

Unit 6a

7.1 - 7.4: Exponential Growth & Decay

Graph of $f(x) = a^x$, $a > 1$

Domain: $(-\infty, \infty)$

Range: $(0, \infty)$

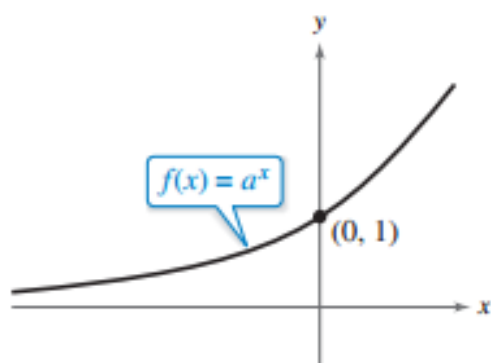
Intercept: $(0, 1)$

Increasing on $(-\infty, \infty)$

x -axis is a horizontal asymptote

$(a^x \rightarrow 0 \text{ as } x \rightarrow -\infty)$

Continuous



Graph of $f(x) = a^{-x}$, $a > 1$

Domain: $(-\infty, \infty)$

Range: $(0, \infty)$

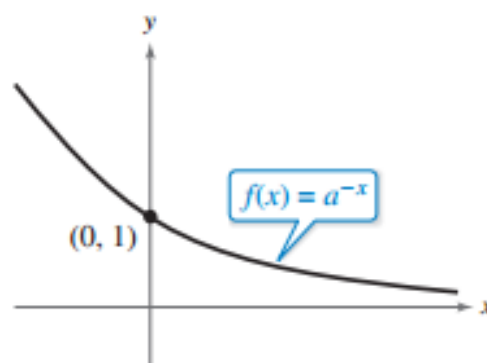
Intercept: $(0, 1)$

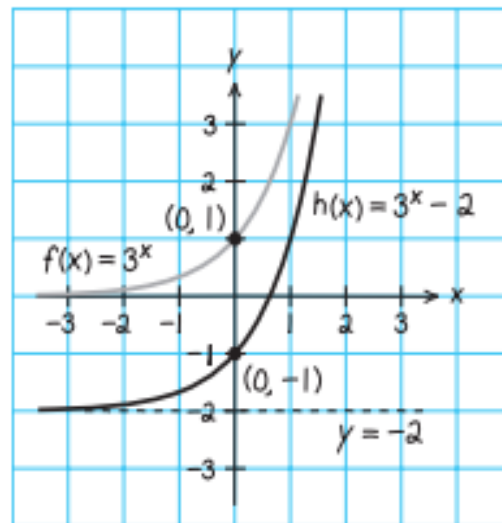
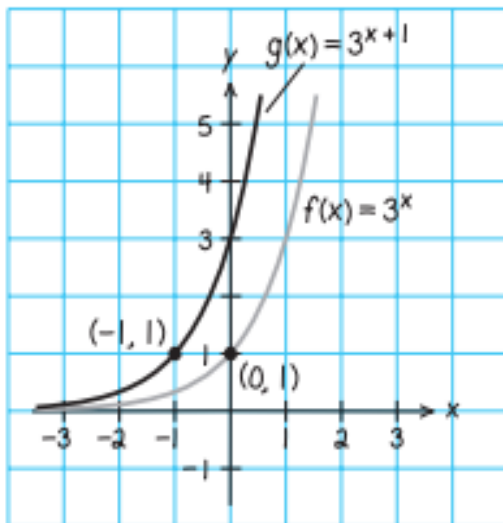
Decreasing on $(-\infty, \infty)$

