gld $y = ab^{x-h} + k$ vertical shift

y-int horizontal shift

Asymptote $y=k$

GUIDED NOTES – Lesson 6-1b

Translations of Exponential Functions

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. (opp. signs) $(0 \pm h, 1)$ y-int

If **h is positive**... Move Right If **h is negative**... Move Left

---

a tells us about stretching, reflecting, and compressing. (vertical v. horizontal)

If **a < 0**... Reflection If **a > 1**... stretch If **0 < a < 1**... compress/shrink

---

k tells us about vertical movement. $(0, 1 \pm k)$ y-int

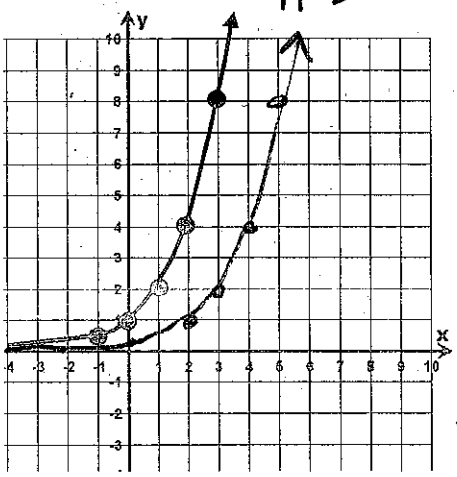
If **k is positive**... Move up If **k is negative**... Move down

If h, k both exist $(0 \pm h, 1 \pm k)$ y-int.

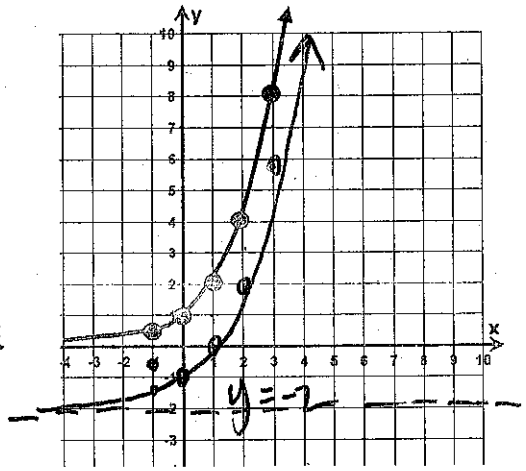
Given the graphed parent function $f(x) = 2^x$, perform the following translations.

* $y=k$ is asymptote.

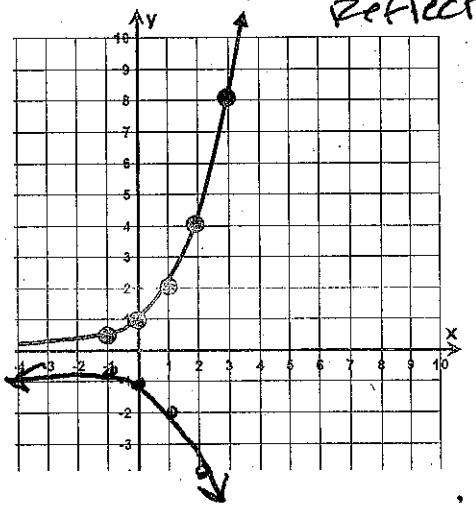
$f(x) = 2^{x-2}$ Right 2 $h=2$



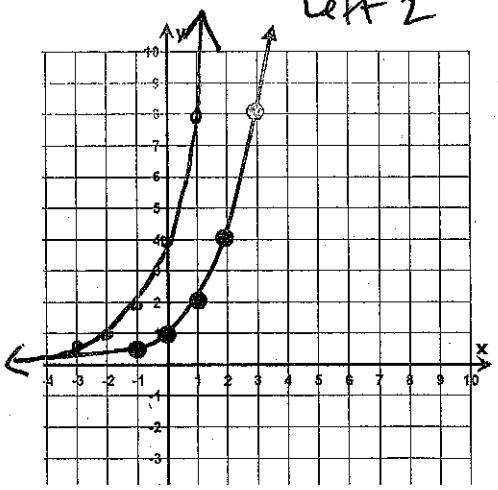
$f(x) = 2^x - 2$ $k=-2$ down 2



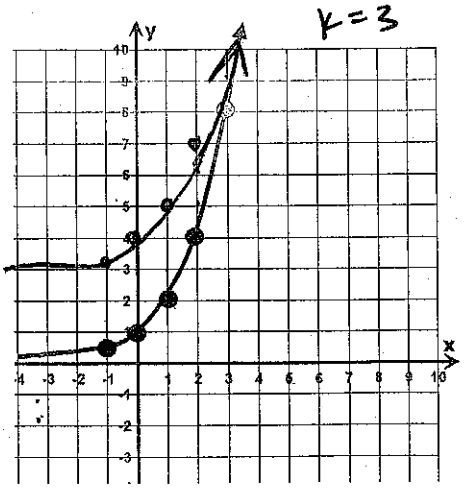
$f(x) = (-1)2^x$ $a=-1$ Reflection



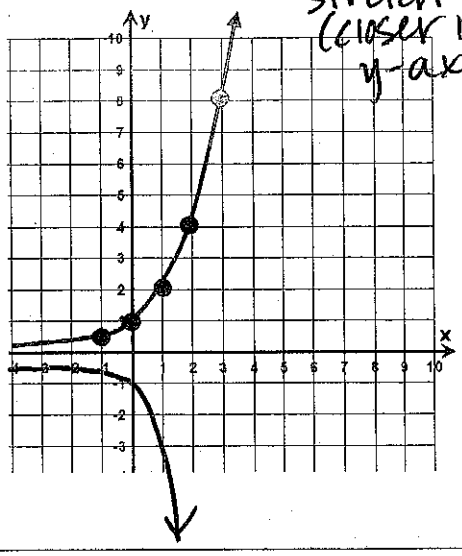
$f(x) = 2^{x+2}$ $h=-2$ left 2



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



$f(x) = (-2)2^x$ Reflection stretch 2 (closer to y-axis)



* For next year → contains horizontal ref.

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

stretch 3
Right 1
UP 1

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

Don't Do

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)

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

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

$y = \left(\frac{1}{3}\right)^{2.4x}$

* **d)** reflect horizontally, stretch vertically by factor of 4

$y = 4\left(\frac{1}{3}\right)^{-x}$

Just List transformations → (no graphing)

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

Reflection

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

shrink
down 3

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

horizontal stretch 2
horizontal Reflection