

## 8.1 Exponential Growth

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

Ex: Linear Function

x	-2	-1	0	1	2
Y	-4	-1	2	5	8

$\downarrow$     $\downarrow$     $\downarrow$     $\downarrow$   
 +3   +3   +3   +3

Ex: Exponential Function

x	-2	-1	0	1	2
Y	2	6	18	54	162

$\downarrow$     $\downarrow$     $\downarrow$     $\downarrow$   
 +4   +12   +36   +108  
 $\downarrow$     $\downarrow$     $\downarrow$   
 $\times 3$     $\times 3$     $\times 3$

Ex 1) Write a rule for the function.

$$y = 2^x$$

x	0	1	2	3	4
Y	1	2	4	8	16

$\downarrow$     $\downarrow$     $\downarrow$     $\downarrow$   
 +1   +2   +4   +8  
 $\downarrow$     $\downarrow$     $\downarrow$   
 $\times 2$     $\times 2$     $\times 2$

Ex 2) Graph the function  $y = 3^x$ 

x	y
-2	$\frac{1}{9}$
-1	$\frac{1}{3}$
0	1
1	3
2	9

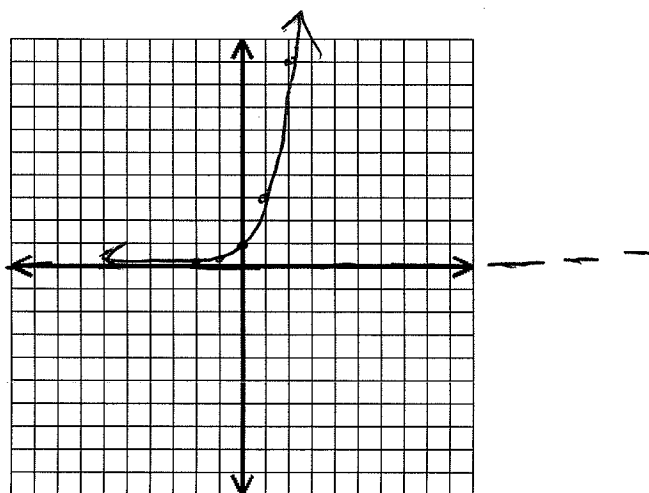
$$3^{-2} = \frac{1}{3^2} = \frac{1}{9}$$

$$3^{-1} = \frac{1}{3}$$

$$3^0 = 1$$

$$3^1 = 3$$

$$3^2 = 9$$

Domain:  $(-\infty, \infty)$ Range:  $(0, \infty)$ Asymptote:  $y = 0$    x-int: none   y-int:  $(0, 1)$ 

A line the curve approaches but never actually touches.

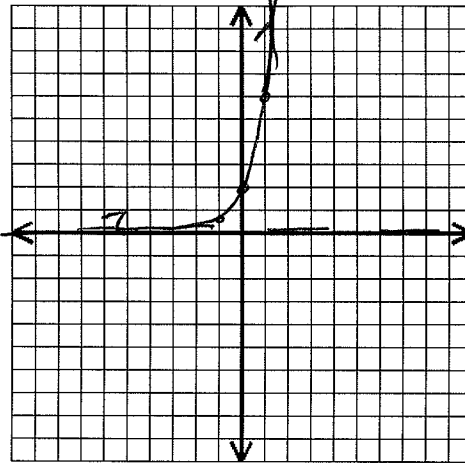
Ex 3) Graph the function  $y = 2 \cdot 3^x$

x	y
-1	$\frac{2}{3}$
0	2
1	6
2	18

$$2 \cdot 3^{-1} = 2 \cdot \frac{1}{3}$$

$$2 \cdot 3^0 = 2 \cdot 1 = 2$$

$$2 \cdot 3^1 = 6$$



Domain:  $(-\infty, \infty)$

Range:  $(0, \infty)$

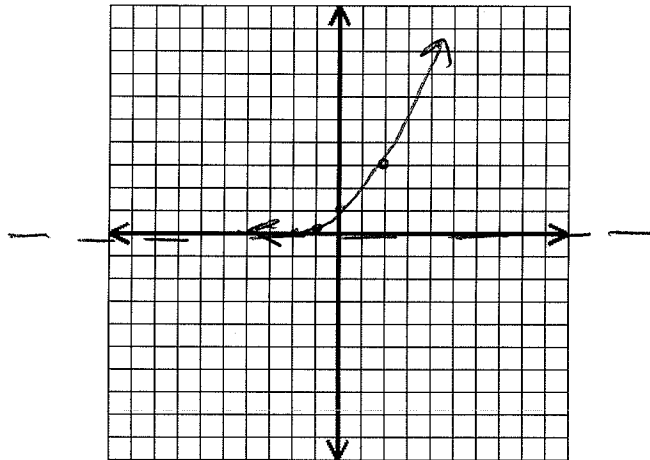
Asymptote:  $y=0$  x-int: none y-int:  $(0, 2)$

