Graphing and Transformations of Exponential Functions

Your Name

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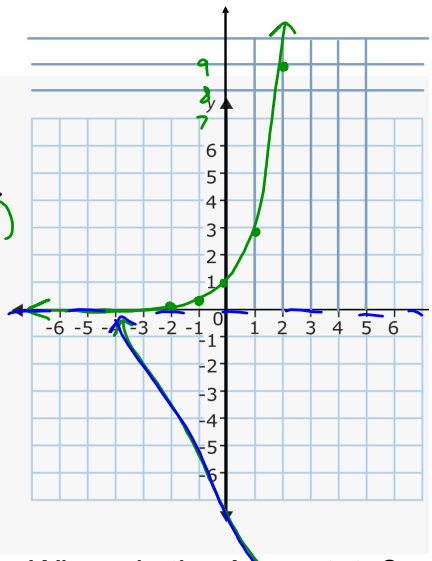
Notes

Graphing Exponential Functions Via XY Table

The Parent Function

Graph $y = 3^x$

x	$f(x) = 3^{(\ )}$	(x, y)
-2	$f(-2) = 3^{(-2)} = \frac{1}{3^2} = \frac{1}{9}$	$(-2, \frac{1}{9})$
-1	$f(-1) = 3^{(-1)} = \frac{1}{3^1}$	$(-1, \frac{1}{3})$
★ 0	$f(0) = 3^{(0)} = 1$	$(0, 1)$
1	$f(1) = 3^{(1)} = 3$	$(1, 3)$
2	$f(2) = 3^{(2)} = 9$	$(2, 9)$



Where is the Asymptote?

invisible line that the function approaches

Where is the y-intercept?

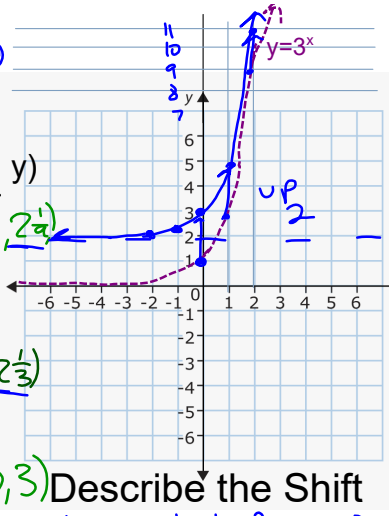
when $x = 0$

$(0, 1)$

Graphing **Vertical Shifts** in Exponential Functions Via XY Table

Graph $y = 3^x + 2$

x	f(x) = 3^( ) +2	(x, y)
-2	$f(-2)=3^{-2}+2$ $\frac{1}{3^2}+2=\frac{1}{9}+2$	$(-2, 2\frac{1}{9})$
-1	$f(-1)=3^{-1}+2$ $=\frac{1}{3}+2=2\frac{1}{3}$	$(-1, 2\frac{1}{3})$
0	$f(0)=3^0+2=1+2$	$(0,3)$
1	$f(1)=3^1+2=5$	$(1,5)$
2	$f(2)=3^2+2=11$ $9+2$	$(2,11)$



Describe the Shift

Vertical shift up 2

Where is the Asymptote?

$y=2$

look at what was added after b^x

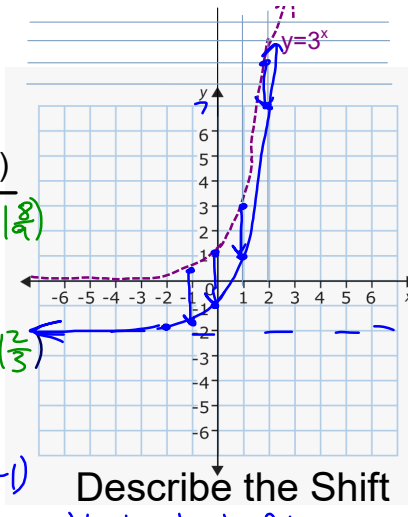
Where is the y-intercept?

