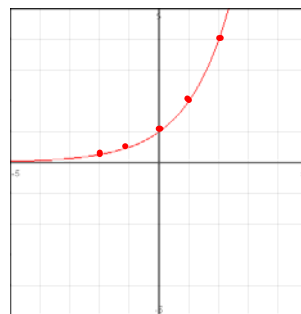# Exponential Functions

$$y = a \cdot b^x$$

An exponential function is a function of the form $y = a \cdot b^x$ where $a \neq 0$, $b > 0$ and not equal to 1 and x is a real number.
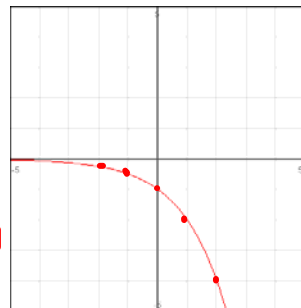
Directions: Graph each exponential function.

1. $y = 2^x$

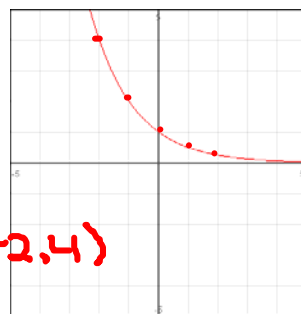| x	2^x	y	
-2	$2^{-2} = \frac{1}{2^2} = \frac{1}{4}$	$\frac{1}{4}$	$(-2, \frac{1}{4})$
-1	$2^{-1} = \frac{1}{2^1} = \frac{1}{2}$	$\frac{1}{2}$	$(-1, \frac{1}{2})$
0	$2^0 = 1$	1	$(0, 1)$
1	$2^1 = 2$	2	$(1, 2)$
2	$2^2 = 4$	4	$(2, 4)$

2. $y = -(2)^x$

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

3. $y = \left(\frac{1}{2}\right)^x$

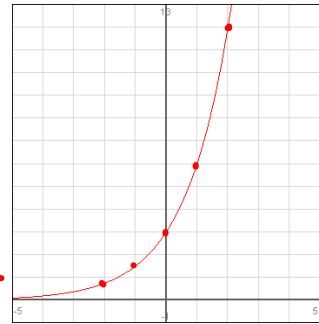| x	$\left(\frac{1}{2}\right)^x$	y	
-2	$\left(\frac{1}{2}\right)^{-2} = \frac{1^{-2}}{2^{-2}} = \frac{2^2}{1^2} = \frac{4}{1} = 4$	4	(-2, 4)
-1	$\left(\frac{1}{2}\right)^{-1} = \frac{1^{-1}}{2^{-1}} = \frac{2^1}{1^1} = \frac{2}{1} = 2$	2	(-1, 2)
0	$\left(\frac{1}{2}\right)^0 = 1$	1	(0, 1)
1	$\left(\frac{1}{2}\right)^1 = \frac{1}{2^1} = \frac{1}{2}$	$\frac{1}{2}$	(1, ¹/₂)
2	$\left(\frac{1}{2}\right)^2 = \frac{1^2}{2^2} = \frac{1}{4}$	$\frac{1}{4}$	(2, ¹/₄)

4. $y = -\left(\frac{1}{2}\right)^x$

x	$-\left(\frac{1}{2}\right)^x$	y
-2	$-\left(\frac{1}{2}\right)^{-2} = -\left(\frac{1^{-2}}{2^{-2}}\right) = -\left(\frac{2^2}{1^2}\right) = -4$	-4
-1	$-\left(\frac{1}{2}\right)^{-1} = -\left(\frac{1^{-1}}{2^{-1}}\right) = -\left(\frac{2^1}{1^1}\right) = -2$	-2
0	$-\left(\frac{1}{2}\right)^0 = -(1) = -1$	-1
1	$-\left(\frac{1}{2}\right)^1 = -\left(\frac{1}{2^1}\right) = -\frac{1}{2}$	$-\frac{1}{2}$
2	$-\left(\frac{1}{2}\right)^2 = -\left(\frac{1^2}{2^2}\right) = -\frac{1}{4}$	$-\frac{1}{4}$

(-2, -4)
(-1, -2)
(0, -1)
(1, -¹/₂)
(2, -¹/₄)

5. $y = 3 \cdot 2^x$

X	$3 \cdot 2^x$	Y
-2	$3 \cdot 2^{-2} = 3 \cdot \dfrac{1}{2^2} = 3 \cdot \dfrac{1}{4} = \dfrac{3}{4}$	$\dfrac{3}{4}$
-1	$3 \cdot 2^{-1} = 3 \cdot \dfrac{1}{2} = \dfrac{3}{2}$	$\dfrac{3}{2}$
0	$3 \cdot 2^0 = 3 \cdot 1 = 3$	3
1	$3 \cdot 2^1 = 3 \cdot 2 = 6$	6
2	$3 \cdot 2^2 = 3 \cdot 4 = 12$	12

$(-2, {}^3|_4)$

$(-1, {}^3|_2)$

$(0, 3)$

$(1, 6)$

$(2, 12)$