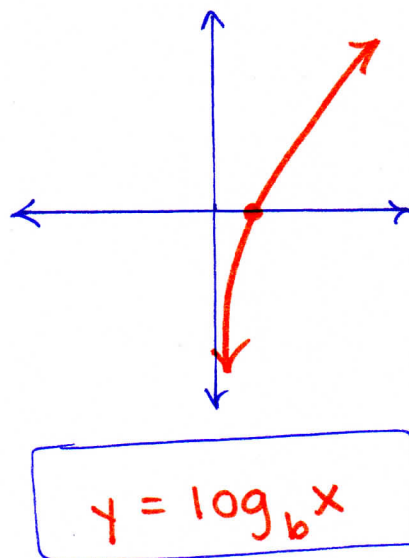
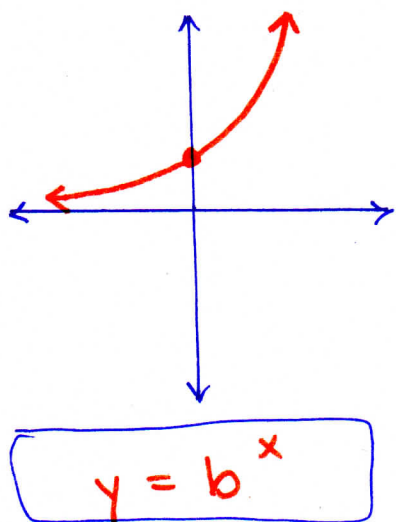


LESSON 3

Logarithmic Functions

Recall: Exponential functions are inverses to logarithmic functions.



$$(y = \log_b x \text{ iff } b^y = x)$$

Ex.1] Write in log form

a) $5^2 = 25$ so ... $\log_5 25 = 2$

b) $8^{-1} = \frac{1}{8}$ so ... $\log_8 \left(\frac{1}{8}\right) = -1$

Ex. 2] Evaluate

a) $\log_3 9$

$3^x = 9$, $x = 2$

b) $\log_4 32$

$4^x = 32$, $2^{2x} = 2^5$, $x = \frac{5}{2}$

c) $\log_5 \sqrt{5}$

$5^x = \sqrt{5}$, $x = \frac{1}{2}$

NOTE:

$f(x) = 3^x$

x	f(x)
-3	1/27
-2	1/9
-1	1/3
0	1
1	3
2	9
3	27

x	f ⁻¹ (x)
1/27	-3
1/9	-2
1/3	-1
1	0
3	1
9	2
27	3

$f^{-1}(x) = \log_3 x$

Common Log (base of 10):

$$\log 10 = 1$$

$$\log 100 = 2$$

$$\log 1 = 0$$

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

Ex. 3] Solve

$$a) \log x = 2 \quad x = 10^2, \quad x = 100$$

$$b) \log_4 x = 3 \quad x = 4^3, \quad x = 64$$

Natural Log (base of e):

$$y = \ln x \quad \text{iff} \quad e^y = x$$

Ex. 4] Evaluate

$$a) \ln \sqrt{e} \quad e^x = \sqrt{e}, \quad x = \frac{1}{2}$$

$$b) \ln e^5 \quad e^x = e^5, \quad x = 5$$

Transformations

Ex. 5] Describe the changes from $\log x$ or $\ln x$ to the equation given.

a) $g(x) = \ln(x-2)$

- trans. right 2 units

b) $h(x) = \ln(4-x)$

$$= \ln(-(x-4))$$

- trans. right 4 units

- reflect over y-axis

c) $k(x) = 4 + \log x$

- trans. up 4 units

Properties of Logarithms

$$\textcircled{1} \log_b RS = \log_b R + \log_b S$$

$$\textcircled{2} \log_b \frac{R}{S} = \log_b R - \log_b S$$

$$\textcircled{3} \log_b R^c = c \log_b R$$