

The equation $f(x) = (a)b^{x-h} + k$ is the translation function that helps us understand how changing values impacts the resulting graph.

h tells us about horizontal movement.

$x+4$
If **h** is positive... moves left

$x-4$
If **h** is negative... moves right

Xs lies!

a tells us about stretching, reflecting, and compressing.

a is negative
If $a < 0$... reflects over the x-axis

If $a > 1$... Vertical stretch

a is a fraction
If $0 < a < 1$... Vertical compression

k tells us about vertical movement.

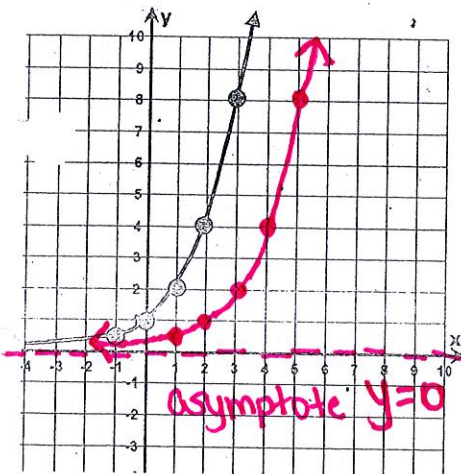
$+5$
If **k** is positive... move up

-5
If **k** is negative... move down

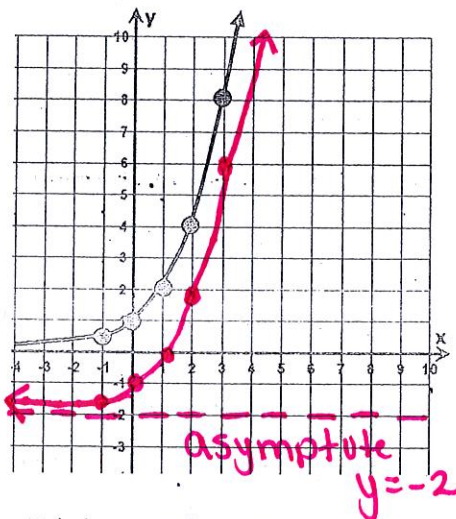
Ys wise!

Given the graphed parent function $f(x) = 2^x$, perform the following translations.

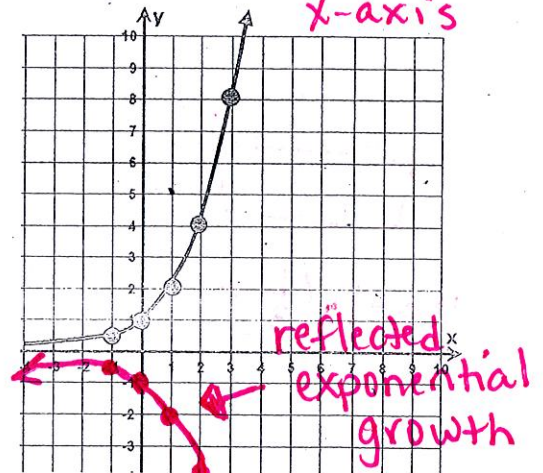
$f(x) = 2^{x-2}$ Right 2



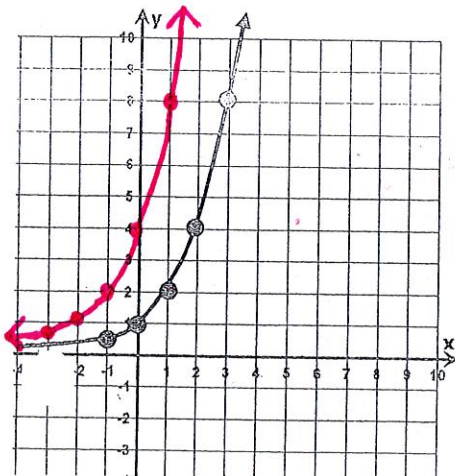
$f(x) = 2^x - 2$ Down 2



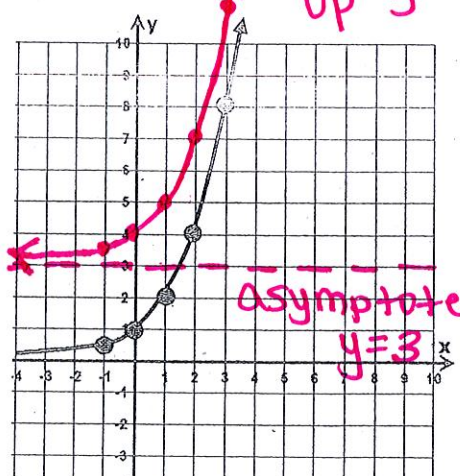
$f(x) = (-1)2^x$ reflect over x-axis



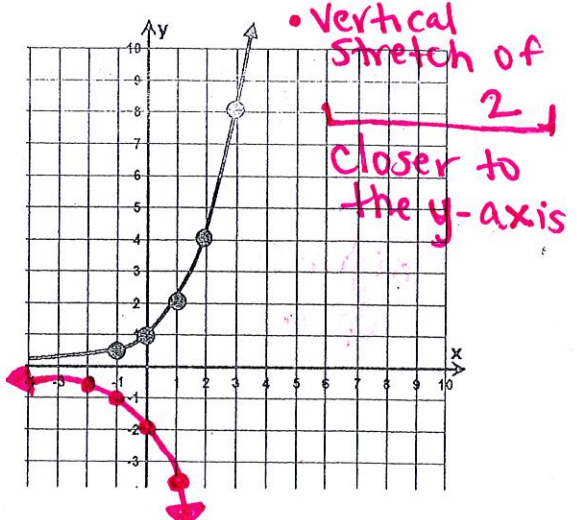
$f(x) = 2^{x+2}$ left 2



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



$f(x) = (-2)2^x$ reflect across x-axis



Exponential Transformations Worksheet

1) Describe the transformations that map the function $y = 2^x$ onto each of the following functions...

a) $y = 2^x - 2$

• Down 2

b) $y = 2^{x+3}$

• Left 3

~~c) $y = 4^x$~~

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

• Vertical stretch of 3
• right 1
• Up 1

2) Create a sketch of each graph for each equation in question 1. (a table of values may help)

SKIP

3) Write the equation for the function that results from each transformation applied to the base function

$y = 5^x$

a) translate down 3 units

$y = 5^x - 3$

b) shift right 2 units

$y = 5^{x-2}$

c) translate left $\frac{1}{2}$ unit

$y = 5^{x+\frac{1}{2}}$

d) shift up 1 unit and left 2.5 units

$y = 5^{x+2.5} + 1$

4) Write the equation for the function that results from each transformation applied to the base function

$f(x) = \left(\frac{1}{3}\right)^x$

a) reflect in the x-axis (vertical reflection)

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

b) stretch vertically by a factor of 3

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

c) stretch horizontally by a factor of 2.4

SKIP

d) reflect horizontally, stretch vertically by factor of 4

SKIP

5) Just list transformations

5) ~~Quickly sketch~~ the following exponential functions by transforming the key points and/or asymptote.

a) $y = 3^{x-3} + 2$

• Right 3
• Up 2

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

• Reflect across x-axis

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

• Vertical compression of $\frac{1}{2}$

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

• Down 3