

8.1 - 8.2 Part 1 Graphing Exponential Growth & Decay Functions

An exponential function has the variable as an exponent.

$$f(x) = a \cdot b^x$$

base
x
exponent

b is any positive number other than 1

examples: $f(x) = 2^x$ or $f(x) = \left(\frac{1}{2}\right)^x$

Example 1

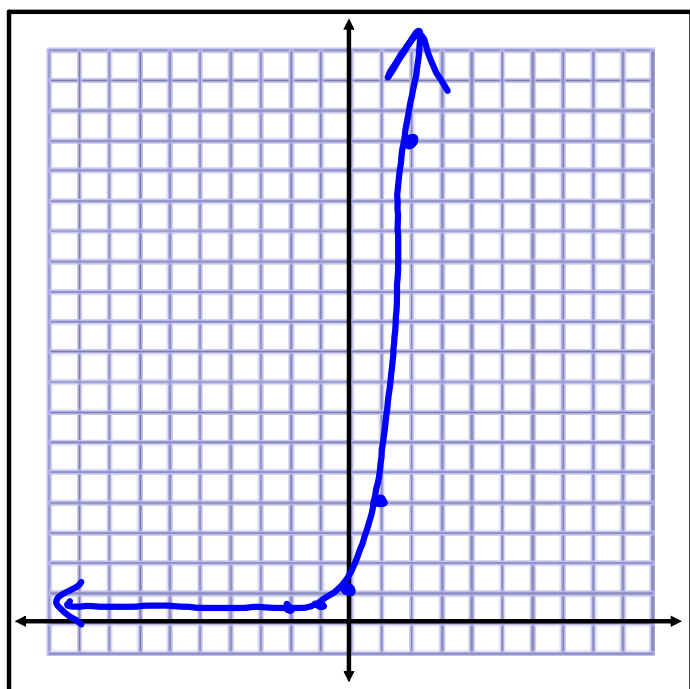
Make a table of values and graph $y = 4^x$.

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

~~Domain:~~

~~Range:~~

~~Asymptote:~~



Example 2

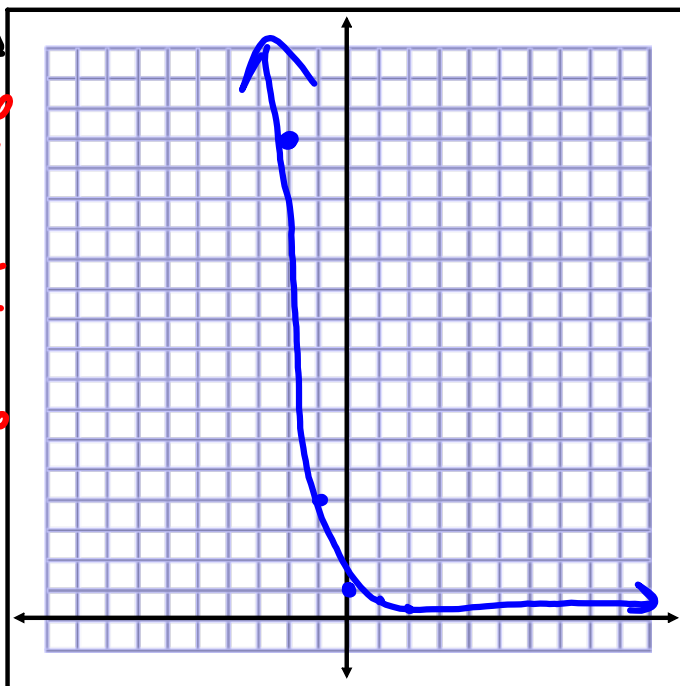
Make a table of values and graph $y = \left(\frac{1}{4}\right)^x$.

| x | $y = \left(\frac{1}{4}\right)^x$ | y |
|----|---|----------------|
| -2 | $\left(\frac{1}{4}\right)^{-2} = 4^2$ | 16 |
| -1 | $\left(\frac{1}{4}\right)^{-1} = 4^1$ | 4 |
| 0 | $\left(\frac{1}{4}\right)^0$ | 1 |
| 1 | $\left(\frac{1}{4}\right)^1$ | $\frac{1}{4}$ |
| 2 | $\left(\frac{1}{4}\right)^2 = \frac{1}{4^2} = \frac{1}{16}$ | $\frac{1}{16}$ |

~~Domain:~~

~~Range:~~

~~Asymptote:~~



The exponential function is a growth function if the base is greater than 1.

