Transformations of Logarithms

$$y = a \log (k (x - d)) + c$$

- V. Stretch
  - $|a| > 1$
- V. Compression
  - $|a| < 1$
- reflection in x-axis

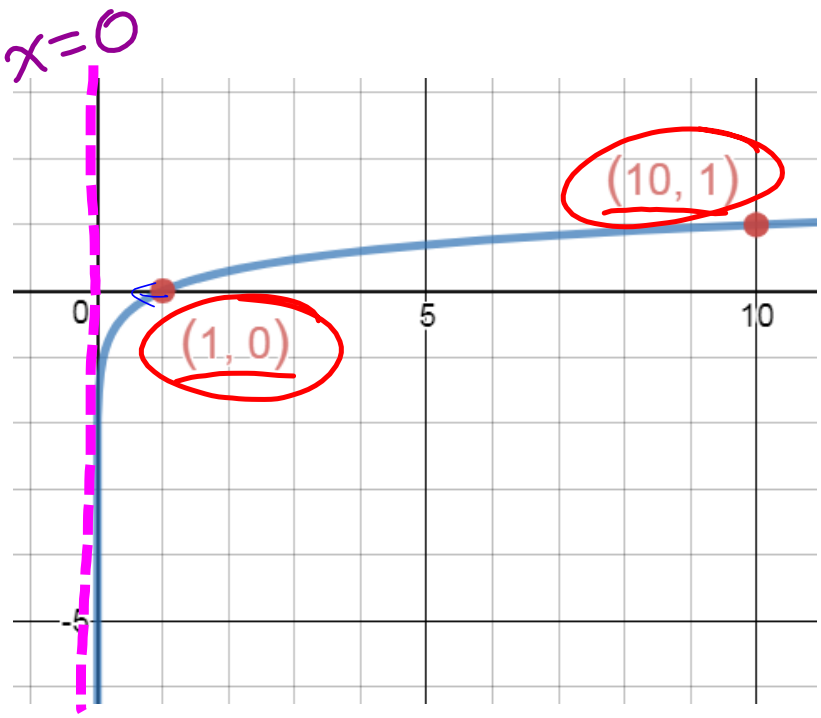
- H. Stretch
  - $|k| < 1$
- H. Compression
  - $|k| > 1$
- reflection in y-axis.

left $(x+d)$

right $(x-d)$

up $+c$

down $-c$



$y = \log x$

Logarithm Laws

Power Law of Logarithms

$$\log_b a^x = x \log_b a$$

Evaluate

$\log_3 9^4$

$3^x = 9$

$= 4 \log_3 9$

$= 4(2)$

$= 8$

$\log_3 9^4$

$= \log_3 (3^2)^4$

$= 4 \log_3 3^2$

$= 8 \log_3 3$

$= 8$

$\log_2 8^5$

$= 5 \log_2 8 = 3$

$2^x = 8$

$= 5 \times 3$

$= 15$

$\log_5 \sqrt{125}$

$= \log_5 (125)^{1/2}$

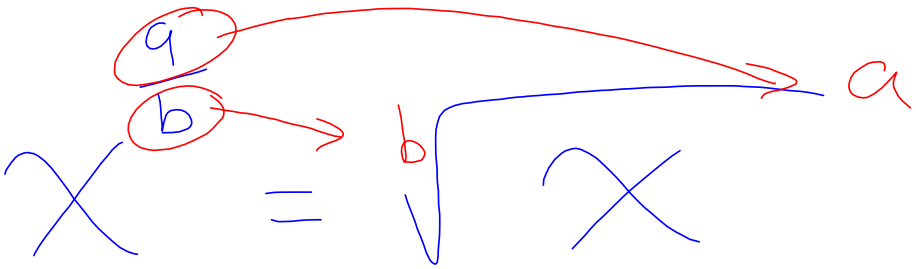
$= \frac{1}{2} \log_5 125$

$5^x = 125$

$= \frac{1}{2} \log_5 5^3$

$= \frac{3}{2} \log_5 5 = 1$

$= \frac{3}{2}$


a
b
a
b
x
=
x

We can use the power law to solve for an unknown exponent, by taking the log of both sides.

