Name: _____ Date: _____

Chapter 7 and 8 Graphing Review

For each type of question, the achievement level is indicated. Showing work is an important strategy in communicating your knowledge and ideas so please be thorough.

Learning Goal 7.1	Applying one or more transformations to a graph, including translations, stretches and reflections.

1. Explain the transformations of the following functions from the original $f(x) = 2^x$ in the order that you would apply them in. State the domain and range of each function and the equation of the asymptote.

Developing		
a. $y = -3 \times 2^x$	b. $y = 2^{-3x}$	c. $y = \frac{1}{3} \times 2^{x/5}$
• vertical stretch by 3 • reflection over the $x-$ axis • $\{x \mid x \in \mathbb{R}\}$ • $\{y \mid y < 0, y \in \mathbb{R}\}$ • $y = 0$	• horizontal stretch by $1/3$ • reflection over the $y-$ axis • $\{x \mid x \in \mathbb{R}\}$ • $\{y \mid y > 0, y \in \mathbb{R}\}$ • $y = 0$	• vertical stretch by $1/3$ • horizontal stretch by 5 • $\{x \mid x \in \mathbb{R}\}$ • $\{y \mid y > 0, y \in \mathbb{R}\}$ • $y = 0$
d. $y = -2^{x+2}$ • reflection over the $x-$ axis • horizontal translation left 2 • $\{x \mid x \in \mathbb{R}\}$ • $\{y \mid y < 0, y \in \mathbb{R}\}$ • $y = 0$	e. $y = \frac{1}{7} \times 2^x + 3$ • vertical stretch by $1/7$ • vertical translation up 3 • $\{x \mid x \in \mathbb{R}\}$ • $\{y \mid y > 3, y \in \mathbb{R}\}$ • $y = 3$	f. $y = 2^{x-5} - 9$ • horizontal translation right 5 • vertical translation down 9 • $\{x \mid x \in \mathbb{R}\}$ • $\{y \mid y > -9, y \in \mathbb{R}\}$ • $y = -9$

Name: _____ Date: _____

Chapter 7 and 8 Graphing Review

2. Explain the transformations of the following functions from the original $f(x) = \log_3 x$ in the order that you would apply them in. State the domain and range of each function and the equation of the asymptote.

Proficient		
g. $y = 3\log_3(-x) + 8$ • vertical stretch by 3 • reflection over the $y-$ axis • vertical translation up 8 • $\{x\|x < 0, x \in \mathbb{R}\}$ • $\{y\|y \in \mathbb{R}\}$ • $x = 0$	h. $y = -\log_3(2(x-5)) + 3$ • reflection over the $x-$ axis • horizontal stretch by $1/2$ • horizontal translation right 5 • vertical translation up 3 • $\{x\|x > 5, x \in \mathbb{R}\}$ • $\{y\| y \in \mathbb{R}\}$ • $x = 5$	i. $y = -\frac{1}{4}\log_3(x-7) - 6$ • reflection over the $x-$ axis • vertical stretch by $1/4$ • horizontal translation right 7 • vertical translation down 6 • $\{x\|x > 7, x \in \mathbb{R}\}$ • $\{y\| y \in \mathbb{R}\}$ • $x = 7$
j. $y = -3\log_3(-(x+1)) + 8$ • reflection over the $x-$ axis • reflection over the $y-$ axis • vertical stretch by 3 • horizontal translation left 1 • vertical translation up 8 • $\{x\|x < -1, x \in \mathbb{R}\}$ • $\{y\|y \in \mathbb{R}\}$ • $x = -1$	k. $y = 1.75\log_3(0.25(x-1.5))$ • vertical stretch by 1.75 • horizontal stretch by 4 • horizontal translation right 1.5 • $\{x\|x > 1.5, x \in \mathbb{R}\}$ • $\{y\|y \in \mathbb{R}\}$ • $x = 1.5$	l. $y = -\frac{1}{2}\log_3(x+6) - 4$ • reflection over the $x-$ axis • vertical stretch by $1/2$ • horizontal translation left 6 • vertical translation down 4 • $\{x\|x > -6, x \in \mathbb{R}\}$ • $\{y\| y \in \mathbb{R}\}$ • $x = -6$

Name: _____ Date: _____

Chapter 7 and 8 Graphing Review

3. Explain the transformations of the following functions from the original $f(x) = \ln x$ in the order that you would apply them in. State the domain and range of each function and the equation of the asymptote.

