Name Key Date ____________ Period _____

12.3 Skills Practice: I Like to Move It
Transformations of Exponential Functions

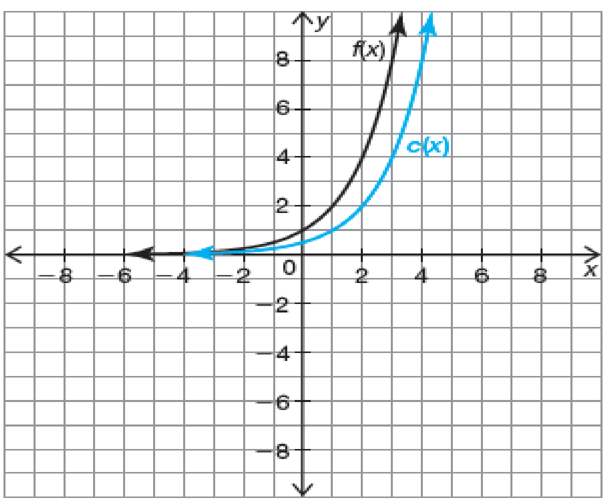
Problem Set

Complete the table to determine the corresponding points on $c(x)$, given reference points on $f(x)$. Then, graph $c(x)$ on the same coordinate plane as $f(x)$ and state the domain, range, and asymptotes of $c(x)$, write the function for the transformed $c(x)$ and state the end behavior using limit notation.

1. $f(x) = 2^x$

$c(x) = f(x - 1)$ $(x+1, y)$

Reference Points on $f(x)$	Corresponding Points on $c(x)$
$\left(-1, \frac{1}{2}\right)$	$\left(0, \frac{1}{2}\right)$
(0, 1)	(1, 1)
(1, 2)	(2, 2)



Domain: All Real Numbers; $(-\infty, \infty)$

Range: All real numbers greater than 0; $y > 0$

Horizontal asymptote: $y = 0$

Transformed function: $c(x) = 2^{x-1}$

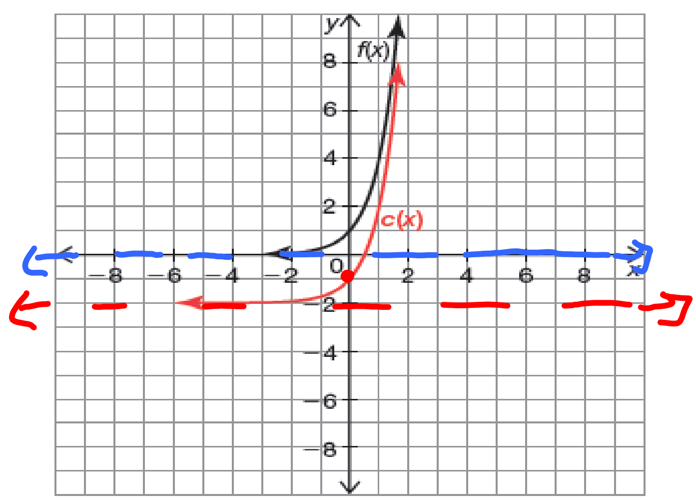
End Behavior:
$\lim_{x \to \infty} c(x) = \infty$ $\lim_{x \to -\infty} c(x) = 0$

Intercepts: $(0, 1)$

2. $f(x) = 4^x$

$c(x) = f(x) - 2$ $(x, y-2)$

Reference Points on $f(x)$	Corresponding Points on $c(x)$
$\left(-1, \frac{1}{4}\right)$	$\left(-1, -\frac{7}{4}\right)$
(0, 1)	(0, −1)
(1, 4)	(1, 2)



Domain: All real numbers; $(-\infty, \infty)$

Range: $y > -2$ $(-2, \infty)$

Horizontal asymptote: $y = -2$

Transformed function: $c(x) = 4^x - 2$

End Behavior: $\lim_{x \to \infty} c(x) = \infty$ $\lim_{x \to -\infty} c(x) = -2$

