October 6, 2023

LOGARITHMS – inverses of exponential functions

John Napier
- Find distances to planets

$y = b^x$

$b > 0, b \neq 1$

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

Range: $(0, \infty)$

$y = \log_b x$

$b > 0, b \neq 1$

Domain: $(0, \infty)$

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

$y = b^x$

$x = b^y$

$y = \log_b x$

$y = \log(x-3)$

Find domain.

$-$ $+$

0 3

$(3, \infty)$

Common Logs

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

Natural logs

$\log_e x = \ln x$

$y = \log_{81}(25 - x^2)$

$(5-x)(5+x)$

$-$ $($ $+$ $)$ $-$

-5 0 5

$(-5, 5)$

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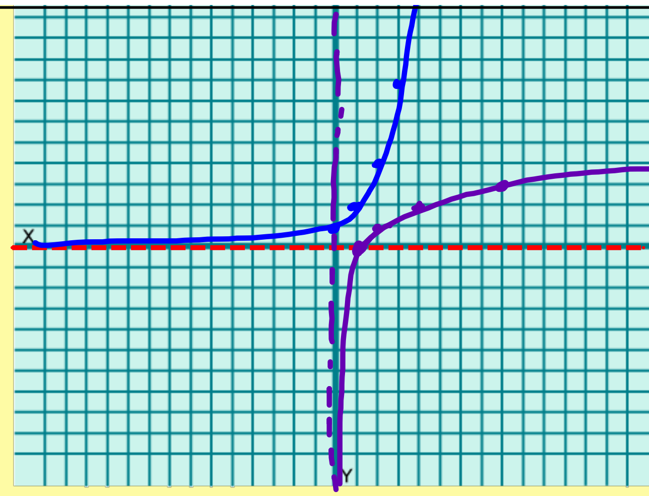
$y = 2^x$

0	1
1	2
2	4
3	8

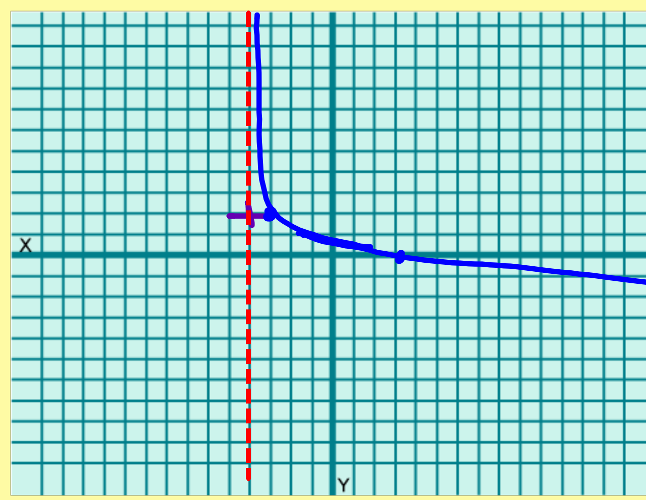
$y = \log_2 x$

1	0
2	1
4	2
8	3



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

1	0
2.7	-1
7.4	-2



$$\log_7 7^4 = 4$$

$$\log_3 9 = \log_3 3^2 = 2$$

$$\log_6 \frac{1}{36} = \log_6 \frac{1}{6^2} = \log_6 6^{-2} = -2$$

$$\log_7 \sqrt[5]{49} = \log_7 \sqrt[5]{7^2} = \log_7 7^{2/5} = \frac{2}{5}$$

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

$$\ln \frac{1}{\sqrt[7]{e^3}} = \ln \frac{1}{e^{3/7}} = \ln e^{-3/7} = -3/7$$

$$e^{\ln 36} = 36$$

$$8^{\log_8 x^2} = x^2$$

Solving Log Equations

Properties of Logs

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

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

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

$$x^2 \cdot x^5 = x^7$$

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

$$\log_7(2x^2 - 7x + 6) = \log_7 x^2$$

Exponentiate

$$7^{\log_7(2x^2-7x+6)} = 7^{\log_7 x^2}$$

$$2x^2 - 7x + 6 = x^2$$

$$-x^2 \qquad -x^2$$

$$x^2 - 7x + 6 = 0$$

$$(x-6)(x-1) = 0$$

$$x = \cancel{1},\ 6$$

$$\log x - \log 2 = 3$$

$$10^{\log_{10}\left(\frac{x}{2}\right)} = 10^{3}$$

$$\frac{x}{2} = 10^3$$

$$\cancel{2}\cdot\frac{x}{\cancel{2}} = 1000 \cdot 2$$

$$\boxed{x = 2000}$$