273$

$\frac{\log 15}{\log 8} = 1.302$

$\log_{10} 10 = 1 \iff 10^1 = 10$

$\log_3 3 = 1 \iff 3^1 = 3$

Rule $\log_a a = 1$

$\log 1 = 0 \iff 10^0 = 1$

$\log_3 1 = 0$

Rule $\log_a 1 = 0$

your turn
solve

1) $\log_3 81 = 4$ $3^x = 81$ $3^x = 3^4$ $x = 4$

2) $\log_9 3 = \frac{1}{2}$ $9^x = 3$ $\sqrt{9} = 3$ $9^{1/2} = 3$

3) $\log 13400 = 4.127$

4) $\log_5 125 =$ $5^x = 125 \rightarrow 5^x = 5^3$ $x = 3$

5) $\log_2 \frac{1}{8} =$ $2^x = \frac{1}{8} \rightarrow 2^x = \frac{1}{2^3} \rightarrow 2^x = 2^{-3}$ $x = -3$

$\log(20 \cdot 5) =$

a) $\log(20) \cdot \log(5)$

b) $5 \cdot \log(20)$

c) $\log(20) + \log(5)$

Rule

$\log_a(MN) = \log_a M + \log_a N$

$\log_3(2x) = \log_3 2 + \log_3 x$

$\log_5(7 \cdot 7 \cdot 7) = \log_5 7 + \log_5 7 + \log_5 7$

$\log_5(7^3) \Leftrightarrow 3\log_5 7$

Rule $\log_a M^p = p \log_a M$

1) $\log_9 9^{-5} \rightarrow -5 \log_9 9 = -5$

2) $\log_7 \sqrt[3]{x} \rightarrow \log_7 (x)^{1/3} \rightarrow \frac{1}{3} \log_7 x$

$$\log \frac{15}{8} = \log 15 - \log 8$$

Rule $\log_a \frac{M}{N} = \log_a M - \log_a N$

1) $\log \frac{5}{x^2} = \log 5 - \log x^2$

$\log 5 - 2\log x$

Change of Base formula

$$\log_b M = \frac{\log_a M}{\log_a b}$$

$$\log_2 32 = \frac{\log 32}{\log 2} = 5$$

$$\log_5 8 = \frac{\log 8}{\log 5} = 1.292$$

$e = 2.718\,28\ldots$

$\log_e = LN$ ← Natural Log

$\log_2 32 = \frac{\log 32}{\log 2} = \frac{LN\ 32}{LN\ 2}$

$$\log_4 31 = \frac{\ln 31}{\ln 4} = 2.477$$

$$\ln 1900 = 7.550$$

$$= \frac{\log 1900}{\log e}$$

Solve $7^{x-2} = 60$

$\log 7^{(x-2)} = \log 60$

$(x-2)\log 7 = \log 60$

$\frac{(x-2)\log 7}{\log 7} = \frac{\log 60}{\log 7}$

$x - 2 = \frac{\log 60}{\log 7}$

$x = \frac{\log 60}{\log 7} + 2$

$x = 4.104$

$\log_7 7^{x-2} = \log_7 60$

$(x-2)\log_7 7 = \log_7 60$

$x - 2 = \log_7 60$

Solve $e^{0.06x} = 1500$

$\ln e^{0.06x} = \ln 1500$

$0.06x \ln e = \ln 1500$

$0.06x = \ln 1500$

$x = \frac{\ln 1500}{0.06}$

Solve $3^{x-1} = 7$

$\ln 3^{x-1} = \ln 7$

$(x-1)\ln 3 = \ln 7$

$x - 1 = \frac{\ln 7}{\ln 3}$

$x = \frac{\ln 7}{\ln 3} + 1$

$\log_4(8x-6) = 3$

4 4

$8x-6 = 4^3$

$8x-6 = 64$

$8x = 70$

$x = 8.75$

$\log(-2) = x$

$10^x = -2$

$$\log x + \log(x-3) = 1$$

$$10^{\log x(x-3)} = 10^{1}$$

$$x^2 - 3x = 10$$

$$x^2 - 3x - 10 = 0$$

$$(x-5)(x+2) = 0$$

$x = 5$ $x = -2$

$$\log x - \log(x+3) = 1$$

$$10^{\log \frac{x}{x+3}} = 10^1$$

$$\frac{x}{x+3} = \frac{10}{1}$$

$$x = 10(x+3)$$

$$x = 10x + 30$$

$$-9x = 30$$

$$x = \frac{-30}{9}$$

$$x = -3.33$$