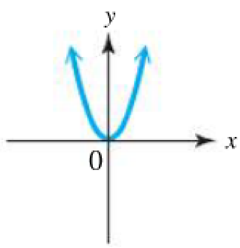
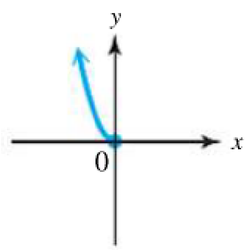
Inverse, Exponential, & Logarithmic Functions

Name_____________________________ Class time: ____________ Score_________________.

In 1-2, Determine whether each graph is the graph of a one-to-one function.

1) 

2) 

In 3-5, Determine whether each function is one-to-one. If it is, find its inverse.

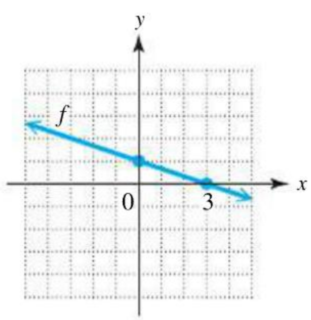
3) $f(x) = -3x + 7$ 4) $f(x) = \sqrt[3]{6x - 4}$ 5) $f(x) = -x^2 + 3$

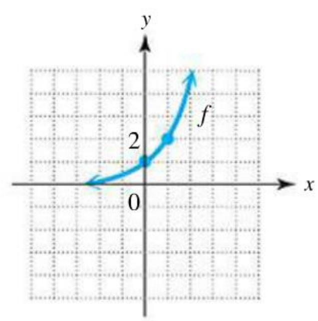
6) The table lists caffeine amounts in several popular 12-oz sodas. If the set of sodas is the domain and the set of caffeine amounts is the range of the function consisting of the six pairs listed, is it a one-to-one function? Why or why not?

Soda	*Caffeine (mg)*
Mountain Dew	55
Diet Coke	45
Dr. Pepper	41
Sunkist Orange Soda	41
Diet Pepsi-Cola	36
Coca-Cola Classic	34

Source: National Soft Drink Association.

In 7-8, Each function graphed is one-to-one. Graph its inverse on the same coordinate grid.

7) 

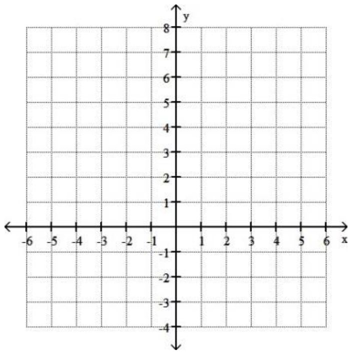
8) 

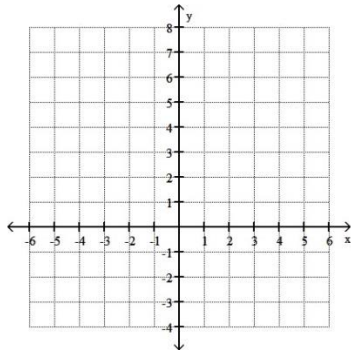
In 9-11, Graph each function.

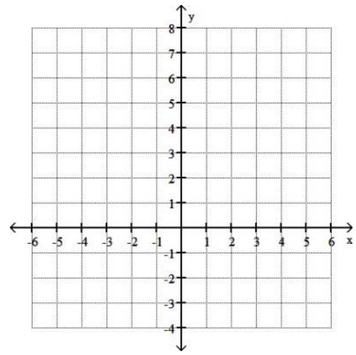
9) $f(x) = 3^x$

10) $f(x) = \left(\frac{1}{3}\right)^x$

11) $f(x) = 2^{2x+3}$







In 12-14, Solve each equation. (Hint: Rewrite with the same base.)

