LOGARITHMS - John Napier 1614

Exp form $\rightarrow$ $y = b^x$ $b>0,\ b\neq 1$

Domain: $(-\infty,\infty)$
Range: $(0,\infty)$

$x = b^y$

$\log_b x = y$

Domain: $(0,\infty)$
Range: $(-\infty,\infty)$

Logarithms are inverses of exponential functions.

Logs are used to solve for exponents!

$2^3 = 8$

$\log_{12} 144 = \log_{12} 12^2 = 2$

Make common bases!

$\log_2 16 = \log_2 2^4 = 4$

$\log_9 \frac{1}{81} = \log_9 \frac{1}{9^2} = \log_9 9^{-2} = -2$

$\log_7 \sqrt[5]{7} = \log_7 7^{1/5} = \frac{1}{5}$

$\log_{11} \sqrt[3]{\frac{1}{121}} = \log_{11} \sqrt[3]{\frac{1}{11^2}} = \log \sqrt[3]{11^{-2}}$

$= \log 11^{-2/3} = -2/3$

Special Logs

Common logs

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

Natural logs

$\log_e x = \ln x$

$\log_{10} 1000 = \log_{10} 10^3$

$= 3$

$\ln \sqrt[5]{e^3} = \ln_e e^{3/5}$

$= 3/5$

$8^{\log_8 50} = 50$

$e^{\ln 17} = 17$

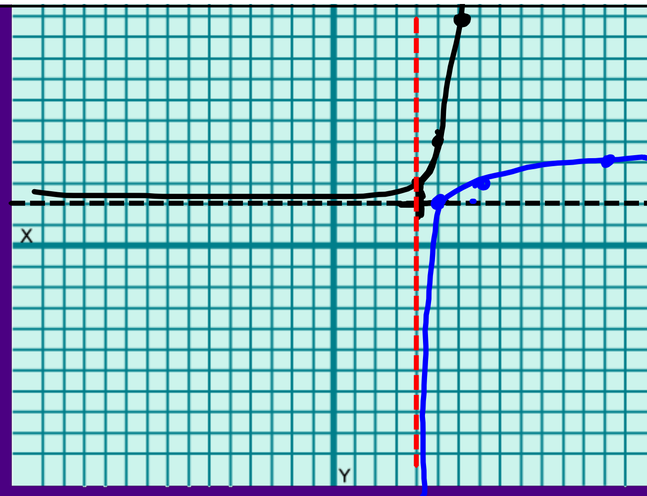
$y = 3^{x-4} + 2$

0	1
1	3
2	9

$y = \log_3(x-4) + 2$

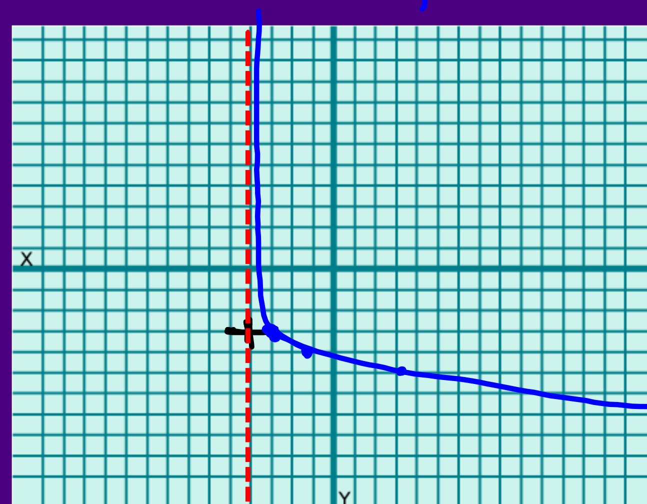
Right 4   Up 2

1	0
3	1
9	2



$y = -\ln_e(x+4) - 3$

1	0
2.7	-1
7.4	-2



0    $y = \log_2(-x)$

SOLVING LOG EQUATIONS

October 4, 2024

Properties

$$\log_b m + \log_b n = \log_b (m \cdot n)$$

$$\log_b m - \log_b n = \log_b \left(\frac{m}{n}\right)$$

$$\log_b m^p = p \cdot \log_b m$$

$$\log_x 64 = 3$$

$$x^{\log_x 64} = x^3$$

$$\sqrt[3]{64} = \sqrt[3]{x^3}$$

$$\boxed{4 = x}$$

Exponentiate!

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

$$\log_7 (x+5)(x-3) = \log_7 3^2$$

$$\log_7 (x^2+2x-15) = \log_7 9$$

$$7^{\log_7 (x^2+2x-15)} = 7^{\log_7 9}$$

$$x^2+2x-15 = 9$$

$$-9$$

$$x^2+2x-24 = 0$$

$$(x+6)(x-4) = 0$$

$$x = \cancel{-6}, 4$$

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

$$\log_{10}\left(\frac{x+3}{x}\right) = \underset{10}{1}$$

$$\cancel{x} \cdot \frac{x+3}{\cancel{x}} = 10x$$

$$x + 3 = 10x$$

$$3 = 9x$$

$$\frac{3}{9} = x$$

$$\boxed{1/3 = x}$$