Exponentials have two graphs, **GROWTH**  and **DECAY**  .

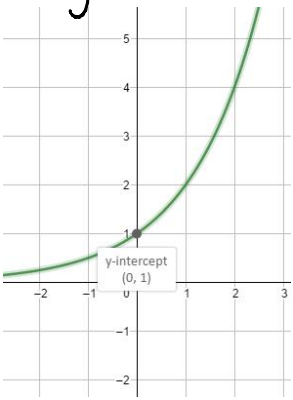
ALL OF THESE GRAPHS START AT (0, 1)!

GROWTH

$y = 2^x$

PARENT GRAPH

Asymptote: y=0 y-int: (0,1)



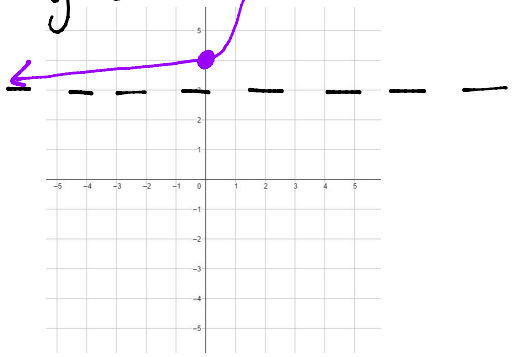
2 → base

> 1 growth

$y = 2^x + 3$

How do we move? Up 3

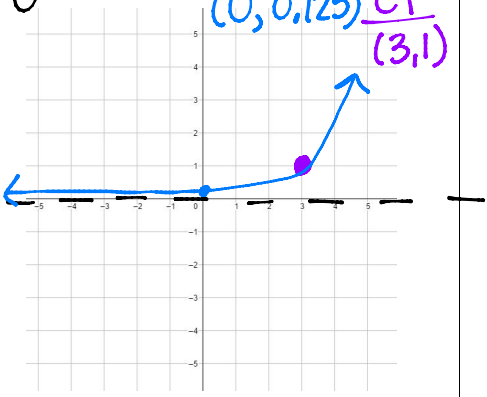
Asymptote: y=3 y-int: (0,4)



$y = 2^{(x-3)}$

How do we move? Right 3

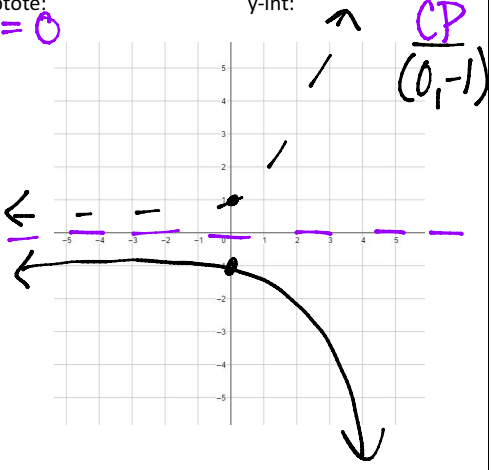
Asymptote: y=0 y-int: (0, 0.125) CP (3,1)



$y = -1(2)^x$

How do we move? Reflect over X-axis

Asymptote: y=0 y-int: CP (0,-1)



$y = 4(2)^x$

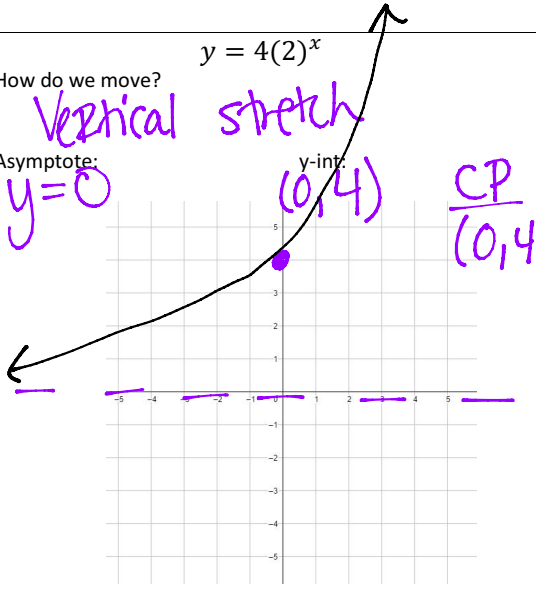
How do we move?

Vertical stretch

Asymptote: $y=0$

y-int: $(0,4)$

CP $(0,4)$



$y = \frac{1}{2}(2)^x$

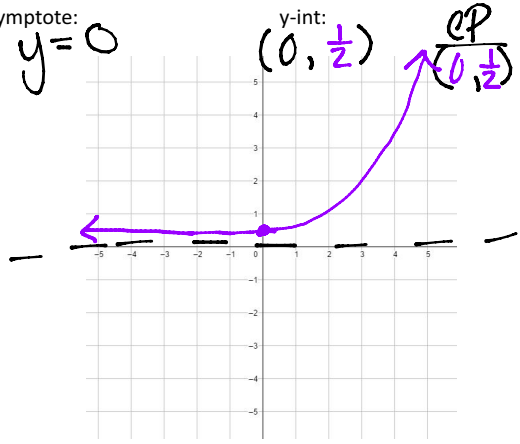
How do we move?