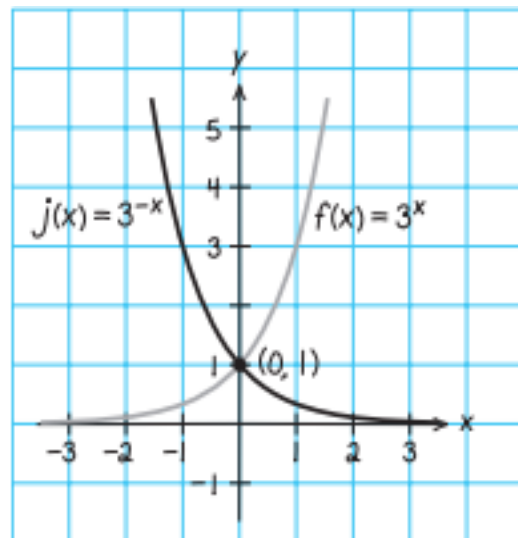
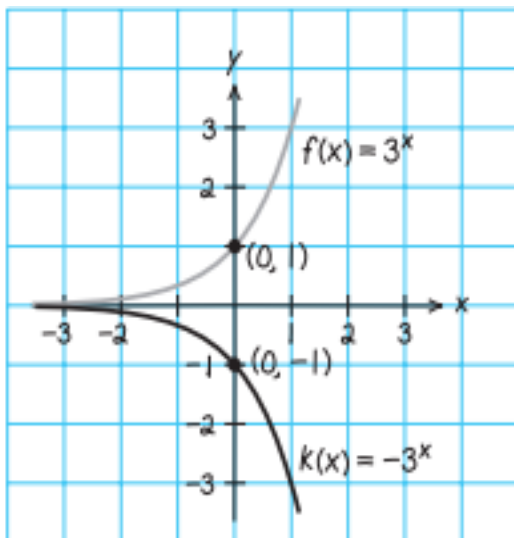
x -axis is a horizontal asymptote