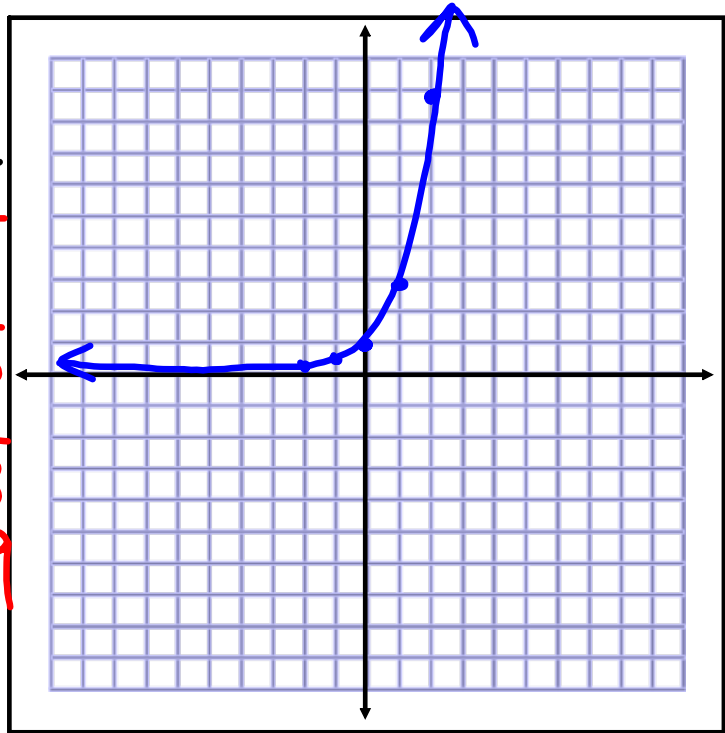
The exponential function is a decay function if the base is between 0 and 1.

Example 3

Graph the function below. ~~Identify the domain, range, & asymptote.~~

$$y = 3^x$$

| X | Y |
|----|--------------------------|
| -2 | $3^{-2} = \frac{1}{3^2}$ |
| -1 | $3^{-1} = \frac{1}{3^1}$ |
| 0 | 3^0 |
| 1 | 3^1 |
| 2 | 3^2 |

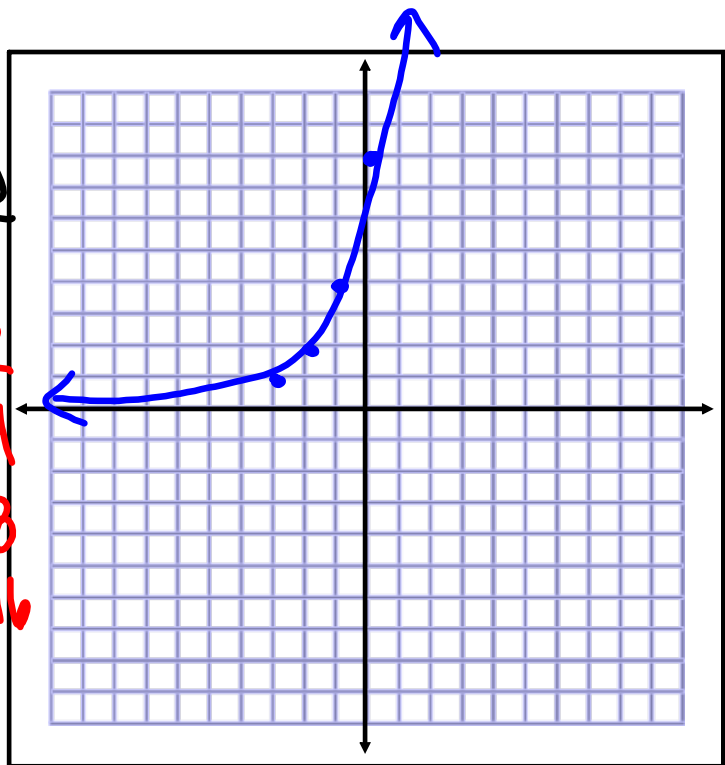


Example 4

Graph the function below. ~~Identify the domain, range, & asymptote.~~

$$y = 4(2)^{x+1}$$

| X | Y |
|----|---|
| -3 | $4(2)^{-3+1} = 4(2)^{-2} = \frac{4}{2^2} = \frac{4}{4} = 1$ |
| -2 | $4(2)^{-2+1} = 4(2)^{-1} = \frac{4}{2^1} = \frac{4}{2} = 2$ |
| -1 | $4(2)^{-1+1} = 4(2)^0 = 4 \cdot 1 = 4$ |
| 0 | $4(2)^{0+1} = 4(2)^1 = 4 \cdot 2 = 8$ |
| 1 | $4(2)^{1+1} = 4(2)^2 = 4 \cdot 4 = 16$ |



