

# 7-3 Logarithms (log)

(Useful in Science)

$$\text{pH} = -\log[\text{H}^+]$$

Acidic:  $\text{pH} < 7$

Neutral:  $\text{pH} = 7$

Basic:  $\text{pH} > 7$

→ *the more acidic, the better electrical conductor.*

Example: Suppose that you test apple juice and find that the hydrogen ion concentration is  $[\text{H}^+] = 0.0003$ . Find the pH value and determine whether the juice is basic or acidic.

$\text{pH} = -\log[\text{H}^+] = -\log[0.0003] = 3.52287874528\dots$   
which is less than 7, so this is acidic.

A. The formula:

$$\log_b y = x \longleftrightarrow b^x = y$$

If there is no base written, then  $b = 10$ .

This is just a way of writing an expression in a different form like we did with:  $.5 = 1/2$  or  $\sqrt[3]{x} = x^{\frac{1}{3}}$ .

(crooked arrow)

B. Convert.

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

$$\frac{1}{125} = 5^{-3} \leftrightarrow$$

$$\log_{\sqrt{3}} 3\sqrt{3} = 3 \leftrightarrow$$

$$\log_m n = c \leftrightarrow$$

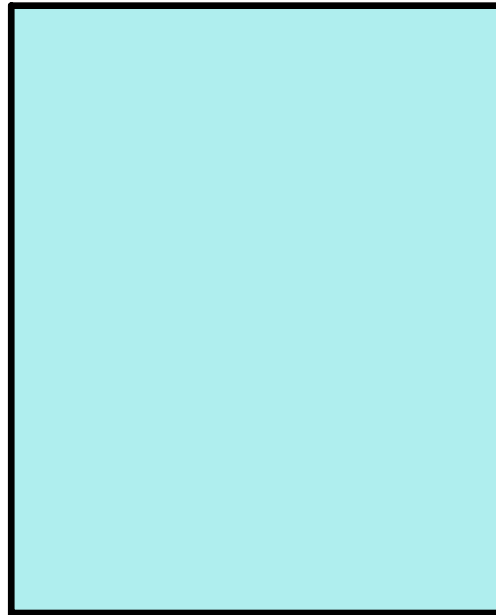
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## C. Evaluate.

Steps:

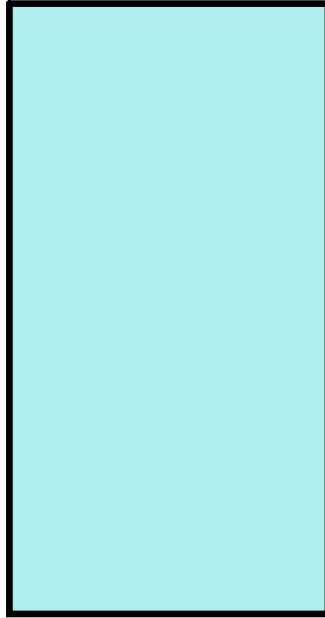
- 1 - Convert to exponential form.
- 2 - Rewrite with the same base.
- 3 - Set exponents equal and solve.

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



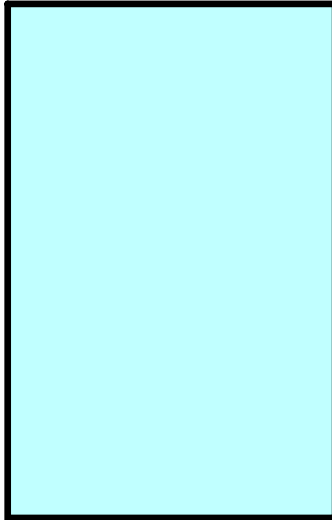
Evaluate.

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



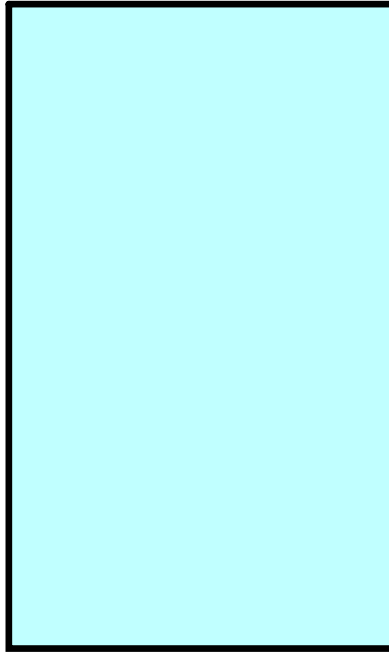
Evaluate.

$$\log_8 16 = x$$



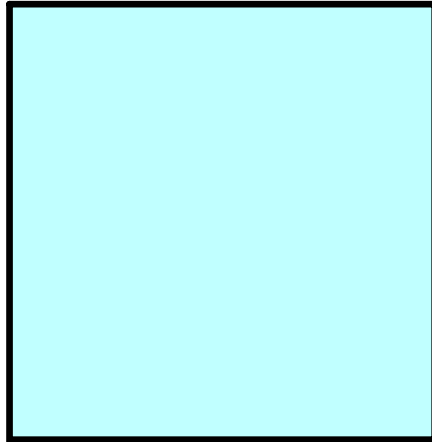
Evaluate.

$$\log_9 \frac{1}{27} = x$$



Evaluate.