$(a^{-x} \rightarrow 0 \text{ as } x \rightarrow \infty)$

Continuous







Warm Up Exponential Growth & Decay

x	y
-2	$\frac{1}{16}$
-1	$\frac{1}{4}$
0	1
1	4
2	16

$$y = 4^x \quad \begin{matrix} 4^{-2} \\ \frac{1}{4^2} \end{matrix}$$

$$a = 1 \quad b = 4$$

$$\text{Asymptote: } y = 0$$

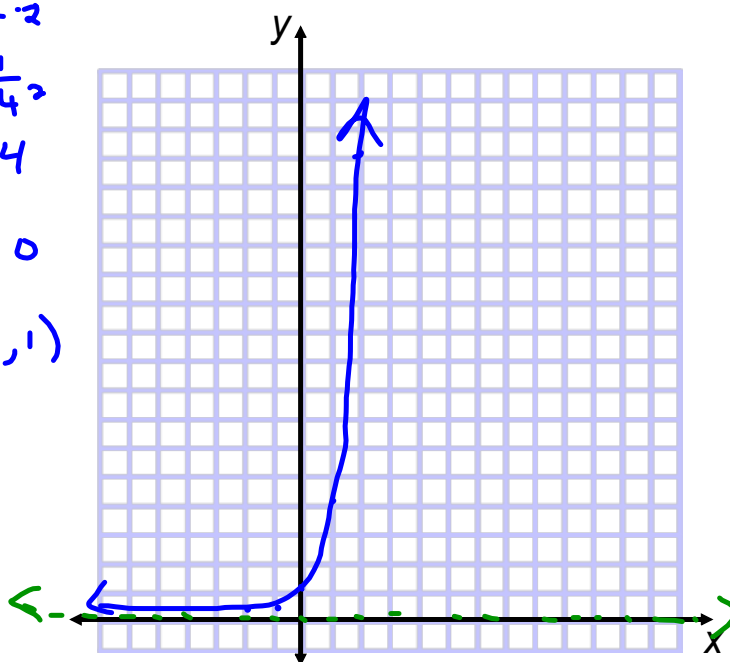
$$\text{y-intercept: } (0, 1)$$

Parent Function $y = 4^x$

Domain $(-\infty, +\infty)$

Range $(0, +\infty)$

Growth or Decay



Warm Up Exponential Growth & Decay

x	y
-2	9
-1	3
0	1
1	$\frac{1}{3}$
2	$\frac{1}{9}$

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

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

$$\text{Asymptote: } y = 0$$

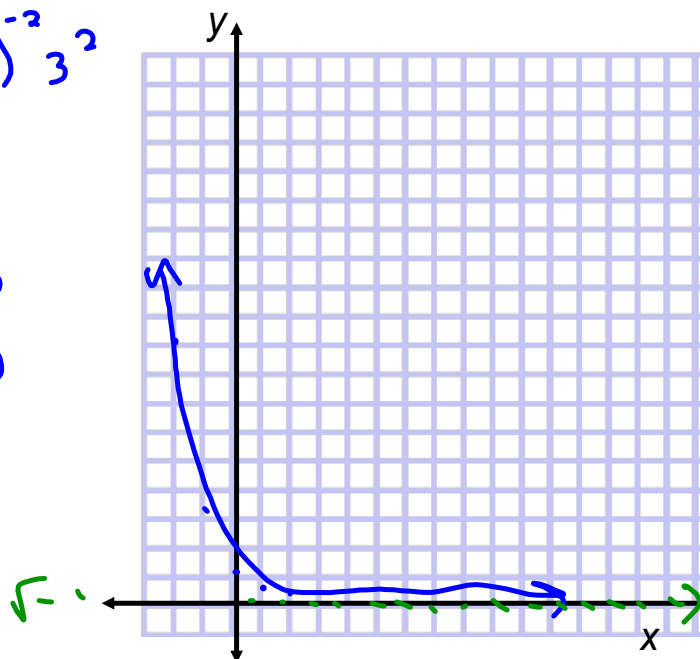
$$\text{y-intercept: } (0, 1)$$

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

Domain $(-\infty, +\infty)$

Range $(0, +\infty)$

Growth or Decay



Partner Paper Exponential Growth & Decay

x	y
-2	$\frac{2}{9}$
-1	$\frac{2}{3}$
0	2
1	6
2	18

$$y = 2 \cdot 3^x$$

$$a = 2$$

$$b = 3$$

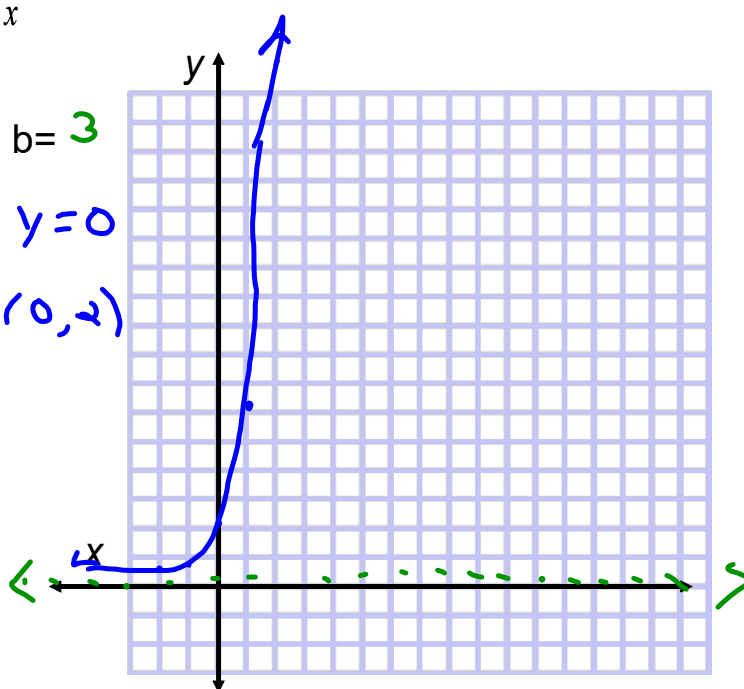
Asymptote: $y = 0$

y-intercept: $(0, 2)$

Domain $(-\infty, +\infty)$

Range $(0, +\infty)$

Growth/Decay



Exponential Growth & Decay