Extending		
m. $y = -3\ln(-x+7)+1$ $y = -3\ln\big(-(x-7)\big)+1$ • reflection over the $y-$ axis • reflection over the $x-$ axis • vertical stretch by 3 • horizontal translation right 7 • vertical translation up 1 • $\{x\|x<7, x\in\mathbb{R}\}$ • $\{y\|\ y\in\mathbb{R}\}$ • $x=7$	n. $y-5=\frac{1}{2}\ln\left(\frac{2}{3}x-4\right)$ $y-5=\frac{1}{2}\ln\left(\frac{2}{3}(x-6)\right)$ • vertical stretch by $^1/_2$ • horizontal stretch by $^3/_2$ • horizontal translation right 6 • vertical translation up 5 • $\{x\|x>6, x\in\mathbb{R}\}$ • $\{y\|\ y\in\mathbb{R}\}$ • $x=6$	o. $y+1=-\ln\left(-\frac{1}{2}x+7\right)$ $y+1=-\ln\left(-\frac{1}{2}(x-14)\right)$ • reflection over the $x-$ axis • reflection over the $y-$ axis • horizontal stretch by 2 • horizontal translation right 14 • vertical translation down 1 • $\{x\|x<14, x\in\mathbb{R}\}$ • $\{y\|\ y\in\mathbb{R}\}$ • $x=14$

4. Write an equation for the transformations given from the original functions.

Developing
a. For $y=3^x$, reflect over the $y-$ axis, translate up 5 and left 2. $y=\left(\frac{1}{3}\right)^{-(x+2)}+5$
b. For $y=\ln x$, horizontal stretch by 6, reflect over the $x-$ axis and right 7. $y=-\ln\left(\frac{1}{6}(x-7)\right)$
c. For $y=5^x$, vertical stretch by $^2/_3$, reflect over both axes. $y=-\frac{2}{3}\times\left(\frac{1}{5}\right)^{-x}$
Proficient
d. For $y=\log x$, reflect over the $y-$ axis, horizontal stretch by 3, translate down 7 and left 4. $y=\log\left(-\frac{1}{3}(x+4)\right)-7$
e. For $y=2^x$, horizontal stretch by $^3/_4$, reflect over both axes, translate up 10 and right 12. $-y+10=\left(\frac{1}{2}\right)^{^4/_3(x-12)}$
f. For $y=\log_3 x$, vertical stretch by 3, horizontal stretch by 2, reflect over the $x-$ axis, translate right 5. $y=-3\log_3\left(\frac{1}{2}(x-5)\right)$

Name: _____ Date: _____

Chapter 7 and 8 Graphing Review

5. Graph the original, then the transformed functions. Label any important points, both original and transformed. State the domain and range, and the equation of the asymptote.

