Chapter 7 Review Practice Questions:
Exponential Functions - Graphs, Transformations & Solving Equations

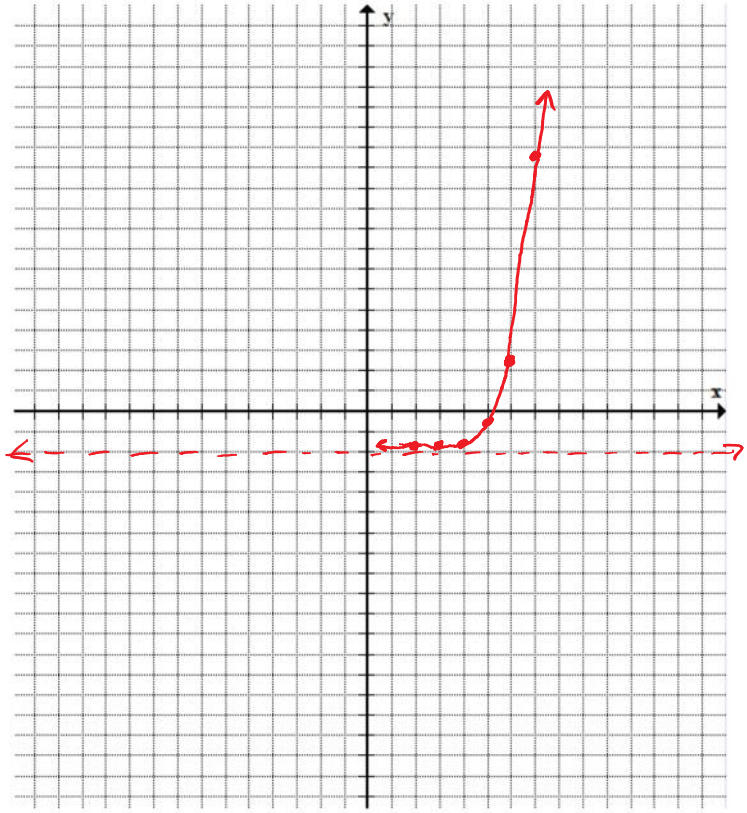
KEY

1. Describe the transformations and graph the base function AND the transformed function below – include mapping notation and the completed table of values.

   a. $y = 3^x$ and $y = \frac{1}{2}(3)^{x-4} - 2$

Describe the transformations: vert. stretch by a factor of $\frac{1}{2}$ & right 2 units

x	y
-2	$\frac{1}{9}$
-1	$\frac{1}{3}$
0	1
1	3
2	9
3	27



x	$\frac{1}{2}y$
-2	$\frac{1}{18}$
-1	$\frac{1}{9}$
0	$\frac{1}{2}$
1	$\frac{3}{2}$
2	$\frac{9}{2}$
3	$\frac{27}{2}$

$x+4$	$\frac{1}{2}y-2$
2	$-\frac{35}{18}$
3	$-\frac{7}{9}$
4	$-\frac{3}{2}$
5	$-\frac{1}{2}$
6	$\frac{5}{2}$
7	$\frac{23}{2}$

State the domain and range: $\{x \mid x \in \mathbb{R}\}$ $\{y \mid y > -2, y \in \mathbb{R}\}$