Horiz. stretch

Asymptote: $y=0$

y-int: $(0, \frac{1}{2})$

CP $(0, \frac{1}{2})$



$y = 2^{(x+2)} - 2$

How do we move?

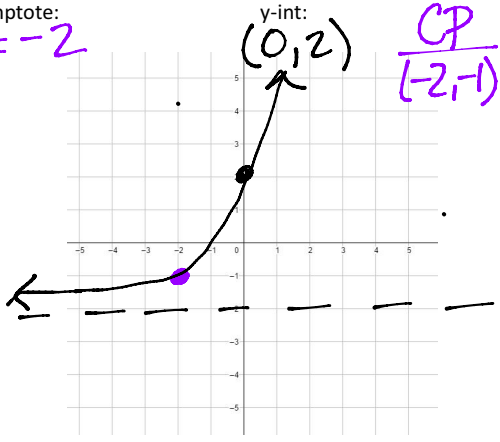
left 2 Down 2

$2^{0+2} - 2$

Asymptote: $y=-2$

y-int: $(0,2)$

CP $(-2,-1)$



$y = 3(2)^x - 4$

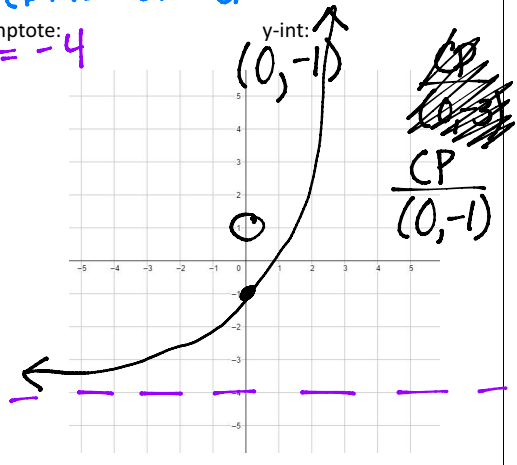
How do we move?

Vertical stretch ↓ Down 4

Asymptote: $y=-4$

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

CP $(0,-1)$

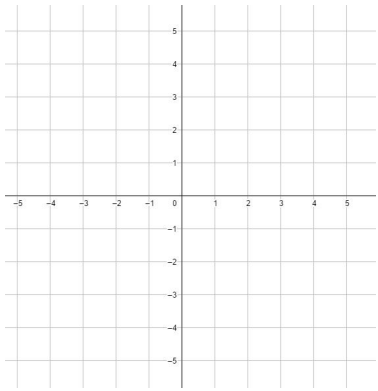


DECAY

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

How do we move?

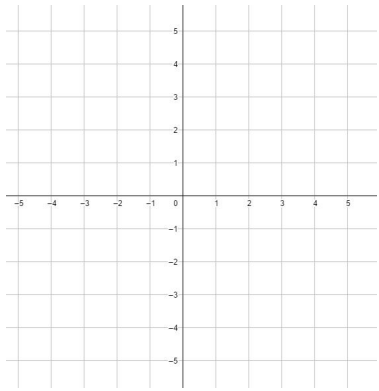
Asymptote: y-int:



$$y = \frac{1}{2}^{(x+3)}$$

How do we move?

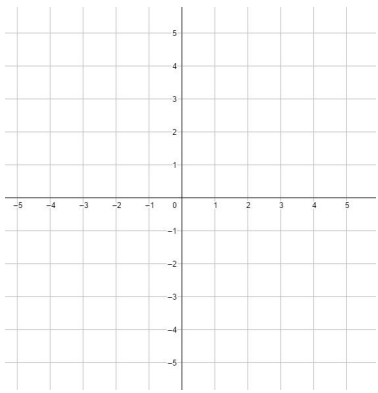
Asymptote: y-int:



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

How do we move?

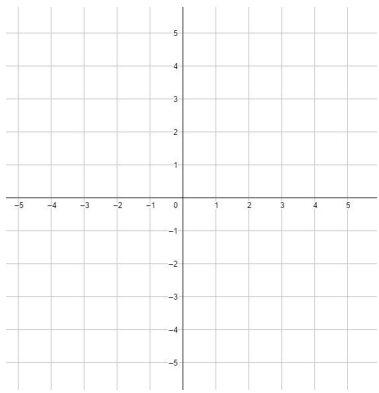
Asymptote: y-int:



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

How do we move?

Asymptote: y-int:



- When you are in the exponent, you move _____ or _____ (think opposite)
- When you are in the back of the equation (_____) you move _____ or _____
- **BIG DIFFERENCE BETWEEN GROWTH** AND **DECAY** IS

Write the equations for the following specific scenarios.

1) An exponential growth that has been shifted right 5 units and down 3 units.

2) A quadratic that has been reflected over the x-axis and left 3 units.

3) An exponential decay that has been vertically stretch by a factor of 10.

4) An exponential growth that has an asymptote of 4 and moved right 2 units.

5) A quadratic that has been horizontally stretched by ¼ and moved down 6 units.

6) A line that has a slope of 10 and a y-intercept of 2.

7) An exponential decay that has been vertically shrunk by a factor of 1/6 and reflected over the x-axis.

8) An exponential growth that has been moved left 8 units and has an asymptote of -4.