12) $5^{2x+1} = 25$

13) $4^{3x} = 8^{x+4}$

14) $\left(\frac{1}{27}\right)^{x-1} = 9^{2x}$

15) Sulfur dioxide emissions in the United States, in millions of tons, from 1970 through 2007 can be approximated by the exponential function defined by

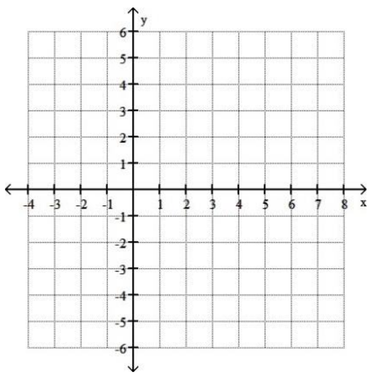
$$S(x) = 33.07(1.0241)^{-x}$$

Where $x = 0$ corresponds to 1970, $x = 5$ to 1975, and so on. Use this function to approximate, to the nearest tenth, the amounts for each year. (*Source:* U.S. Environmental Protection Agency.)

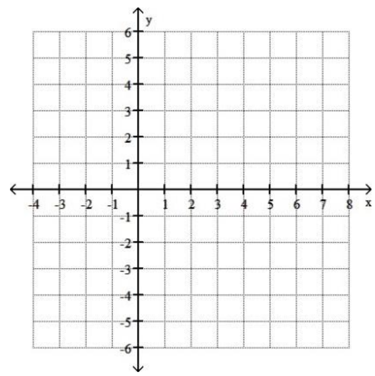
(a) 1975 **(b)** 1995 **(c)** 2005

In 16-17, Graph each function. (Hint: write in exponential form.)

16) $g(x) = \log_3 x$



17) $g(x) = \log_{\frac{1}{3}} x$



In 18-23, Solve each equation. (Hint: Rewrite in exponential form.)

18) $\log_8 64 = x$

19) $\log_2 \sqrt{8} = x$

20) $\log_x \left(\frac{1}{49}\right) = -2$

21) $\log_4 x = \frac{3}{2}$

22) $\log_k 4 = 1$

23) $\log_b b^2 = 2$

24) In your own words, explain the meaning of $\log_b a$.

Properties of Logarithms		
Name of Property	Property	Example
Special Properties	$\log_b b = 1$ and $\log_b 1 = 0$	$\log_8 8 = 1$ and $\log_{0.6} 1 = 0$
Product Rule	$\log_b xy = \log_b x + \log_b y$	$\log_5(6 \cdot 9) = \log_5 6 + \log_5 9$
Quotient Rule	$\log_b \frac{x}{y} = \log_b x - \log_b y$	$\log_4 \frac{7}{3} = \log_4 7 - \log_4 3$
Power Rule	$\log_b x^r = r \log_b x$	$\log_5 4^2 = 2 \log_5 4$
Special Properties	$b^{\log_b x} = x$ and $\log_b b^x = x$	$4^{\log_4 10} = 10$ and $\log_5 5^4 = 4$

In 25-26, Apply the properties of logarithms to express each logarithm as a sum or difference of logarithms. Assume that all variables represent positive real numbers.

25) $\log_2 3xy^2$

26) $\log_4 \left(\frac{\sqrt{x} \cdot w^2}{z}\right)$

In 27-28, Apply the properties of logarithms to write each expression as a single logarithm. Assume that all variables represent positive real numbers.

27) $\log_b 3 + \log_b x - 2\log_b y$

28) $\log_3(x + 7) - \log_3(4x + 6)$

In 29-30, To four decimal places, the values of $\log_{10} 2 = 0.3010$ *and* $\log_{10} 9 = 0.9542$. *Evaluate each logarithm by applying the appropriate rule or rules of logarithms. DO NOT USE A CALCULATOR.*

29) $\log_{10} 18$

30) $\log_{10} 36$

In 31-32, Decide whether each statement is true or false.

31) $\log_2(8 + 32) = \log_2 8 + \log_2 32$

32) $\log_6 60 - \log_6 10 = 1$