$(0,3)$

$(x, y+2) \rightarrow (0, 1+2)$

Graph $y = 3^x - 2$

x	f(x) = 3^( ) - 2	(x, y)
-2	$3^{(-2)}-2=$ $\frac{1}{3^2}-2=\frac{1}{9}-2=-1\frac{8}{9}$	$(-2, -1\frac{8}{9})$
-1	$3^{-1}-2=$ $\frac{1}{3}-2=-1\frac{2}{3}$	$(-1, -1\frac{2}{3})$
0	$3^0-2=1-2=-1$	$(0,-1)$
1	$3^1-2=1$	$(1,1)$
2	$3^2-2=9-2=7$	$(2,7)$



Describe the Shift

Vertical shift down 2

Where is the Asymptote?

$y=-2$

Where is the y-intercept?

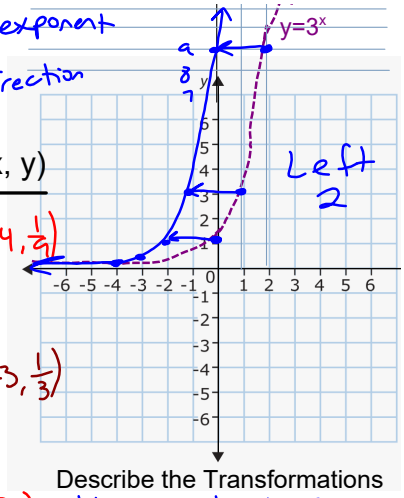
$(0,-1)$

$(x, y-2) \rightarrow (0, 1-2)$

Graphing **Horizontal Shifts in** Exponential Functions Via XY Table

Graph $y = 3^{x+2}$ +2 in exponent, negative direction

x	$f(x) = 3^{x+2}$	(x, y)
-4	$f(-4) = 3^{-4+2} = 3^{-2} = \frac{1}{9}$	$(-4, \frac{1}{9})$
-3	$f(-3) = 3^{-3+2} = 3^{-1} = \frac{1}{3}$	$(-3, \frac{1}{3})$
-2	$f(-2) = 3^{-2+2} = 3^{0} = 1$	$(-2, 1)$
-1	$f(-1) = 3^{-1+2} = 3^{1}$	$(-1, 3)$
★ 0	$f(0) = 3^{0+2} = 3^{2} = 9$	$(0, 9)$



Describe the Transformations

Horizontal shift left 2

Where is the Asymptote?

$y = 0$

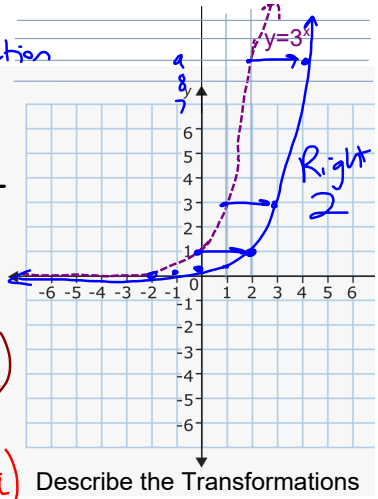
Where is the y-intercept?

$(0, 9)$

$(x-2, y) \rightarrow (2-2, 9)$

Graph $y = 3^{x-2}$ −2 positive direction

x	$f(x) = 3^{x-2}$	(x, y)
-2	$f(-2) = 3^{-2-2} = 3^{-4} = \frac{1}{3^4} = \frac{1}{3 \cdot 3 \cdot 3 \cdot 3} = \frac{1}{9 \cdot 9} = \frac{1}{81}$	$(-2, \frac{1}{81})$
-1	$f(-1) = 3^{-1-2} = 3^{-3} = \frac{1}{3^3} = \frac{1}{27}$	$(-1, \frac{1}{27})$
★ 0	$f(0) = 3^{0-2} = 3^{-2} = \frac{1}{3^2}$	$(0, \frac{1}{9})$
2	$f(2) = 3^{2-2} = 3^{0} = 1$	$(2, 1)$
3	$f(3) = 3^{3-2} = 3^{1} = 3$	$(3, 3)$
4	$f(4) = 3^{4-2} = 3^{2} = 9$	$(4, 9)$



Describe the Transformations

Horiz. shift right 2

Where is the Asymptote?

