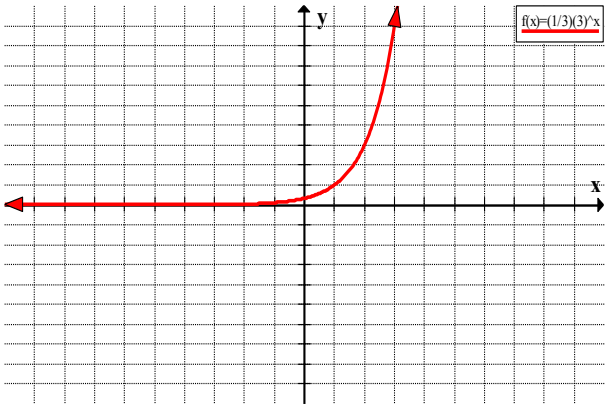
**Name** _____ **Date** _____ **Period** _____

**Pre-Calculus Unit 4 Practice Test**

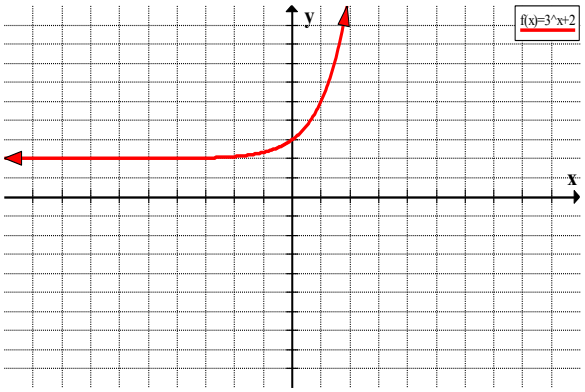
**Learning Target 4A—I can graph and describe transformations for exponential functions.**

**1.** Graph the following functions and describe the transformation(s) for $f(x) = 3^x$.

a. $f(x) = \frac{1}{3}(3^x)$




b. $f(x) = 3^x + 2$




**2.** Write the equation for $f(x) = 6^x$ that undergoes the following transformations:

- Shifted left 3 units,
- 4 units down,
- and reflected across the $x$-axis.

$$\boldsymbol{g(x) = -6^{x+3} - 4}$$

**3.** Write the equation for $f(x) = 3^x$ that undergoes the following transformations:

- Shifted right 2 units,
- 3 units up,
- and reflected across the $x$-axis.

$$\boldsymbol{g(x) = -3^{x-2} + 3}$$

**If all of the graphs below have equations with the form $\boldsymbol{f(x) = ab^x}$**

**4.** Which graph has the smallest $a$ value?

*B*

**5.** Which graph has the largest $a$ value?

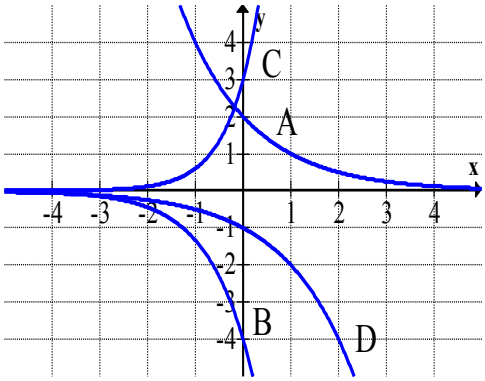
*C*

**6.** Which graph has the smallest $b$ value?

*A*

**7.** Which graph has the largest $b$ value?

*C*



**Learning Target 4B—I can graph and describe transformations for logarithmic functions.**

**8.** Describe the transformations that change $f(x) = \log_3 x$ to $g(x) = \log_3(x - 4) + 7$.

$$Right\ 4, up\ 7$$

**9.** Describe the transformations that change $f(x) = \log_2 x$ to $g(x) = -2\log_2(x + 2) - 3$.

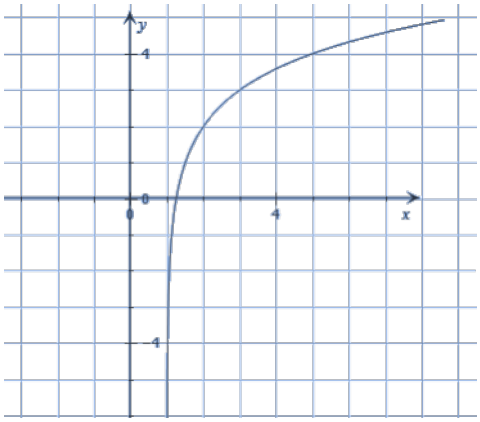
$$Vertical\ flip\ and\ stretch\ by\ a\ factor\ of\ 2, left\ 2, down\ 3$$

**10.** Find the domain and vertical asymptote of $f(x) = \log(3x + 1)$.

$$Asymptote: x = -\frac{1}{3}$$
$$because\ 3x + 1 = 0$$
$$Domain: \left(-\frac{1}{3}, \infty\right)$$

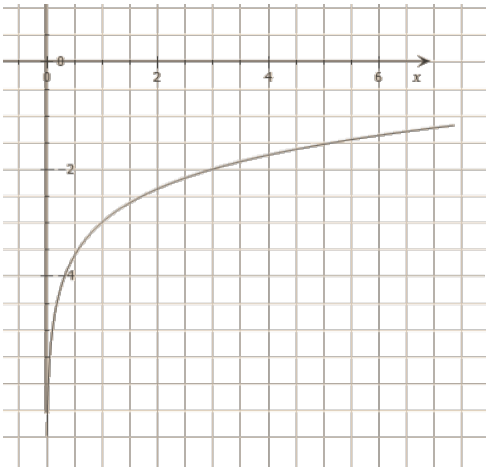
**11.** Graph $\log_2(x - 1) + 2$. Describe the transformation(s) from $\log_2 x$.