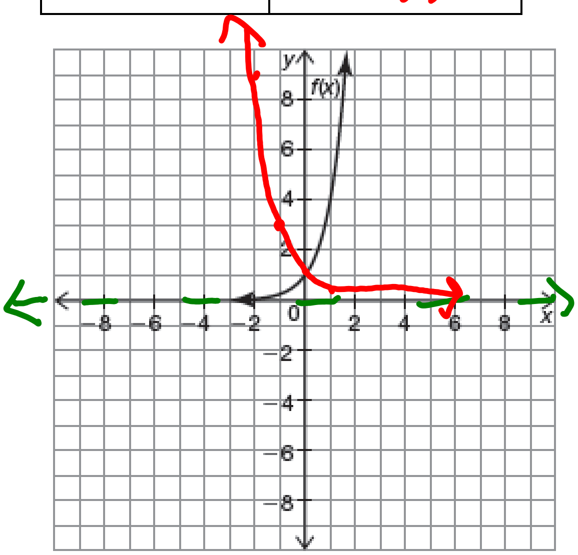
Intercepts: $(0, -1)$ $\left(\frac{1}{2}, 0\right)$

Complete the table to determine the corresponding points on $c(x)$, given reference points on $f(x)$. Then, graph $c(x)$ on the same coordinate plane as $f(x)$ and state the domain, range, and asymptotes of $c(x)$, write the function for the transformed $c(x)$ and state the end behavior using limit notation.

3. $f(x) = 3^x$ *and* $c(x) = f(-x)$

$(-x, y)$

Reference Points on $f(x)$	Corresponding Points on $c(x)$
$\left(-1, \frac{1}{3}\right)$	$(-1, 3)$
$(0, 1)$	$(0, 1)$
$(1, 3)$	$(1, \frac{1}{3})$



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

Range: $(0, \infty)$

Horizontal asymptote: $y = 0$

Transformed function:

End Behavior: $\lim_{x \to \infty} c(x) = 0$ $\lim_{x \to -\infty} c(x) = \infty$

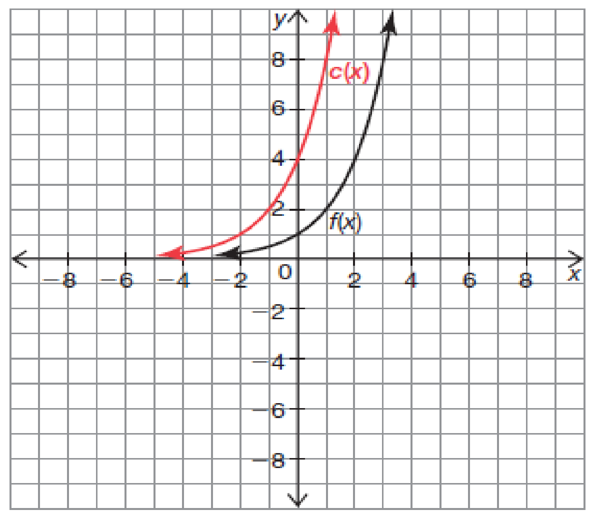
Intercepts: $(0, 1)$

4. $f(x) = 2^x$

$c(x) = 4f(x)$

$(x, 4y)$

Reference Points on $f(x)$	Corresponding Points on $c(x)$
$\left(-1, \frac{1}{2}\right)$	$(-1, 2)$
$(0, 1)$	$(0, 4)$
$(1, 2)$	$(1, 8)$



Domain: All real numbers ; $(-\infty, \infty)$

Range: $y > 0$; $(0, \infty)$

Horizontal asymptote: $y = 0$

Transformed function: $c(x) = 4 \cdot 2^x$

End Behavior: $\lim_{x \to \infty} c(x) = \infty$ $\lim_{x \to -\infty} c(x) = 0$

Intercepts:

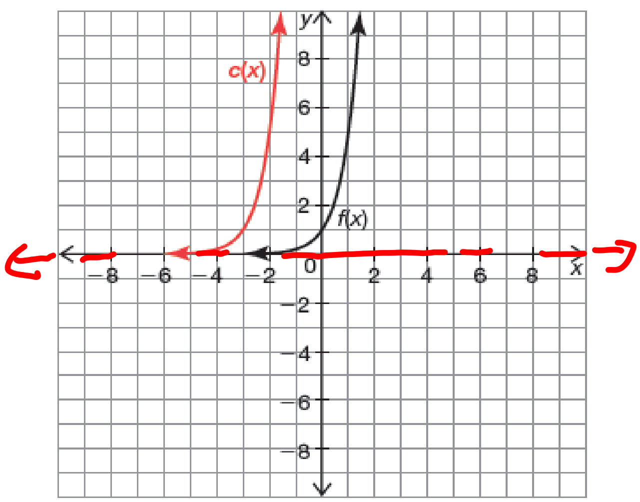
$(0, 4)$

Complete the table to determine the corresponding points on $c(x)$, given reference points on $f(x)$. Then, graph $c(x)$ on the same coordinate plane as $f(x)$ and state the domain, range, and asymptotes of $c(x)$, write the function for the transformed $c(x)$ and state the end behavior using limit notation.

5. $f(x) = 5^x$

$c(x) = f(x + 3)$ $(x - 3, y)$

Reference Points on $f(x)$	Corresponding Points on $c(x)$
$\left(-1, \frac{1}{5}\right)$	$\left(-4, \frac{1}{5}\right)$
(0, 1)	(−3, 1)
(1, 5)	(−2, 5)



Domain: All real numbers or $(-\infty, \infty)$

Range: $y > 0$ $(0, \infty)$

Horizontal asymptote: $y = 0$

Transformed function: $c(x) = 5^{x+3}$

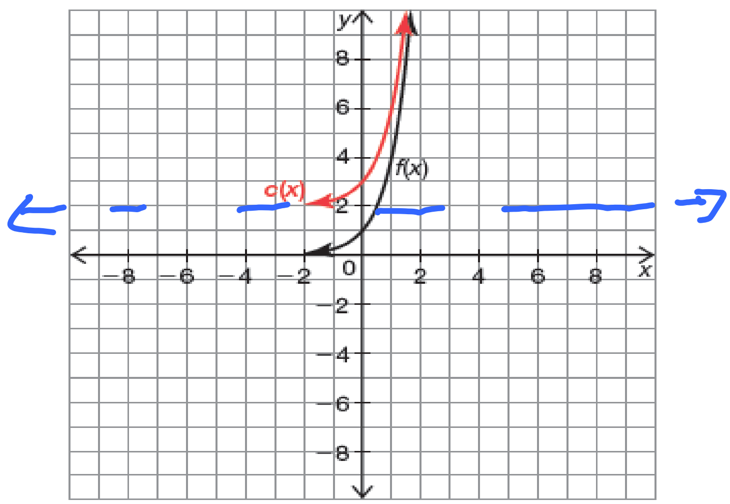
End Behavior: $\lim_{x \to \infty} c(x) = \infty$ $\lim_{x \to -\infty} c(x) = 0$

Intercepts: none

6. $f(x) = 4^x$

$c(x) = f(x) + 2$ $(x, y + 2)$

Reference Points on $f(x)$	Corresponding Points on $c(x)$
$\left(-1, \frac{1}{4}\right)$	$\left(-1, 2\frac{1}{4}\right)$
(0, 1)	(0, 3)
(1, 4)	(1, 6)



