5.1 Notes $f(x) = ab^{x-h} + k$

TRANSFORMATIONS of Exponential Functions

- h is a horizontal shift
- k is a vertical shift asymptote $y = k$
- $-a$ is a reflection
- $|a| > 1$ is a stretch
- $0 < |a| < 1$ is a compression

Directions: Identify the parent function and describe the transformation.

1. $f(x) = -\left(\frac{4}{3}\right)^{x+2} + 7$ $y = \left(\frac{4}{3}\right)^x$ parent

The graph is shifted two units left and 7 units up. It is reflected over the x axis.

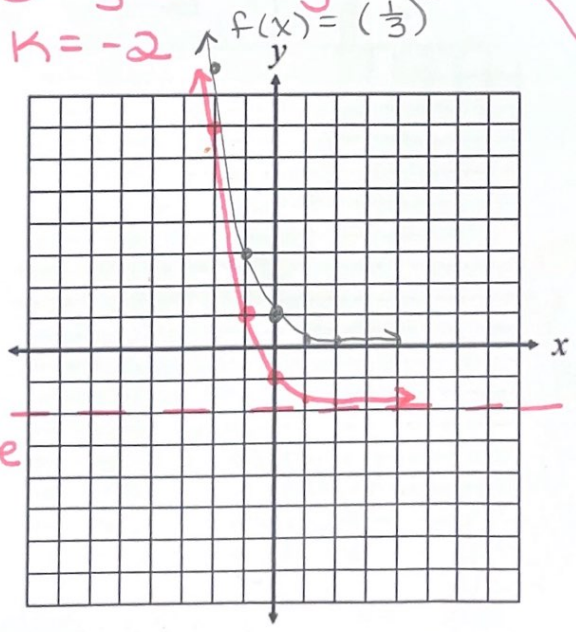
2. $f(x) = \frac{1}{2}(5)^{x-4} - 2$ $y = 5^x$ parent

The graph is shifted 4 units right and 2 units down. It is vertically compressed by factor of $\frac{1}{2}$

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

$a = 1$ $b = \frac{1}{3}$ decay

$h = 0$ $k = -2$



Domain $(-\infty, \infty)$

Range $(-2, \infty)$

End Behavior:

as $x \to \infty$, $f(x) \to -2$

as $x \to -\infty$, $f(x) \to \infty$

y-intercept: $(0, -1)$

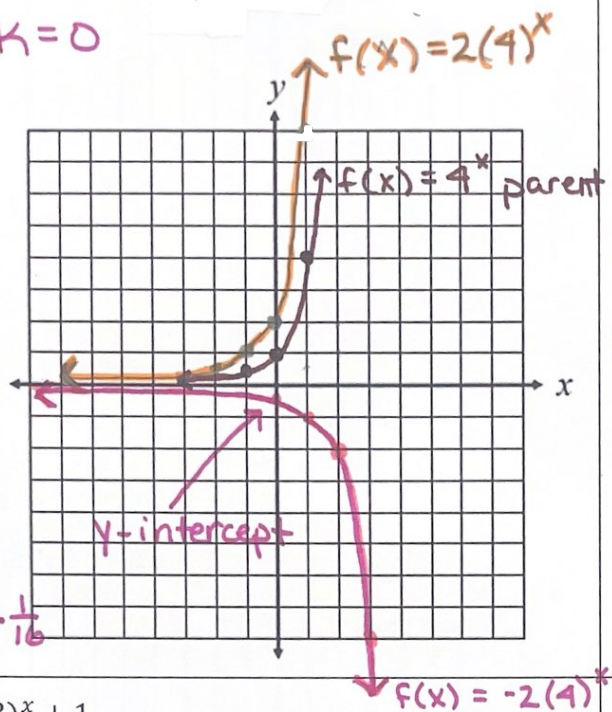
Asymptote: $y = -2$

When graphing parent shifts: 1. horizontal 2. stretch 3. reflect ~~4. vertical shift~~

4. $f(x) = -2(4)^{x-2}$

$a = -2 \quad b = 4$

$h = 2 \quad k = 0$



y-intercept $x = 0$

$y = -2(4)^{0-2}$

$= -2(4)^{-2} = -2 \cdot \frac{1}{16}$

$= -\frac{1}{8}$

Domain $(-\infty, \infty)$

Range $(-\infty, 0)$

End Behavior:

as $x \to \infty$, $f(x) \to -\infty$

as $x \to -\infty$, $f(x) \to 0$

y-intercept: $(0, -\frac{1}{8})$

Asymptote: $y = 0$

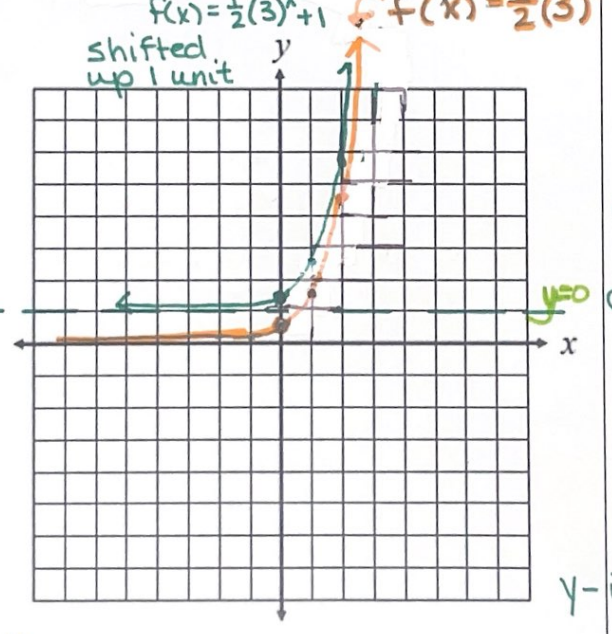
5. $f(x) = \frac{1}{2}(3)^x + 1$

$a = \frac{1}{2} \quad b = 3$

$h = 0$

$k = 1$

OR Graph $f(x) = ab^x$ Then, complete other transformations.



Domain $(-\infty, \infty)$

Range $(1, \infty)$

End Behavior:

as $x \to \infty$, $f(x) \to \infty$

as $x \to -\infty$, $f(x) \to 1$

y-intercept: $(0, \frac{3}{2})$

Asymptote: $y = 1$

y-intercept $x = 0$

$y = \frac{1}{2}(3)^0 + 1$

$= \frac{1}{2}(1) + 1$

$= \frac{3}{2}$

$a \times b$

$\frac{1}{2} \cdot \frac{3}{1}$; $\frac{3}{2} \cdot \frac{3}{1}$; $\frac{9}{2} \cdot \frac{3}{1}$

$\frac{3}{2}$ $\frac{9}{2}$ $\frac{27}{2}$