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

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

Parent Function $y = 2^x$

Asymptote $y = 1$

Domain $(-\infty, +\infty)$

Range $(1, +\infty)$

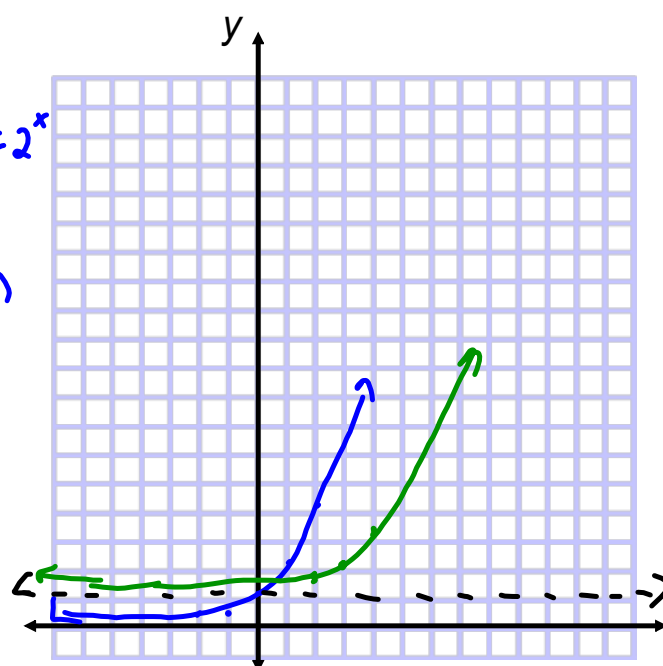
Horizontal Shift

Right + 3

Vertical Shift

Up 1

Growth or Decay



Transformations:

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

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

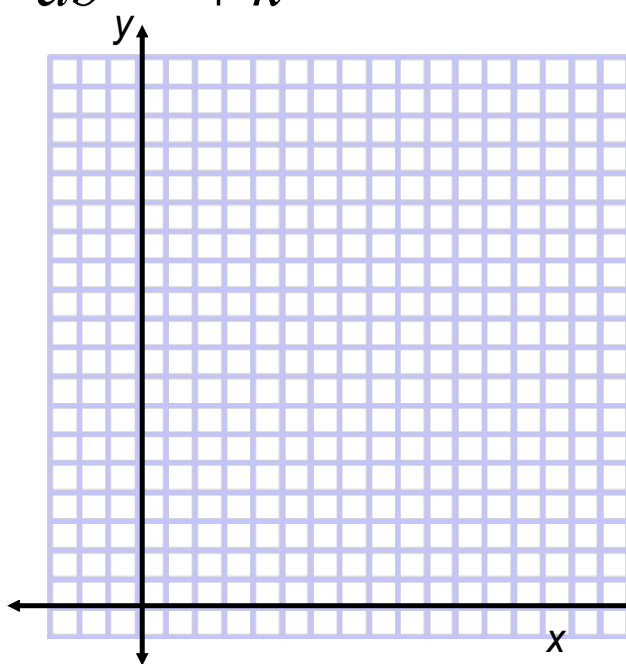
Parent Function $y = \left(\frac{1}{2}\right)^x$ Asymptote $y = -3$ Domain $(-\infty, +\infty)$ Range $(-3, +\infty)$

Horizontal Shift Right 2

Vertical Shift Down 3

Growth or Decay

$$\begin{array}{r} -2 \\ -1 \\ 0 \\ 1 \\ 2 \end{array}$$



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

Parent Function

Asymptote

Domain

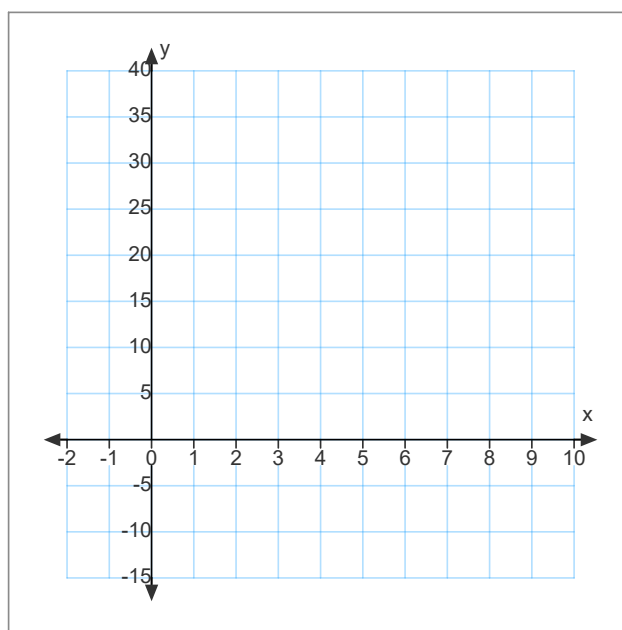
Range

Horizontal Shift

Vertical Shift

Growth or Decay

Vertical Stretch or Shrink



Without Graphing Describe each of the following.

$$f(x) = 5 \left(\frac{1}{4} \right)^{x-8} + 6$$

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

Parent Function

Asymptote

Domain

Range

Horizontal Shift

Vertical Shift

Growth or Decay

Vertical Stretch or Shrink