Example 5

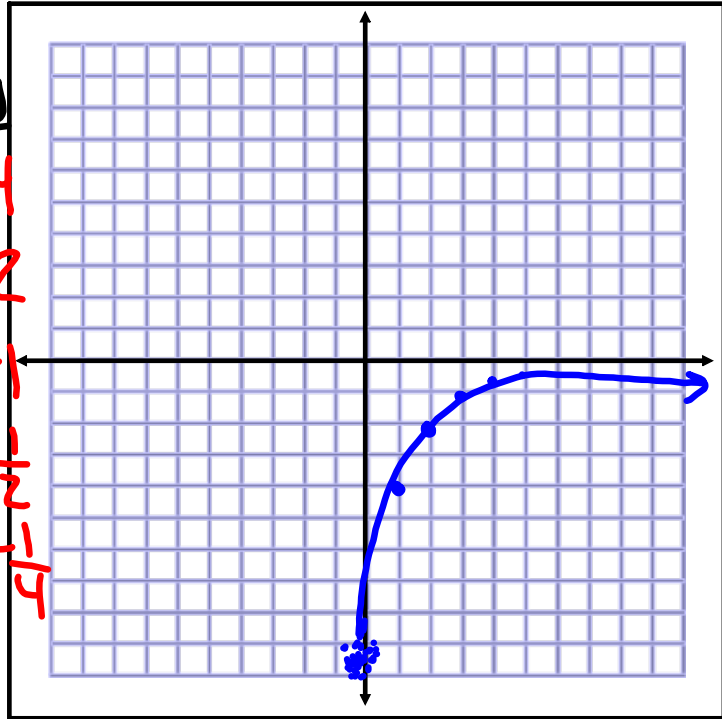
$$\begin{array}{ccccc}
 x-3=-2 & x-3=-1 & x-3=0 & x-3=1 & x-3=2 \\
 +3 & +3 & +3 & +3 & +3 \\
 x=1 & x=2 & x=3 & x=4 & x=5
 \end{array}$$

Graph the function below. Identify the domain, range, & asymptote.

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

| x | y |
|---|--|
| 1 | $-\left(\frac{1}{2}\right)^{-2} = -(2)^2$ |
| 2 | $-\left(\frac{1}{2}\right)^{-1} = -(2)^1$ |
| 3 | $-\left(\frac{1}{2}\right)^0 = -1$ |
| 4 | $-\left(\frac{1}{2}\right)^1 = -\frac{1}{2}$ |
| 5 | $-\left(\frac{1}{2}\right)^2 = -\frac{1}{2^2}$ |

x+2



Example 6

$$\begin{array}{ccccc}
 x+5=-2 & x+5=-1 & x+5=0 & x+5=1 & x+5=2 \\
 -5 & -5 & -5 & -5 & -5 \\
 x=-7 & x=-6 & x=-5 & x=-4 & x=-3
 \end{array}$$

Graph the function below. Identify the domain, range, & asymptote.

$y = -2\left(\frac{1}{3}\right)^{x+5} + 8$

| x | y |
|----|---|
| -7 | $-2\left(\frac{1}{3}\right)^{-2} + 8 = -2(3)^2 + 8$ $= -2(9) + 8$ $= -18 + 8$ |
| -6 | $-2\left(\frac{1}{3}\right)^{-1} + 8 = -2(3)^1 + 8$ $= -6 + 8$ |
| -5 | $-2\left(\frac{1}{3}\right)^0 + 8 = -2(1) + 8$ $= -2 + 8$ |
| -4 | $-2\left(\frac{1}{3}\right)^1 + 8 = -2\left(\frac{1}{3}\right) + 8$ $= -\frac{2}{3} + \frac{24}{3}$ or $7\frac{1}{3}$ |
| -3 | $-2\left(\frac{1}{3}\right)^2 + 8 = -2\left(\frac{1}{9}\right) + 8$ $= -\frac{2}{9} + \frac{72}{9}$ or $7\frac{2}{9}$ |