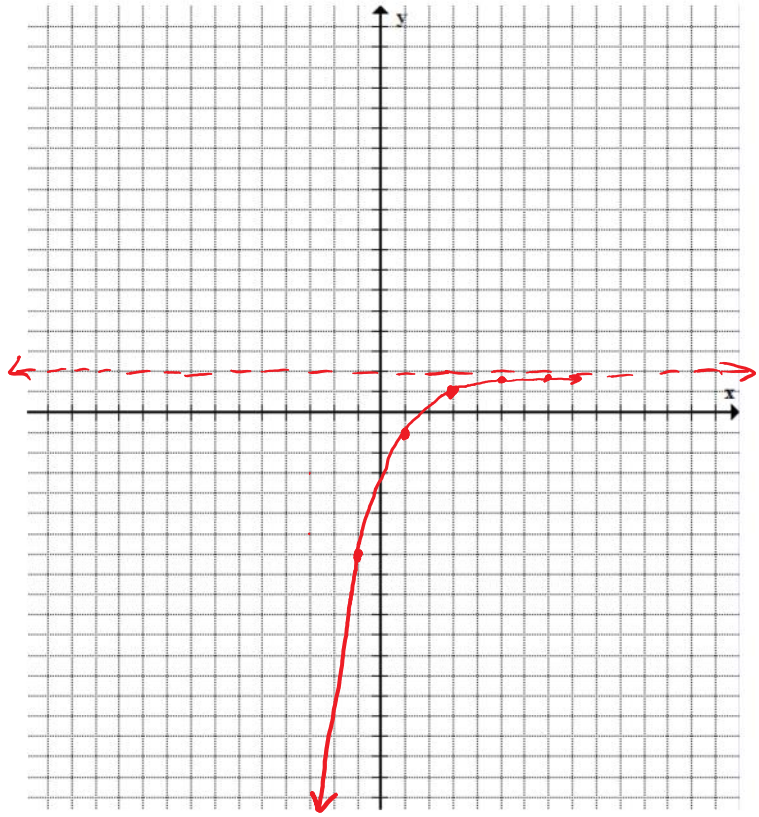
State the equation of the asymptote:

$y = -2$

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

Describe the transformations: horiz. stretch by a factor of 2
reflect over x-axis
3 right, 2 up

x	y
-3	27
-2	9
-1	3
0	1
1	1/3
2	1/9



$2x$	$-y$
-6	-27
-4	-9
-2	-3
0	-1
2	-1/3
4	-1/9

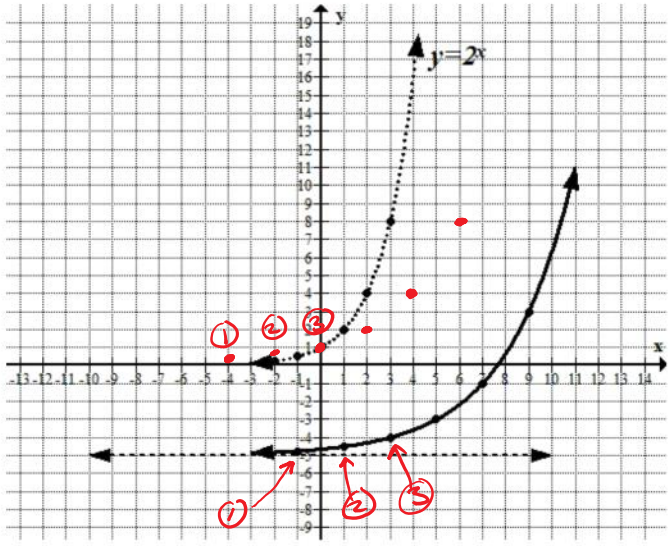
$2x+3$	$-y+2$
-3	-25
-1	-7
1	-1
3	1
5	5/3
7	17/9

State the domain and range: $\{x \mid x \in \mathbb{R}\}$ $\{y \mid y < 2, y \in \mathbb{R}\}$

State the equation of the asymptote: $y = 2$

2. Write an equation for each of the transformed graphs below. The base function is given.

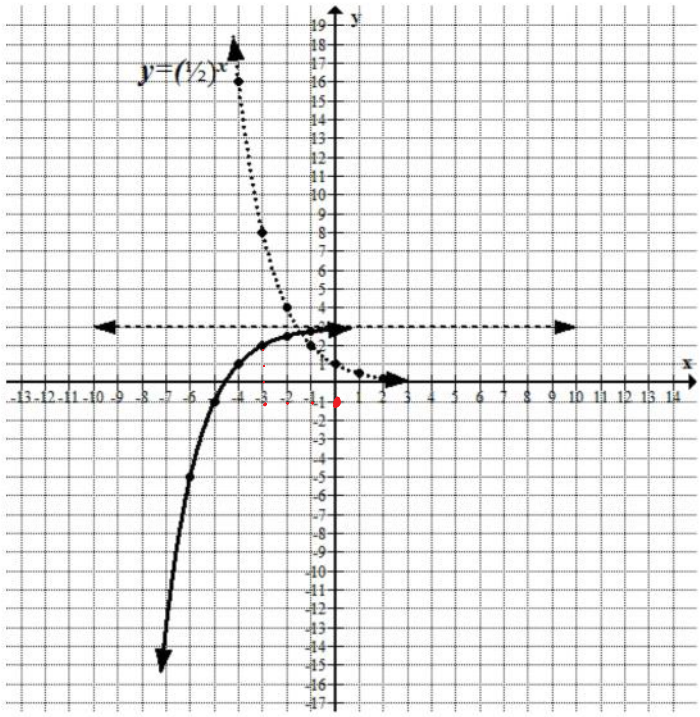
a.



