Section 4.1
Exponential Functions

Solving exponential equations

Example 1

Solve $2^x = 32$

$$2^x = 32$$
$$2^x = 2^5$$
$$x = 5$$

Example 2

Solve $5^x = 625$

$$5^x = 625$$
$$5^x = 5^4$$
$$x = 4$$

Example 3

Solve $5^x = \frac{1}{125}$

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

Example 4

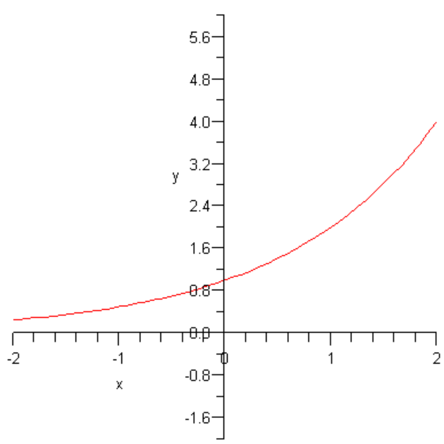
Solve $4^x = \frac{1}{256}$

$$4^x = \frac{1}{256}$$
$$4^x = \frac{1}{4^4}$$
$$4^x = 4^{-4}$$
$$x = -4$$

Graphs of Exponential Functions

Graph $y = 2^x$

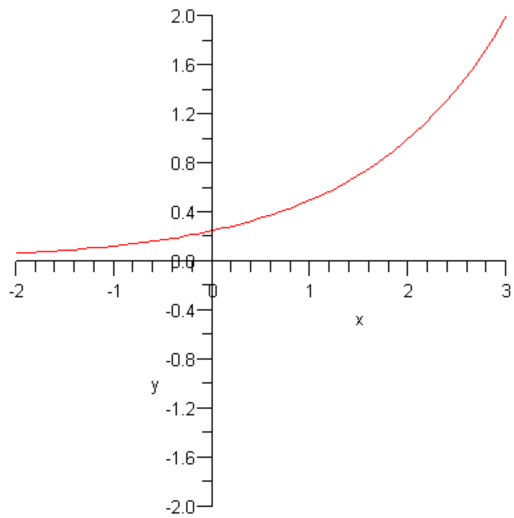
x	$y = 2^x$
-2	$y = 2^{-2} = \frac{1}{2^2} = \frac{1}{4}$
-1	$y = 2^{-1} = \frac{1}{2}$
0	$y = 2^0 = 1$
1	$y = 2^1 = 2$
2	$y = 2^2 = 4$



Example 5

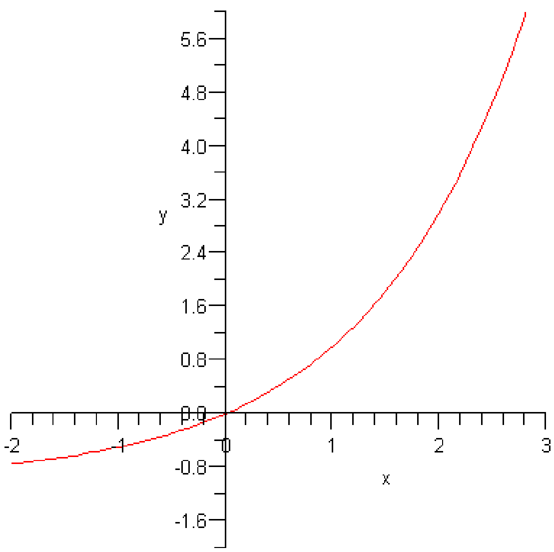
Graph $y = 2^{x-2}$

x	$y = 2^{x-2}$
-2	$y = 2^{-2-2} = \frac{1}{2^4} = \frac{1}{16}$
-1	$y = 2^{-1-2} = \frac{1}{2^3} = \frac{1}{8}$
0	$y = 2^{0-2} = \frac{1}{2^2} = \frac{1}{4}$
1	$y = 2^{1-2} = 2^{-1} = \frac{1}{2}$
2	$y = 2^{2-2} = 2^0 = 1$
3	$y = 2^{3-2} = 2^1 = 2$



Example 6

x	$y = 2^x - 1$
-2	$y = 2^{-2} - 1 = .25 - 1 = -.75$
-1	$y = 2^{-1} - 1 = .5 - 1 = -.5$
0	$y = 2^0 - 1 = 1 - 1 = 0$
1	$y = 2^1 - 1 = 2 - 1 = 1$
2	$y = 2^2 - 1 = 4 - 1 = 3$



Example 7

Evaluate the function

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

a) $f(-2)$

$$f(-2) = 3^{-2} + 2 = \frac{1}{3^2} + 2 = \frac{1}{9} + 2 = 2\frac{1}{9}$$

b) $f(3)$

$$f(3) = 3^3 + 2 = 27 + 2 = 29$$

c) $f\left(\frac{1}{2}\right)$

$f\left(\frac{1}{2}\right) = 3^{\frac{1}{2}} + 2 = \sqrt{3} + 2$

Example 8

The population of the United States from 2000 to 2010 can be modeled by the function $P(t) = 288.5(1.0118)^t$ where $t = 0$ corresponds to the year 2000. Use the model to predict the population of the U S is 2006 and 2010.

$t = 6 \;\; for \;\; 2006$

$P(6) = 288.5(1.0118)^6 = 288.5(1.072918) = 309.5 \;\; million$

$P(6) = 288.5(1.0118)^{10} = 288.5(1.124467) = 324.4 \; million$