Developing		
a. $y = 2^{x-2} - 4$ solution • $\{x\|x \in \mathbb{R}\}$ • $\{y\|y > 0, y \in \mathbb{R}\}$ • $y = 0$	b. $y = -2^x + 1$ solution • $\{x\|x \in \mathbb{R}\}$ • $\{y\|y < 1, y \in \mathbb{R}\}$ • $y = 1$	c. $y = 3 \times 2^x$ solution • $\{x\|x \in \mathbb{R}\}$ • $\{y\|y > 0, y \in \mathbb{R}\}$ • $y = 0$
d. $y = 3^{x+3} - 6$ solution • $\{x\|x \in \mathbb{R}\}$ • $\{y\|y > -6, y \in \mathbb{R}\}$ • $y = -6$	e. $y = 3^{-(x-2)}$ solution • $\{x\|x \in \mathbb{R}\}$ • $\{y\|y > 0, y \in \mathbb{R}\}$ • $y = 0$	f. $y = \frac{1}{4} \times 3^x$ solution • $\{x\|x \in \mathbb{R}\}$ • $\{y\|y > 0, y \in \mathbb{R}\}$ • $y = 0$
g. $y = -3\log_2 x$ solution • $\{x\|x > 0, x \in \mathbb{R}\}$ • $\{y\| y \in \mathbb{R}\}$ • $x = 0$	h. $y = \log_2(-2x)$ solution • $\{x\|x < 0, x \in \mathbb{R}\}$ • $\{y\| y \in \mathbb{R}\}$ • $x = 0$	i. $y = -\log_2\left(\frac{x}{4}\right)$ solution • $\{x\|x > 0, x \in \mathbb{R}\}$ • $\{y\| y \in \mathbb{R}\}$ • $x = 0$
j. $y = -2\log_3 x$ solution • $\{x\|x > 0, x \in \mathbb{R}\}$ • $\{y\| y \in \mathbb{R}\}$ • $x = 0$	k. $y = \frac{1}{3}\log_3(-x)$ solution • $\{x\|x < 0, x \in \mathbb{R}\}$ • $\{y\| y \in \mathbb{R}\}$ • $x = 0$	l. $y = -\frac{1}{2}\log_3 x$ solution • $\{x\|x > 0, x \in \mathbb{R}\}$ • $\{y\| y \in \mathbb{R}\}$ • $x = 0$
Proficient		
m. $y = -\frac{1}{4} \times 2^{x-1} - 3$ solution • $\{x\|x \in \mathbb{R}\}$ • $\{y\|y < -3, y \in \mathbb{R}\}$ • $y = -3$	n. $y = 2^{-1/2(x+3)} + 6$ solution • $\{x\|x \in \mathbb{R}\}$ • $\{y\|y > 6, y \in \mathbb{R}\}$ • $y = 6$	o. $y = -2^{3(x+2)} + 5$ solution • $\{x\|x \in \mathbb{R}\}$ • $\{y\|y < 5, y \in \mathbb{R}\}$ • $y = 5$

Name: _____ Date: _____

Chapter 7 and 8 Graphing Review

p. $y = -2 \times 3^{x+5} + 1$ solution • $\{x \mid x \in \mathbb{R}\}$ • $\{y \mid y < 1, y \in \mathbb{R}\}$ • $y = 1$	q. $y = 2 \times 3^{5(x-4)} + 3$ solution • $\{x \mid x \in \mathbb{R}\}$ • $\{y \mid y > 3, y \in \mathbb{R}\}$ • $y = 3$	r. $y = \frac{1}{2} \times 3^{3(x+2)} - 5$ solution • $\{x \mid x \in \mathbb{R}\}$ • $\{y \mid y > -5, y \in \mathbb{R}\}$ • $y = -5$
s. $y = -3\log_2(x-7) - 5$ solution • $\{x \mid x > 7, x \in \mathbb{R}\}$ • $\{y \mid y \in \mathbb{R}\}$ • $x = 7$	t. $y = -\log_2(2(x-4)) - 3$ solution • $\{x \mid x > 4, x \in \mathbb{R}\}$ • $\{y \mid y \in \mathbb{R}\}$ • $x = 4$	u. $y = \frac{1}{4}\log_2(-(x-6)) - 2$ solution • $\{x \mid x < 6, x \in \mathbb{R}\}$ • $\{y \mid y \in \mathbb{R}\}$ • $x = 6$
v. $y = -\log_3 2(x-3) + 4$ solution • $\{x \mid x > 3, x \in \mathbb{R}\}$ • $\{y \mid y \in \mathbb{R}\}$ • $x = 3$	w. $y = 3\log_3(-(x+2)) - 1$ solution • $\{x \mid x < -2, x \in \mathbb{R}\}$ • $\{y \mid y \in \mathbb{R}\}$ • $x = -2$	x. $y = \log_3\left(-\frac{1}{2}(x+1)\right) + 3$ solution • $\{x \mid x < -1, x \in \mathbb{R}\}$ • $\{y \mid y \in \mathbb{R}\}$ • $x = -1$
Extending		
y. $y = -3 \times 2^{1/4 x+2} + 6$ solution • $\{x \mid x \in \mathbb{R}\}$ • $\{y \mid y < 6, y \in \mathbb{R}\}$ • $y = 6$	z. $y = 5 \times 2^{-1/2 x+1} + 4$ solution • $\{x \mid x \in \mathbb{R}\}$ • $\{y \mid y > 4, y \in \mathbb{R}\}$ • $y = 4$	aa. $y = -\frac{1}{2} \times 2^{-3x+9} - 4$ solution • $\{x \mid x \in \mathbb{R}\}$ • $\{y \mid y < -4, y \in \mathbb{R}\}$ • $y = -4$
bb. $y = -2\log_3(3x+4) + 5$ solution • $\{x \mid x > -4/3, x \in \mathbb{R}\}$ • $\{y \mid y \in \mathbb{R}\}$ • $x = -4/3$	cc. $y = 2\log_3(-4x-4) + 3$ solution • $\{x \mid x < -1, x \in \mathbb{R}\}$ • $\{y \mid y \in \mathbb{R}\}$ • $x = -1$	dd. $y = -2\log_3(3x-6) - 1$ solution • $\{x \mid x > 2, x \in \mathbb{R}\}$ • $\{y \mid y \in \mathbb{R}\}$ • $x = 2$