$y = 0$

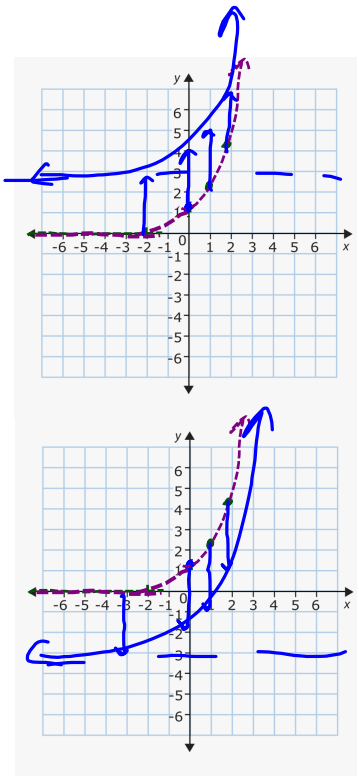
Where is the y-intercept?

$(0, \frac{1}{9})$

$(x+2, y) \quad (-2+2, \frac{1}{9})$

Summarize and Sketch a picture:

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



The function shifts Vertically Up

when the k value is positive

and looks like $2^x + k$

So I am adding to each y value

The function shifts Vertically Down

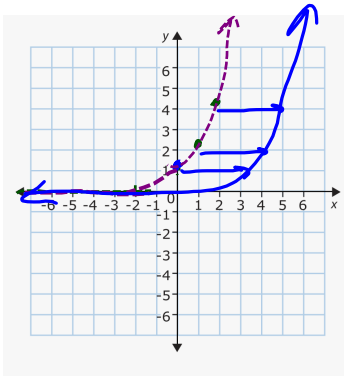
when the k value is negative

and looks like $2^x - k$

So I am Subtracting from each y value

Summarize and Sketch a picture:

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

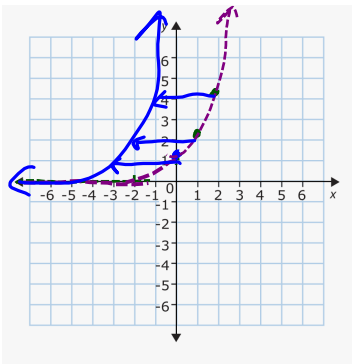


The function Horizontally shifts Right

when the h value is positive

BUT it looks like 2^{x-h}

and I am Subtracting from each x value



The function Horizontally shifts Left

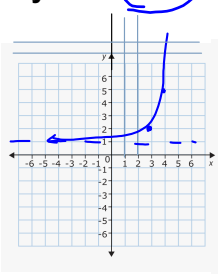
when the h value is negative

BUT it looks like 2^{x+h}

and I am adding to each x value

Level 1 Given the graphs and functions, answer the questions below each.

1. $y = 4^{x-3} + 1$



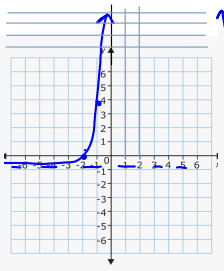
Is this growth or decay?

growth

Describe the Shift

shift right 3
up 1

2. $y = (5)^{x+2} - 1$



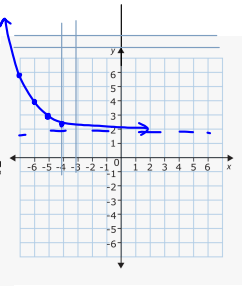
growth or decay?

growth
base = 5 > 1

Describe the Shift

left 2
down 1

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



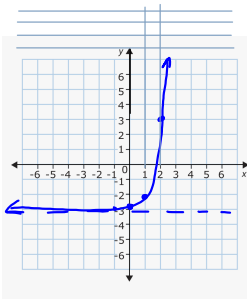
growth or decay?

decay
base = $\frac{1}{2}$ < 1

Describe the Shift

left 4
up 2

4. $y = (5/2)^{x-1} - 3$



growth or decay?

growth
base = 2.5 > 1

Describe the Shift

right 1
down 3