Warm Up

Determine the y-intercept, the equation of the horizontal asymptote and state whether the function grows or decays:

1. $3y - 5 = 9(5^x) + 2$

$$\frac{3y}{3} = \frac{9(5^x)}{3} + \frac{7}{3}$$

$$y = 3(5^x) + \frac{7}{3}$$

→ y-Int (x=0)

$$y = \frac{3(1)}{1} + \frac{7}{3}$$

$$y = \frac{16}{3}$$

$$\left(0, \frac{16}{3}\right)$$

→ Hor. Asym

$$y = \frac{7}{3}$$

→ Growth

2. $(3)\frac{2}{3}(y-1) = (3)6 - (3)\left(\frac{3}{2}\right)^x$

$$2(y-1) = 18 - 3\left(\frac{3}{2}\right)^x$$

$$2y - 2 = 18 - 3\left(\frac{3}{2}\right)^x$$

$$2y = -3\left(\frac{3}{2}\right)^x + 20$$

$$y = \frac{-3}{2}\left(\frac{3}{2}\right)^x + 10$$

→ y-Int: (x=0)

$$y = -\frac{3}{2}(1) + \frac{10}{1}$$

$$y = \frac{17}{2}$$

$$\left(0, \frac{17}{2}\right)$$

→ Hor. Asym.

$$y = 10$$

→ Growth

Graphing Exponential Functions

- Using Transformations:

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

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

$y = a(x-h)^2 + K$
$= 3(x+1)^2 + 3$

What transformations have been applied to $y = 2^x$?

- Vertical Stretch: 3
- Vertical Translation: Up 3
- Horizontal Translation: Left 1

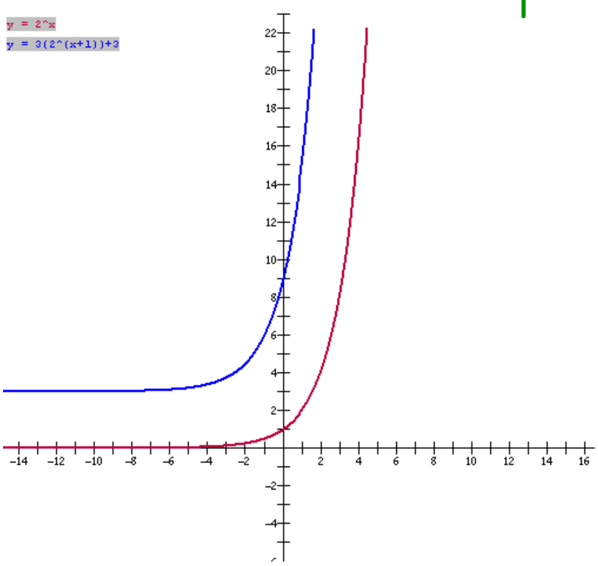
Mapping Rule: $(x, y) \to (x-1, 3y+3)$

$y = 2^x$

x	y
0	1
1	2
2	4
3	8

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

x	y
-1	6
0	9
1	15
2	27



Given: $y = a(b)^{x-h} + k$

Mapping Rule would be: $(x, y) \rightarrow (x + h, ay + k)$

Example:

The exponential function $y = 5^x$ is transformed according to the following mapping rule: $(x, y) \rightarrow (x - 2, 3y + 6)$

5^{x+2}

$(5^x)(5^2)$

- Determine the equation of this function
- What is the y-intercept?
- What is the equation of the ~~axis of symmetry~~ Horiz. Asymptote?
- Sketch this function

??

$y = 3(5)^{x+2} + 6 \Rightarrow y = 75(5)^x + 6$

y-Int:

$y = 3(5)^2 + 6$

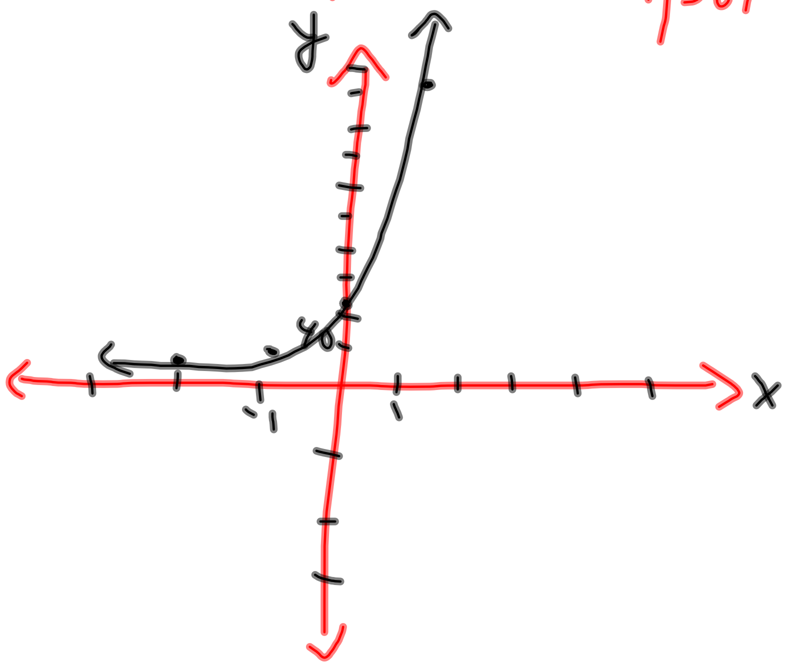
$y = 81$

Horiz. Asym.

$y = 6$

x	y
0	1
1	5
2	25
3	125

x	y
-2	9
-1	21
0	81
1	381



What about an exponential function of the form $y = b^{\frac{x}{c}}$, $h \in R$?

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Plot1  Plot2  Plot3
\Y1=2^X
\Y2=2^(X/2)
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
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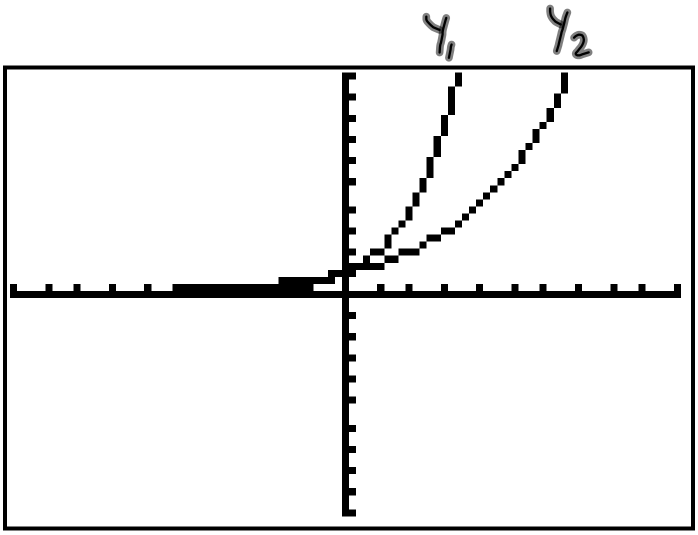
X	Y1	Y2
-3	.125	.35355
-2	.25	.5
-1	.5	.70711
0	1	1
1	2	1.4142
2	4	2
3	8	2.8284

X= -3



How is graph being stretched??

$y = 2^x$

$y = 2^{x/3}$

$y = 2^{3x}$

$y = (2^3)^x$

$y = 8^x$

$y = (\sqrt[3]{2})^x$

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

$y = 2^{x/3}$

Example:

Given the exponential function shown below...

- Write a mapping that would map the graph of $y = 2^x$ to this function.
- Complete the tables of values below using the mapping rule.

$$y = 7(2)^{\frac{1}{5}(x+3)} + 4$$

$y = 2^x$

x	y
-3	$\frac{1}{8}$
-2	$\frac{1}{4}$
-1	$\frac{1}{2}$
0	1
1	2
2	4
3	8

maps to...

$(x, y) \rightarrow (5x - 3, 7y + 4)$

x	y
-18	39/8
-13	23/4
-8	15/2
-3	11
2	18
7	32
12	60

Focal Point

Focal Point - the point shared by all exponential functions.

It is the point (0,1) for the function $y = b^x$

It is the point (0,a) for the function $y = ab^x$

Example:

Given the exponential function shown below...

- Write a mapping that would map the graph of $y = 3^x$ to this function.

(b) What is Focal Point?

$$4y+7=8(3)^{5x-3}-13$$

$4y = 8(3)^{5x-3} - 20$

Be Careful!!!

$y = 2(3)^{5x-3} - 5$

$y = 2(3)^{5(x-\frac{3}{5})} - 5$

$(x,y) \rightarrow \left(\frac{1}{5}x+\frac{3}{5}, 2y-5\right)$

$(0,1) \rightarrow \left(\frac{1}{5}(0)+\frac{3}{5}, 2(1)-5\right)$

Focal Point $\rightarrow \left(\frac{3}{5}, -3\right)$

Example:

Given the mapping rule shown below is used to transform the graph of $y = 6^x$ ...

- Determine the equation of the new function.

$$(x,y) \rightarrow \left(\frac{2}{5}x+4\ ,\ \frac{3}{8}y+6\right)$$

Homework

Textbook

page 145 #4
page 148 #9, 10, 11, 16

*A graphing calculator may be used
for any graphs(instead of sketching)