Domain: All real numbers $(-\infty, \infty)$

Range: $y > 2$ $(2, \infty)$

Horizontal asymptote: $y = 2$

Transformed function: $c(x) = 4^x + 2$

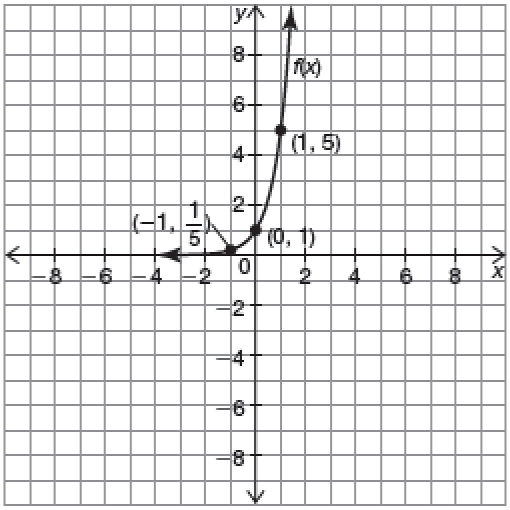
End Behavior: $\lim_{x \to \infty} c(x) = \infty$ $\lim_{x \to -\infty} c(x) = 2$

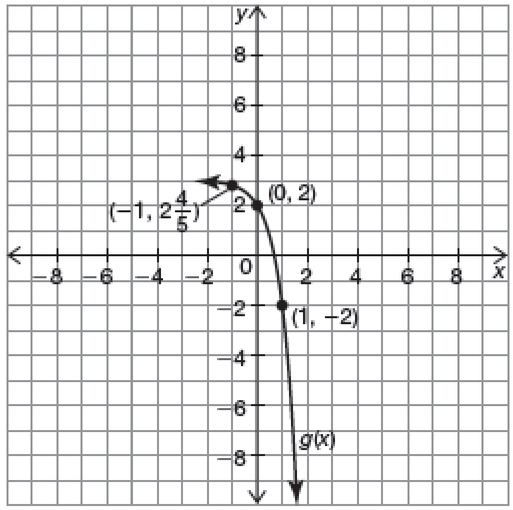
Intercepts: $(0, 3)$

Describe the transformations performed on $f(x)$ to create $g(x)$. Then, write an equation for $g(x)$ in terms of $f(x)$.

$f(x) = 5^x$

7.





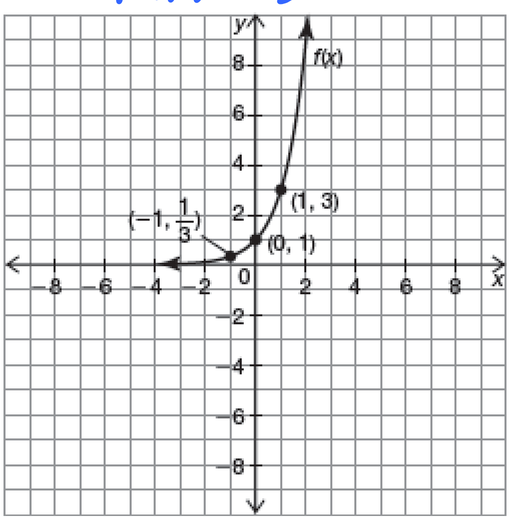
Description of transformation: To create $g(x)$, the graph of $f(x)$ was reflected over the x-axis and vertically translated up 3 units.

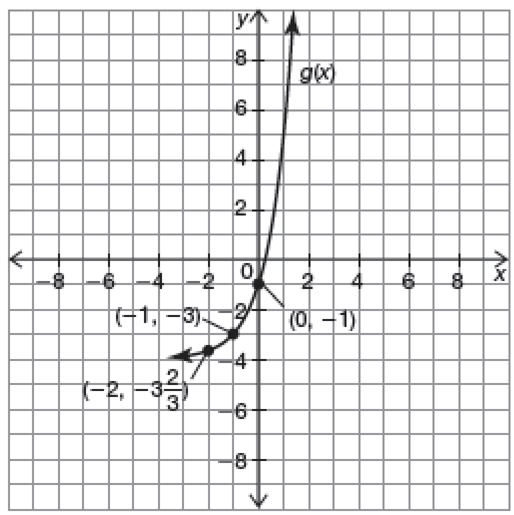
$g(x) = -f(x) + 3$

Transformed function: $g(x) = -1 \cdot 5^x + 3$

$f(x) = 3^x$

8.





Description of transformation: To create $g(x)$, the graph of $f(x)$ was horizontally translated left 1 unit and vertically translated down 4 units.

