

3.2 Logarithmic Function and Their Graphs

Exponential
Function

$$f(x) = a^x$$

$$y = 10^x$$

Logarithmic
Functions

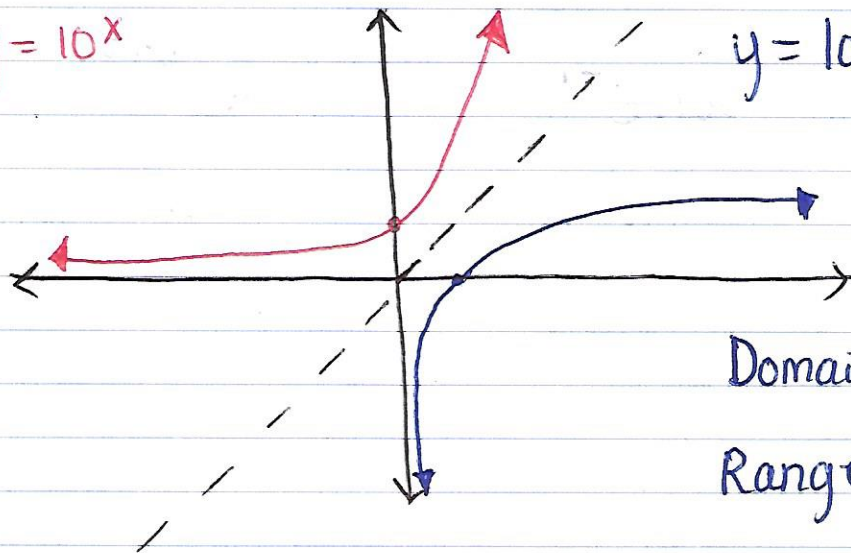
$$f(x) = \log_a x$$

$$y = \log_a x$$

$$a^y = x \Leftrightarrow y = \log_a x$$

$$y = 10^x$$

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



Domain $(0, \infty)$

Range $(-\infty, \infty)$

Exponential
& Log functions
are inverses of
each other.

Ex. 1 Write the logarithmic equ. in exponential form.

a) $y = \log_2 16$ b) $5 = \log_x 32$ c) $3 = \log_4 X$
 $2^y = 16$ $X^5 = 32$ $4^3 = X$

Ex. 2. Change from exponential form to log. form

a) $6^3 = X$ b) $X^4 = 625$ c) $3^X = 81$
 $3 = \log_6 X$ $4 = \log_x 625$ $X = \log_3 81$

Exponential

$$y = e^x$$



Inverses of each other

Log form

Natural Log

$$y = \ln x$$



Ex. 3

a) $\ln \frac{1}{e}$

$$\ln e^{-1}$$

-1

b) $e^{\ln 5}$

$$\textcircled{e^{\ln 5}}$$

5

c) $4 \ln 1$ d) $2 \ln e$

$$4(0)$$

0

$$2(1)$$

2

Properties
of
Logs

$$\log_a 1 = 0 \quad b/c \quad a^0 = 1$$

$$\log_a a = 1 \quad b/c \quad a^1 = a$$

$$\log_a a^x = x \quad \text{and} \quad a^{\log_a x} = x$$

$$\text{if } \log_a x = \log_a y \quad \text{then} \quad x = y$$

Example 3 Solve for X

a) $\log_2 X = \log_2 3$ b) $\log_4 4 = X$
 $X = 3$

c) $\log_5 5^x = X$ $4^x = 4$
 $5^x = 5^x$ $X = 1$

d) $\log_7 14$
14

CW p 199 7 - 39 odd 45 - 49 odd