$y = a(b)^{b(x-h)} + k$

$y = 2^{\frac{1}{2}(x-3)} - 5$

b.



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

3. Write the equation of each function with the given transformations:

a. $f(x)=\left(\frac{1}{4}\right)^x$ is stretched vertically by a factor of 3, stretched horizontal by a factor of ½, reflected in the y-axis, and translated 2 right and 1 down.

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

b. $y=6^x$ is stretched vertically by a factor of ½, reflected in the y-axis, and translated 5 left and 7 down.

$y = \frac{1}{2}(6)^{-(x+5)} - 7$

4. Solve each of the following algebraically. (hint: change to the common base)

a. $16^{2x-3}=32^{x+2}$

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

$8x - 12 = 5x + 10$ (+12, −5x)

$3x = 22$

$x = 22/3$

b. $9(27)^{x-1}=\left(\frac{1}{3}\right)^{4-2x}$

$3^2 \cdot 3^{3(x-1)} = 3^{-1(4-2x)}$

$3^{2+3x-3} = 3^{-4+2x}$

$3x - 1 = -4 + 2x$ (+1, −2x)

$x = -3$

c. $\left(\frac{1}{25}\right)^x = 5^x(125)^{x+1}$

$5^{-2x} = 5^x \cdot 5^{3(x+1)}$

$5^{-2x} = 5^{x+3x+3}$

$-2x = 4x + 3$ (−4x)

$-6x = 3$ (÷ −6)

$x = -\frac{1}{2}$

6. The following function represents the growth rate of bacteria in the intestinal tract of mice after eating a probiotic where P(t) represents the total population of bacteria and t represents time in hours. Use it to answer the following questions:

$$P(t) = 13(2)^{\frac{t}{0.68}}$$

a. Determine the total number of bacteria present after 3.2 hours.

$P(t) = 13(2)^{3.2/0.68}$

$= 339.28 =$ **339 bacteria**

b. Determine the time it took for the bacteria to double.

0.68 hours

or $\frac{26}{13} = \frac{13(2)}{13}$

$2 = 2^{t/0.68}$

c. Determine the time it took for the bacteria population to reach 15000.

$15000 = 13(2)^{3.2/0.68}$

$y_1 \quad y_2$

5: intercept

$t = 6.92$ hours

$1 = \frac{t}{0.68}$

$t = 0.68$ hr

7. Given the following information, determine an exponential equation that represents the growth or decay.
   a. A 5.3 gram sample of Carbon-14 that decays and has a half-life of 5740 years.

$$A = 5.3\left(\frac{1}{2}\right)^{\frac{t}{5740}}$$

   b. The growth rate of mold cells that triple every 5 days. Assume you start with one cell.

$$A = (3)^{t/5}$$

   c. The population of Langley increases by 0.5% per year with a current population of 127,000 people.

$$A = 127{,}000(1+0.005)^{t}$$

$$A = 127{,}000(1.005)^{t}$$

   d. The percent of light that is lost with every 2 meter depth in a lake is 25%.

$$A = (1-0.25)^{\frac{d}{2}}$$

$$A = (0.75)^{\frac{d}{2}}$$

8. Determine how much more intense and earthquake of Magnitude 9.4 on the Richter scale would be in comparison to an earthquake of Magnitude 3.7 on the Richter scale.

$$I = 10^{9.4-3.7}$$

$$= 10^{5.7}$$

$I = 501{,}187.23$ times more intense.