How does this graph compare to  $y = 3^x$ ?

steeper

Ex 3) Graph the function  $y = \frac{1}{3} \cdot 3^x$

x	y
-1	$\frac{1}{9}$
0	$\frac{1}{3}$
1	1
2	3



Domain:  $(-\infty, \infty)$

Range:  $(0, \infty)$

Asymptote:  $y=0$  x-int: none y-int:  $(0, 1)$

How does this graph compare to  $y = 3^x$ ?

not as steep

left/right opposite

### Translating Exponential Functions

$$y = a \cdot b^{x-h} + k$$

↑ vertical stretch/shrink      ↑ up/down

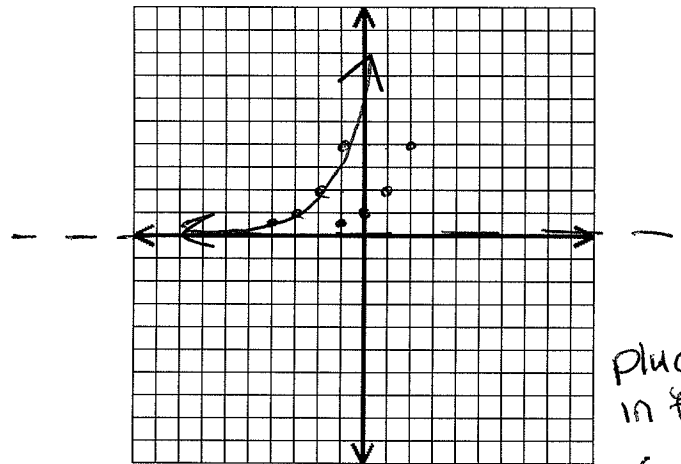
- 1.) graph the parent function  $y = a \cdot b^x$
- 2.) shift each point

Ex 4) Graph the function  $y = 2^{x+3}$

Parent  $y = 2^x$

x	y
-1	1/2
0	1
1	2
2	4

↓ left 3



plug zero in for x

Asymptote:  $y = 0$  x-int: none y-int:  $(0, 8)$

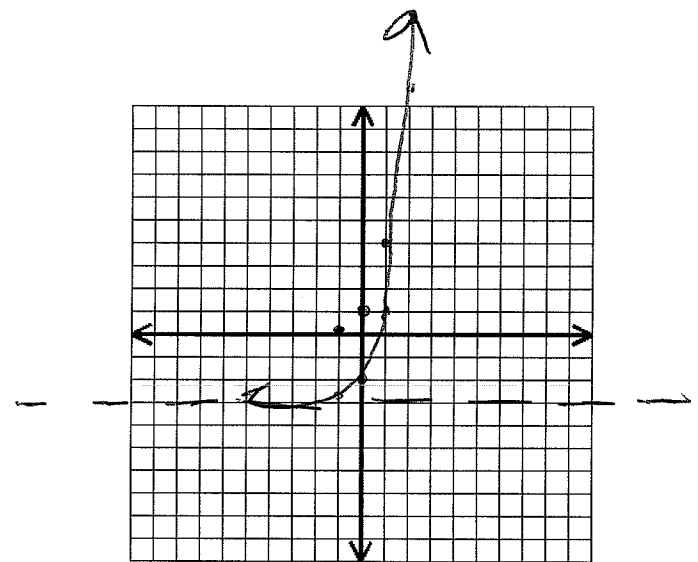
Domain:  $(-\infty, \infty)$  Range:  $(0, \infty)$

Describe the shift: left 3

Ex 5) Graph the function  $y = 4^x - 3$

Parent  $y = 4^x$

x	y
-1	1/4
0	1
1	4
2	16



Asymptote:  $y = -3$  y-int:  $(0, -2)$

Domain:  $(-\infty, \infty)$  Range:  $(-3, \infty)$

Describe the shift: down 3