

1.) Solve for x: $2(x + 8) - 4x = 10x + 4$

$$\begin{aligned} 2x + 16 - 4x &= 10x + 4 \\ -2x + 16 &= 10x + 4 \\ +2x \quad \quad +2x & \\ \hline 16 &= 12x + 4 \\ -4 \quad \quad -4 & \\ \hline 12 &= 12x \\ \frac{12}{12} &= \frac{12x}{12} \\ \boxed{1} &= \boxed{x} \end{aligned}$$

2.) What is the value of x in the system of equations shown below?

$$\begin{aligned} 5x + 4y &= 1 \\ y &= 1 - x \\ 5x + 4(1 - x) &= 1 \\ 5x + 4 - 4x &= 1 \\ x + 4 &= 1 \\ -4 \quad -4 & \\ \hline \boxed{x} &= \boxed{-3} \end{aligned}$$

Recall:

Given the sequences below, determine whether they are arithmetic or geometric, find the next three terms, and write an equation and NEXT/NOW statement.

Ex.) Ex. 7, -14, 28, -56,....

Arithmetic or Geometric $r = -2$

Next three terms: 112, -224, 448

Explicit: $a_n = \underline{7 \cdot (-2)^{n-1}}$

Recursive: $a_n = \underline{a_{n-1} \cdot -2}$

Intro to Exponential Functions

An exponential function is a form of a geometric sequence.

A function in which the variable is the exponent is called an exponential function.

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

a = y-intercept (when there is no shift)

b = common ratio, base

Geometric Sequence

$$a_n = a_1 \cdot r^{n-1}$$

←

a_n is the n^{th} term in the sequence (green arrow)
 a_1 is the 1st term in the sequence (blue arrow)
 r is the common ratio (red arrow)
 $n-1$ is the number of terms in the sequence (orange arrow)

Exponential Function

$$y = a_1 \cdot r^{x-1}$$

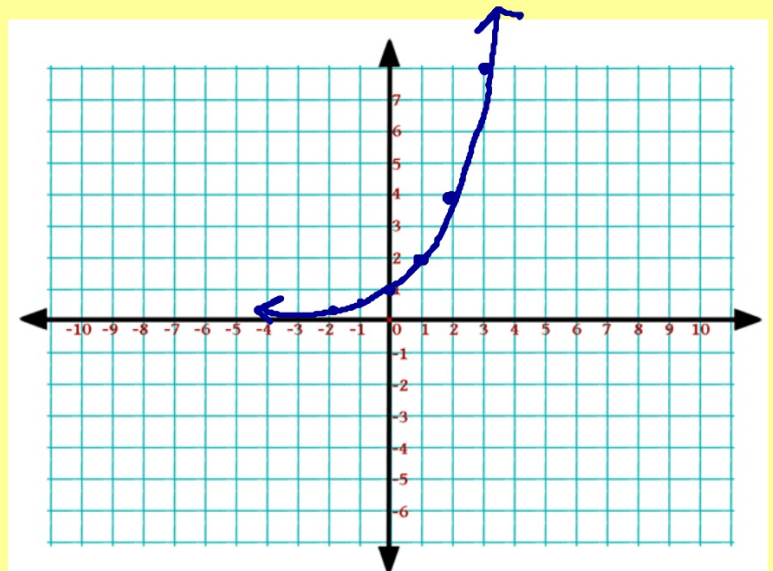
→

y is the value of the function (green arrow)
 a_1 is the 1st term in the sequence (blue arrow)
 r is the common ratio (red arrow)
 $x-1$ is the number of terms in the sequence (orange arrow)