$$\log 100 =$$



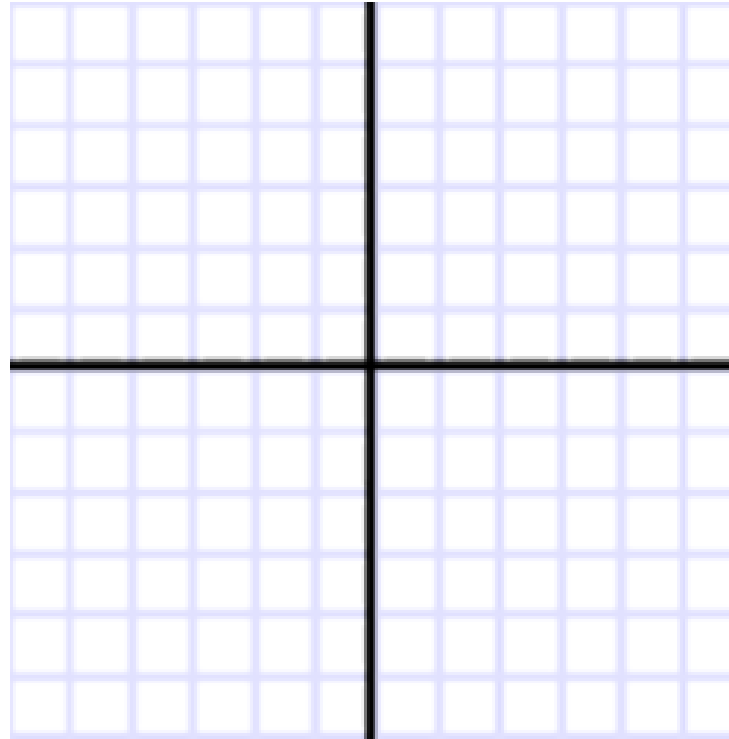
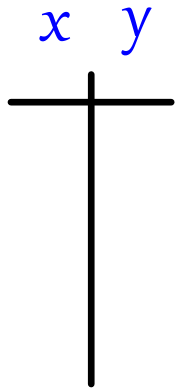


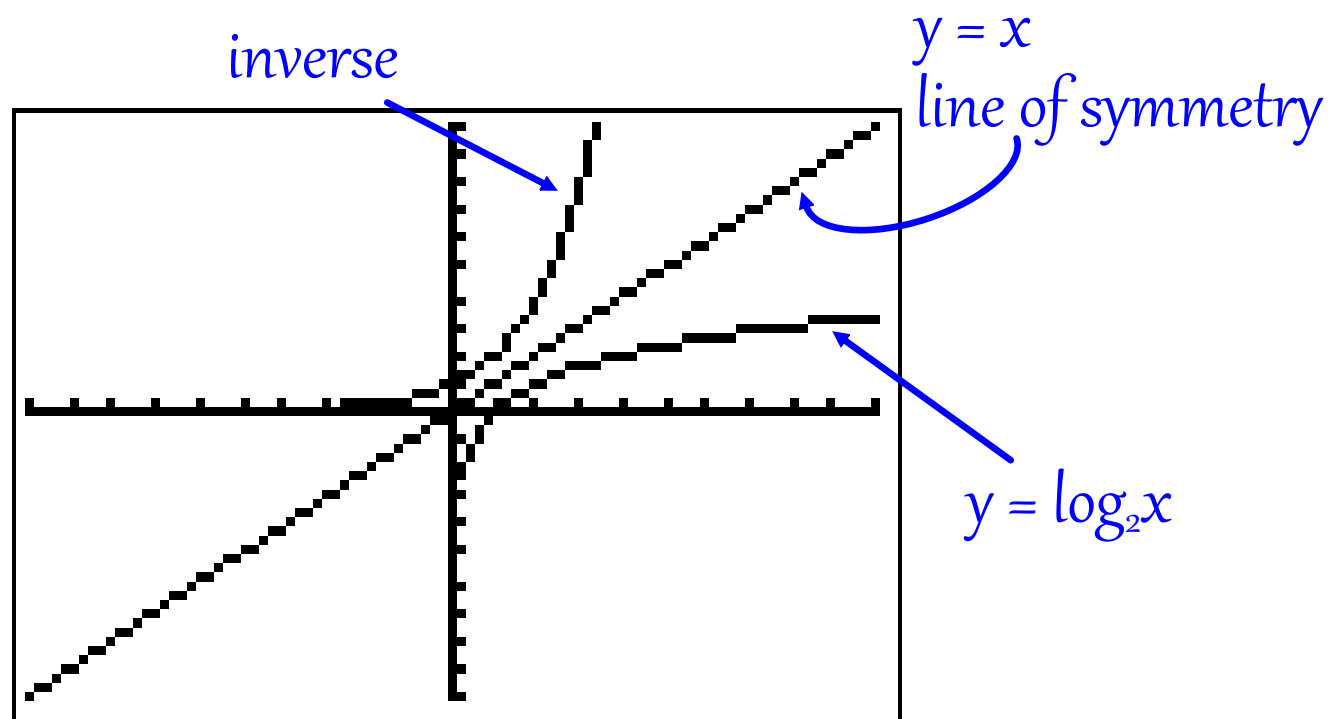
D. Graph.

$$y = \log_2 x$$

Exponential Form:

Inverse:





Based on the graph of the log, can you take the log of zero?  
of a negative?