Name: _____ Date: _____

Chapter 7 and 8 Graphing Review

6. Express each equation in logarithmic form.

Developing		
a. $5^3 = 125$ $\log_5 125 = 3$	b. $2^6 = 64$ $\log_2 64 = 6$	c. $7^3 = 343$ $\log_7 343 = 3$
d. $36^{-1/2} = \frac{1}{6}$ $\log_{36}\left(\frac{1}{6}\right) = -\frac{1}{2}$	e. $2^{3/2} = \sqrt{8}$ $\log_2 2\sqrt{2} = \frac{3}{2}$	f. $10^4 = 10\,000$ $\log 10\,000 = 4$

7. Express each equation in exponential form.

Developing		
a. $\log_3 243 = 5$ $3^5 = 243$	b. $\log_9 6\,561 = 4$ $9^4 = 6\,561$	c. $\log 0.0001 = -4$ $10^{-4} = 0.0001$
d. $\log_{27}\left(\frac{1}{3}\right) = -\frac{1}{3}$ $27^{-1/3} = \frac{1}{3}$	e. $\log_4 \sqrt{64} = \frac{3}{2}$ $4^{3/2} = 8$	f. $\ln e = 1$ $e^1 = e$

8. Find the value of x in the following equations without a calculator.

Developing		
a. $x = \log 0.001$ $x = -3$	b. $\log_9 x = 3$ $x = 729$	c. $\log_x(1/16) = -4$ $x = 2$
d. $x = \log_5 \sqrt{5}$ $x = \frac{1}{2}$	e. $\log_4 x = -2$ $x = \frac{1}{16}$	f. $\log_{3x} 1 = 3$ $x = \frac{1}{3}$

Extending
9. In 1990, the population of a town was 32 000 and was increasing at a rate of 3.5% per year. Write an equation to represent the population of this town, P, as a function of the number of years, n, since 1990. $P(n) = 32\,000\,(1.035)^n$
10. A colony of insects can multiply fivefold in 6 weeks. There are 800 insects now. a. Write an equation to represent the number of insects, N, as a function of time elapsed in weeks, w. b. Calculate the number of insects after 6 weeks and after 18 weeks. c. How many times as great is the number of insects after 18 weeks than after 6 weeks? a. $N(w) = 800\,(5)^{w/6}$ b. $N(6) = 40\,000$, $N(18) = 100\,000$ c. $2.5\times$

Name: _____ Date: _____

Chapter 7 and 8 Graphing Review

11. A ball is dropped from a height of 4.0 m to the floor. After each bounce, the ball rises to 55% of its previous height.
    a. Write an equation that represents the height of the ball, h, after n bounces.
    b. What is the total vertical distance the ball has travelled after 4 bounces?

a. $h(n) = 4.0(0.55)^n$ d. 12.15 m