

# 6-4b Exponential Functions Transformations

The general form of an exponential function is

$$f(x) = a * b^{x-h} + k$$

The  $a$  value represents: *initial value (starting amount)*

The  $b$  value represents: *growth/decay factor*

Graph the 5 functions below.

1.  $f(x) = 2^x$

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

3.  $f(x) = 2^x - 4$

4.  $f(x) = 2^{x-4}$

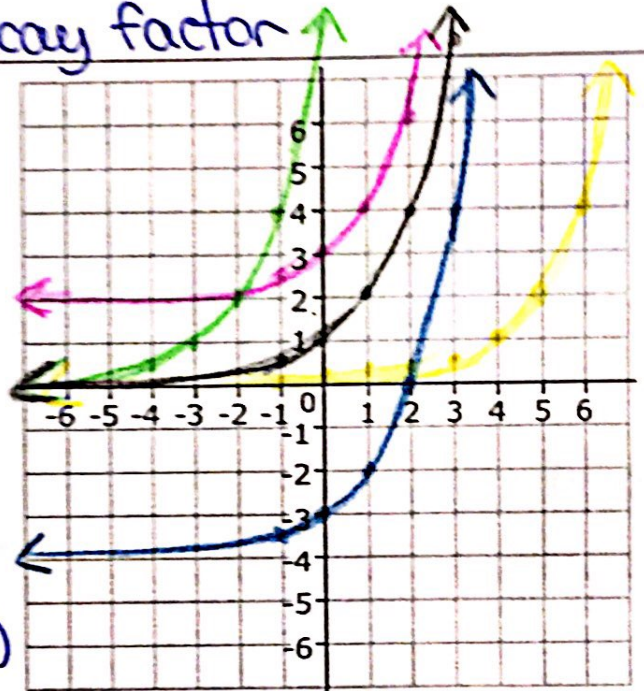
5.  $f(x) = 2^{x+3}$

How does  $k$  affect the graph?

*vertical shift (up/down)*

How does  $h$  affect the graph?

*horizontal shift (left / right)*



Graph the 3 functions below.

1.  $f(x) = 2^x$

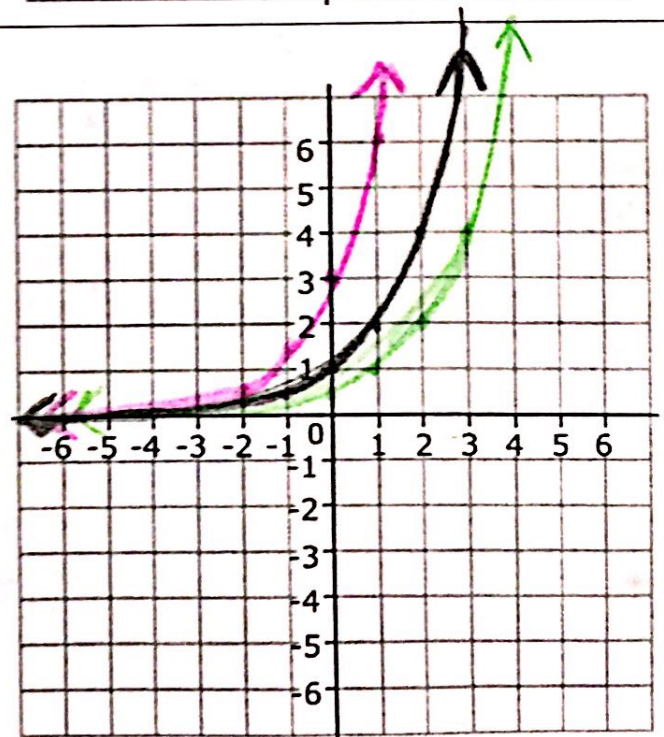
2.  $f(x) = 3 * 2^x$   $3 > 0 = 3$

3.  $f(x) = (\frac{1}{2})2^x$

How does changing  $a$  affect the graph?

$a > 1$  vertical stretch  
(gets bigger faster)

$0 < a < 1$  vertical shrink  
(grows slower)



$$f(x) = ab^{x-h} + k$$

Parameter	Effect
<b>h</b>	If $h > 0$ , the graph of the parent function is translated $h$ units to the <u>left</u> If $h < 0$ , the graph of the parent function is translated $h$ units to the <u>right</u>
<b>k</b>	If $k > 0$ , the graph of the parent function is translated $k$ units <u>up</u> If $k < 0$ , the graph of the parent function is translated $k$ units <u>down</u>
<b>a</b>	If $a > 1$ , the graph of the parent function is <u>stretched</u> vertically by a factor of $a$ . If $0 < a < 1$ , the graph of the parent function is <u>shrunk</u> vertically by a factor of $a$ .

EXAMPLES:

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

- Write a function translating  $f(x)$  to the right 2 units.  $f(x) = 3^{x-2}$
- Write a function translating  $f(x)$  up 4 units.  $f(x) = 3^x + 4$
- Write a function stretching  $f(x)$  by a factor of 7.  $f(x) = 7 \cdot 3^x$

### Y-INTERCEPT = $a+k$

\*The y-intercept is when  $x=0$ . Remember the zero power rule!

- What is the y-intercept of  $f(x) = 7 \cdot 3^x + 4$ ?  $7+4 = 11$
- What is the y-intercept of  $f(x) = 2 \cdot \frac{3^x}{4} - 1$ ?  $2-1 = 1$

**ASYMPTOTE** (a line that a curve approaches, but never actually touches)

Asymptote =  $k$

- Graph the function and identify the horizontal asymptote.

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

$$y=3$$