Ex. Solve for x

$$1.04^{x} = 3$$

$$\log 1.04^{x} = \log 3$$

$$\frac{x \log 1.04}{\log 1.04} = \frac{\log 3}{\log 1.04}$$

$$x = 28.01$$

Jake puts $1000 into a bank account that pays him 4% per year, compounded monthly. How long does Jake need to keep his money in the bank before it will double?

$$A = A_0(1+i)^t$$

$$A = 1000(1+0.00333\ldots)^t$$

$$\frac{2000}{1000} = \frac{1000(1.00333)^t}{1000}$$

$$2 = (1.00333)^t$$

$$\log 2 = \log 1.00333^t$$

$$\log 2 = t \log 1.00333$$

$$\frac{\log 2}{\log 1.00333} = t$$

$$t = 208.3$$

Change of Base Formula

$$\log_b a = \frac{\log a}{\log b}$$

Evaluate

$\log_3 21$

$= \frac{\log 21}{\log 3}$

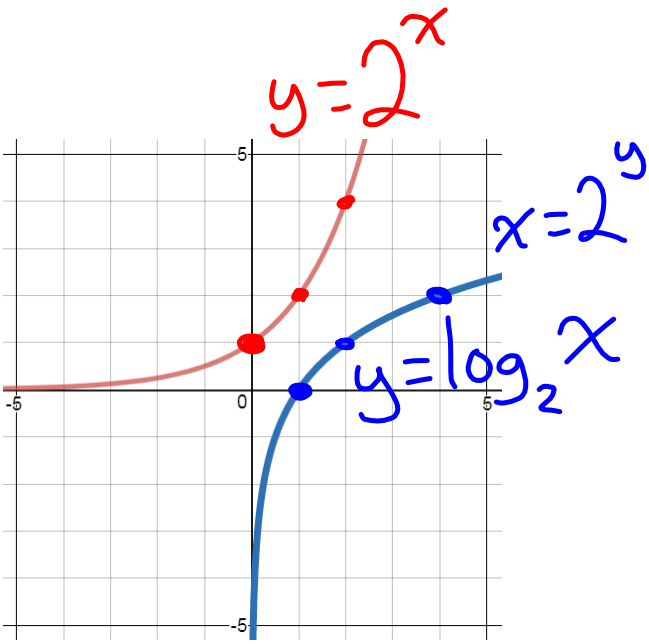
$= 2.77$

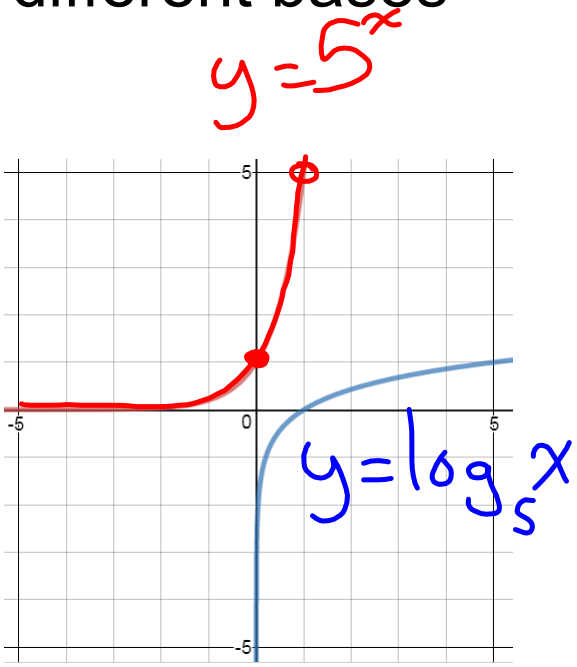
$\log_{\frac{1}{2}} 20$

$= \frac{\log 20}{\log \frac{1}{2}}$

$= -4.32$

Graphs of Logs with different bases





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