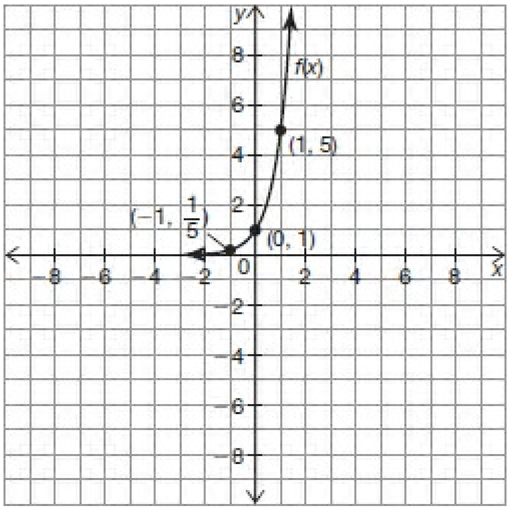
$g(x) = f(x + 1) - 4$

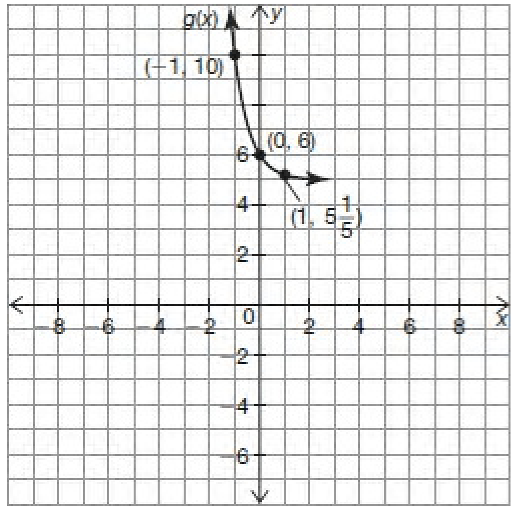
Transformed function: $g(x) = 3^{x+1} - 4$

Describe the transformations performed on $f(x)$ to create $g(x)$. Then, write an equation for $g(x)$ in terms of $f(x)$.

$f(x) = 5^x$

9.





Description of transformation: To create $g(x)$, the graph of $f(x)$ was reflected over the y-axis and vertically translated up 5 units.

$g(x) = f(-x) + 5$

Transformed function: $g(x) = 5^{-x} + 5$

Describe the transformations performed on $m(x)$ that produced $t(x)$. Then, write an exponential equation for $t(x)$.

10. $m(x) = 3^x$

$t(x) = -m(x+1)$

The graph of the function *m(x)* is reflected over the x-axis and horizontally translated left 1 unit to produce *t(x)*.

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

11. $m(x) = 5^x$

$t(x) = 3m(x) - 2$

The graph of the function m(x) is stretched vertically by a factor of 3 and vertically translated down 2 units to produce t(x).

$t(x) = 3 \cdot 5^x - 2$

12. $m(x) = e^x$

$t(x) = \frac{1}{2}m(x) + 4$

The graph of the functions m(x) is vertically compressed by a factor of 1/2 and vertically translated up 4 units to produce t(x).

$t(x) = \frac{1}{2} \cdot e^x + 4$

13. $m(x) = 4^x$

$t(x) = m(3x - 1)$

The graph of the function *m(x)* is compressed horizontally by a factor of $\frac{1}{3}$ and horizontally translated right $\frac{1}{3}$ units to produce *t(x)*.

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

14. $m(x) = 7^x$

$t(x) = m(0.5x + 2)$

The graph of the function *m(x)* is stretched horizontally by a factor of 2 and horizontally translated left 4 units to produce *t(x)*.

$t(x) = 7^{0.5x+2}$ or $t(x) = 7^{0.5(x+4)}$

15. $m(x) = 6x$

$t(x) = -2m(-x) + 3$

The graph of the function m(x) is reflected over the x-axis and reflected over the y-axis, vertically stretched by a factor of 2, and vertically translated up 3 units to produce t(x).

$t(x) = -2 \cdot 6^{-x} + 3$