3.1 (continued) Writing Equations for Exponential Functions

ex: Write an exponential eqn. in the form $y = a \cdot b^x$ for a curve through $(3, 4)$ and $(5, 64)$.

$(3, 4)$: $x = 3$, $y = 4$ $\qquad$ $(5, 64)$: $x = 5$, $y = 64$

$4 = a \cdot b^3$ $\qquad$ $64 = a \cdot b^5$

$$\frac{64 = a \cdot b^5}{4 = a \cdot b^3}$$

$$\sqrt{16} = \sqrt{b^2}$$

$$\boxed{b = 4}$$

$$4 = a \cdot 4^3 \quad\Rightarrow\quad \frac{4}{4^3} = \frac{a \cdot 4^3}{4^3}$$

$$\boxed{a = \frac{1}{16}}$$

$$\boxed{y = \frac{1}{16} \cdot (4)^x}$$

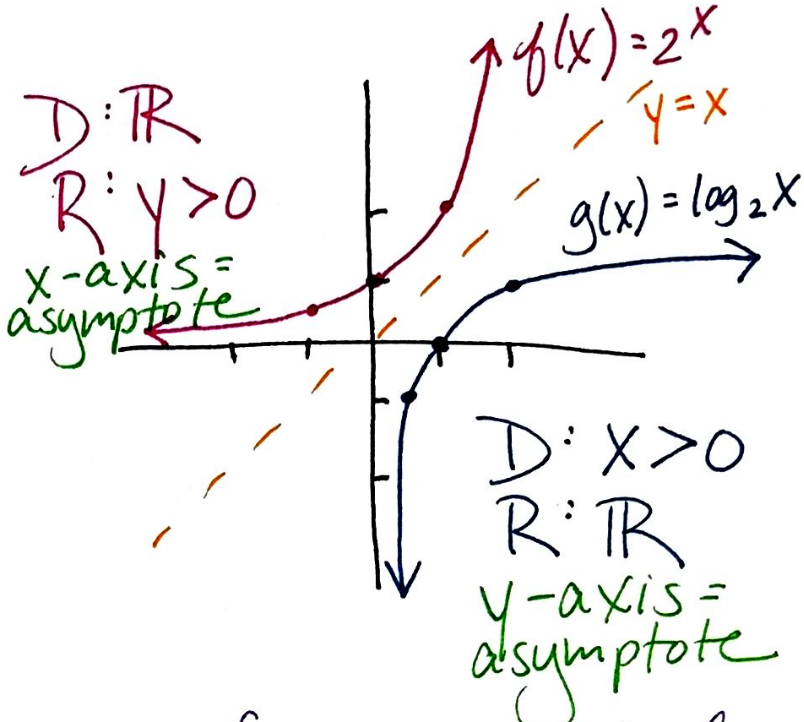
3.2 Logarithmic Functions

Plot $f(x) = 2^x$

x	y ($f(x)$)
-1	$\frac{1}{2}$
0	1
1	2

x	y ($g(x)$)
$\frac{1}{2}$	-1
1	0
2	1

inverse



Logarithm (log) = inverse of an exponential function ("undoers")

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

$\ln = \log_e$ = natural log

$\log_7 7^x = x$ $\qquad$ $8^{\log_8 x} = x$

Rule: $\log_a x = y \Rightarrow a^y = x$

ex: $\log_3 81 = x$

$3^x = 81$

$\boxed{x = 4}$

ex: $\log_4 16 = x$

$4^x = 16$

$\boxed{x = 2}$

Approximate to the nearest tenth:

$\log_3 10 = x$ $\quad x \approx 2.1 \quad 3^{2.1} \approx 10$

$\log_2 12 = x$ $\quad x \approx 3.6 \quad 2^{3.6} \approx 12$

$\log_5 350 = x$ $\quad x \approx 3.6 \quad 5^{3.6} \approx 350$

Evaluate:

a) $\log_5 1 = x$

$5^x = 1$

$\boxed{x = 0}$

b) $\log_9 27 = x$

$9^x = 27$

$(3^2)^x = 3^3$

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

$\boxed{x = \frac{3}{2}}$

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

$3^x = \frac{1}{81}$

$3^x = \frac{1}{3^4}$

$3^x = 3^{-4}$

$\boxed{x = -4}$

d) $\log_{64} \frac{1}{8} = x$

$64^x = \frac{1}{8^1}$

$(8^2)^x = 8^{-1}$

$\frac{2x}{2} = -\frac{1}{2}$

$\boxed{x = -\frac{1}{2}}$

e) $\log_{10} .01 = x$

$10^x = .01$

$10^x = \frac{1}{100}$

$10^x = 10^{-2}$

$\boxed{x = -2}$

f) $\log_{10} \sqrt[3]{100} = x$

$10^x = \sqrt[3]{100}$

$10^x = \sqrt[3]{10^2}$

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

$\boxed{x = \frac{2}{3}}$