Make a graph using a table

$$y = 2^x \longrightarrow 1 \cdot 2^x$$

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



y-int: $(0, 1)$ ---

base: 2 -----

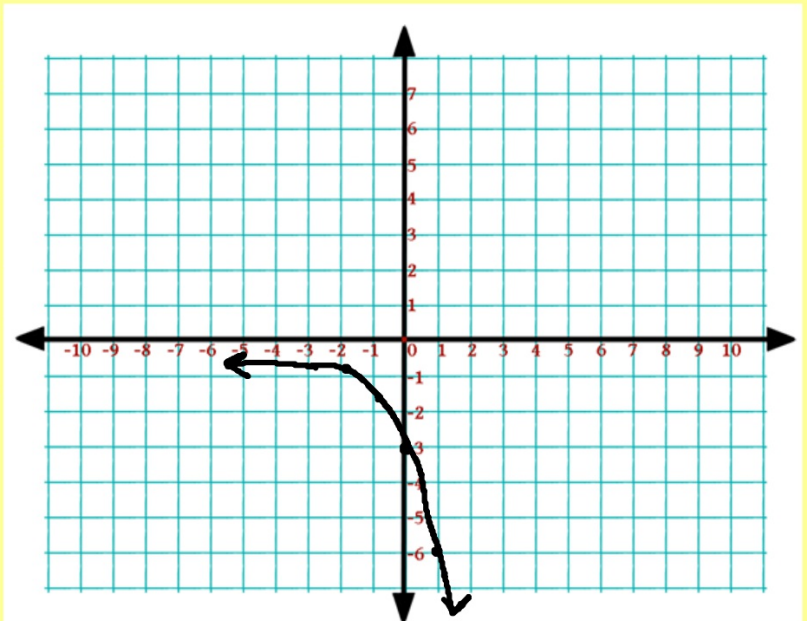
Make a graph using a table

$$y = (-3)^a 2^b x$$

x		y
-2	$-3(2)^{-2}$	$-.75$
-1	$-3(2)^{-1}$	-1.5
0	$-3(2)^0$	-3
1	$-3(2)^1$	-6
2	$-3(2)^2$	-12

y-int: $(0, -3)$

base: 2



Turn and Talk

What did you notice about the graphs of exponential functions?

How would you describe the increase?

(1 - 2 min)

Find the y-intercept of the exponential functions.

$$\text{A.) } y = \overset{a}{\boxed{3}}(.75)^x$$

$(0, 3)$

$$\text{C.) } y = 2(1.05)^x - 4$$

$(0, -2)$

$$\text{B.) } y = \overset{a}{\boxed{0.5}}(1.04)^x$$

$(0, 0.5)$

$$\text{D.) } y = .80^x - 3$$

$y = 1(.80)^x - 3$
 $(0, -2)$

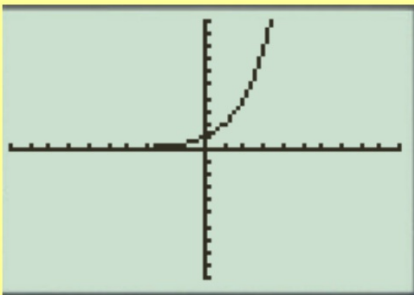
Hint: Exercises C and D have shifts.
Y-intercept is value of y when x = 0

$$y = 4^x \longrightarrow \text{Y-Intercept is } (0, 1).$$

What does it mean when an exponential function has a shift?

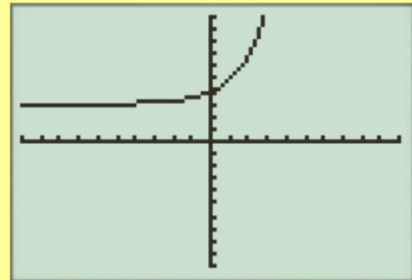
An exponential function in the form $f(x) = a(b^x) + k$ has a vertical shift.

The constant, k , is what causes the shift to occur.



$$y = 2^x$$

(0,1)



$$y = 2^x + 3$$

(0,4)

***Notice the y-intercepts.**

Ex.) The function $f(x) = 3(2)^x$ was replaced with $f(x) + k$ so that the y-intercept became $(0,5)$. What is the value of k ?

original

vertical
shift

$$a = 3, b = 2$$

$$y\text{-int: } (0,3)$$

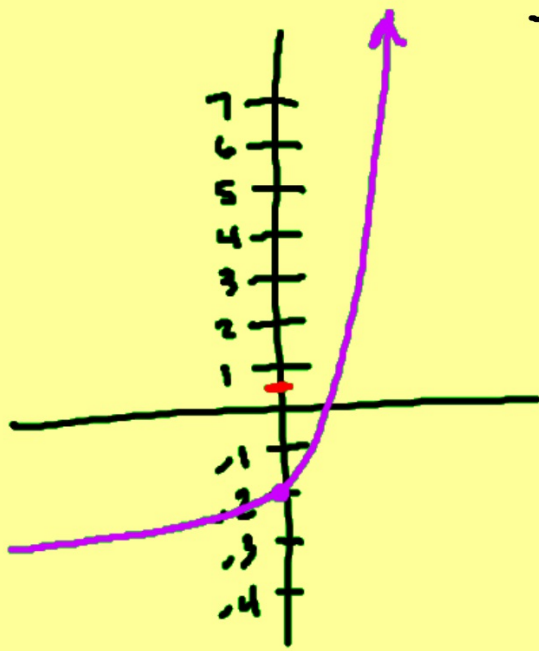
$$\text{original} + k = \text{new}$$

$$\begin{array}{r} 3 + k = 5 \\ \underline{-3 \quad -3} \\ k = 2 \end{array}$$

Ex.) The function $f(x) = -4(3)^x$ was replaced with $f(x) + k$ so that the y-intercept became $(0,3)$. What is the value of k ?

$$\begin{array}{r} -4 + k = 3 \\ +4 \quad +4 \\ \hline k = 7 \end{array}$$

Ex.) The function $f(x) = 0.5(1.5)^x$ was replaced with $f(x) + k$, as graphed below. What is the value of k ?



$$\begin{array}{r} 0.5 + k = -2 \\ -0.5 \quad -0.5 \\ \hline k = -2.5 \end{array}$$