$$Right\ 1, up\ 2, asymptote\ at\ x = 1$$




**12.** Graph $f(x) = \log_3(x) - 3$. Describe the transformation(s) from $\log_3 x$.

$$Down\ 3, vertical\ asyptote\ at\ x = 0$$



**Learning Target 4C—I can solve problems involving exponential functions.**

**13.** Given the function $f(x) = 3(0.5)^x$, does $f(x)$ represent exponential growth or decay? Explain how you know

***Exponential decay because*** $\boldsymbol{b < 1}$

**14.** Given the function $f(x) = -2(1.2)^x$, does $f(x)$ represent exponential growth or decay? Explain how you know.

***Exponential growth because*** $\boldsymbol{b > 1}$

**15.** Write the exponential function that passes through the points $(0, 5)$ and $(4, 405)$. Show your algebraic steps to find the function.

$$5 = ab^0 \rightarrow a = 5$$
$$405 = 5 \cdot b^4$$
$$81 = b^4$$
$$b = \sqrt[4]{81} = 3$$
$$\boldsymbol{y = 5 \cdot 3^x}$$

**16.** Write the exponential function that passes through the points $(2, 2)$ and $(4, 8)$. Show your algebraic steps to find the function

$$2 = ab^2 \rightarrow a = \frac{2}{b^2}$$
$$8 = ab^4$$
$$8 = \left(\frac{2}{b^2}\right) b^4$$
$$8 = 2b^2$$
$$b = \pm 2,$$

*however the base of an exponentila equation cannot be negative, so* $b = 2$

$$8 = a(2)^4 \rightarrow a = \frac{1}{2}$$
$$\boldsymbol{y = \frac{1}{2} \cdot 2^x}$$

**17.** Solve $216^{x-5} = 36^{x+2}$ for $x$.

$$216^{x-5} = 36^{x+2}$$
$$(6^3)^{x-5} = (6^2)^{x+2}$$
$$(6)^{3(x-5)} = (6)^{2(x+2)}$$
$$3(x-5) = 2(x+2)$$
$$3x - 15 = 2x + 4$$
$$\boldsymbol{x = 19}$$

**18.** Solve $8 + 3^{2x+1} = 35$

$$8 + 3^{2x+1} = 35$$
$$3^{2x+1} = 27$$
$$2x + 1 = \log_3 27$$
$$2x + 1 = 3$$
$$2x = 2$$
$$x = 1$$

**19.** Solve $5^x = \frac{1}{625}$

$$5^x = \frac{1}{625}$$
$$x = \log_5\left(\frac{1}{625}\right)$$
$$x = \log_5(5^{-4})$$
$$x = -4$$

**20.** Determine whether the following table could represent an exponential function. Explain your reasoning.

| $x$ | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| $y$ | 1 | 2 | 4 | 8 |

*Yes, this is an exponential function because the rato of each consecutive y − value is 2. The funciton is* $\boldsymbol{y = 2^x}$.

**Learning Target 4D—I can solve problems involving logarithmic functions.**

**Solve the following for $x$.**
**Solve the following for $x$.**

**21.** $\log_3 \sqrt{x-2} = 2$

$3^2 = \sqrt{x-2}$
$9 = \sqrt{x-2}$
$81 = x - 2$
$x = 83$

**22.** $5 + \ln(0.02x) = -5$

$\ln(0.02x) = -10$
$e^{-10} = 0.02x$
$x \approx 0.0023$

**23.** $\log(x+4) - \log(x) = 2\log 3$

$\log\frac{x+4}{x} = \log 3^2$
$\frac{x+4}{x} = 9$
$x + 4 = 9x$
$4 = 8x$ so $x = \frac{1}{2}$

**24.** $\log_2(x+3) + \log_2(x+1) = 3$

$\log_2\big((x+3)(x+1)\big) = 3$
$x^2 + 4x + 3 = 2^3$
$x^2 + 4x + 3 = 8$
$x^2 + 4x - 5 = 0$
$(x+5)(x-1) = 0$
Two possible solutions: $x = -5, 1$
However, we must throw out -5 because of domain restrictions.
**Solution: $x = 1$**

**25.** Evaluate $\log_4 12$.

$\frac{\log 12}{\log 4} \approx 1.792$

**26.** Evaluate $\log_{\frac{1}{3}} 26$.

$\frac{\log 26}{\log \frac{1}{3}} \approx -2.966$

**27.** Write the expression as a single logarithm.

a. $2\log_3 x + 4\log_3 y - 3\log_3 z$

$\log_3 x^2 + \log_3 y^4 - \log_3 z^3$

$\log_3\left(\frac{x^2y^4}{z^3}\right)$

b. $4\log_x w + 6\log_x y$

$\log_x w^4 + \log_x y^6$

$\log_x(w^4y^6)$

**28.** Write the expression as the sum or difference of logarithms with no exponents

a. $\log_2(\frac{x^2}{a^2b^3})$

$\log_2 x^2 - \log_2 a^2 b^3$

$\log_2 x^2 - (\log_2 a^2 + \log_2 b^3)$

$2\log_2 x - 2\log_2 a - 3\log_2 b$

b. $\log_2((x-2)^5(4x)^3)$

$5\log_2(x-2) + 3\log_2(4x)$

**29.** Calculate the number of years necessary for \$250 to grow to \$750 at 4.3% compounded continuously. Use the compound interest formula: $A=Pe^{rt}$, where A = final amount, P = starting amount, $r$ = interest rate, and $t$ = time in years. Show your work and round your answer to the nearest tenth.

$750 = 250e^{.043t}$

$.043t = \ln 3$

$t = \frac{\ln 3}{.043} \approx 25.5\ years$