# Bellwork: Find the inverse of the function

$$f(x) = \frac{x-8}{x+3}$$

## Bellwork:

This month, Kami sold 70 figurines in 2 sizes. The large figurines sold for \$12 each, and the small figurines sold for \$8 each. The amount of money he received from the sales of the large figurines was equal to the amount of money he received from the sales of the small figurines. How many large figurines did Kami sell this month?

A. 20
B. 28
C. 35
D. 42
E. 50

$12L = 8S$

$L + \cancel{S} = 70 - S$

$-\cancel{S}$

$12(70-S) = 8S$

$840 - 12\cancel{S} = 8S$

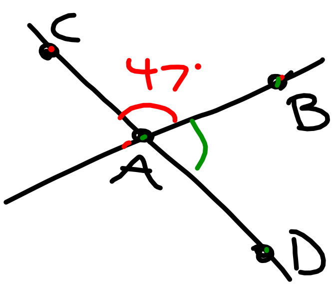
$+12S \quad +12S$

$\frac{840}{20} = \frac{20S}{20}$

$S = 42$

In a plane, the distinct lines $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ intersect at $A$, where $A$ is between $C$ and $D$. The measure of $\angle BAC$ is 47°. What is the measure of $\angle BAD$ ?

A. 43°
B. 47°
C. 94°
D. 133°
E. 137°

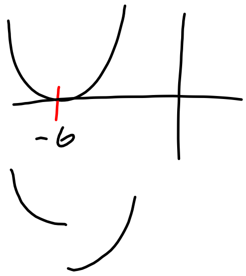



$180 - 47$

14) $x^2+12x+32$

$(x+6)^2 \quad x \le -6$

$x \ge -6$




4) $f(x) = \sqrt{x+4}$

$x^2 = \sqrt{y+4}^{\,2} \qquad x^2 = y + \cancel{4}$

$-4 \qquad -\cancel{4}$

$f^{-1}(x) = x^2 - 4, \; x \ge 0 \qquad x \ge h, \sqrt{\ }$

$(x+0)^2 - 4 \qquad x \le h, -\sqrt{\ }$

Homework 5.1 Solutions

1. $f(x) = -\dfrac{x-8}{6}$
2. $f(x) = \dfrac{x+5}{3}$
3. $f(x) = \sqrt{x+16} + 2$
4. $f(x) = x^2-4, \; x \ge 0$
5. $f(x) = \dfrac{x+5}{x-3}$
6. $f(x) = \dfrac{-2x-6}{3x-7}$
7. $f(x) = \sqrt[3]{2x+6}$
8. $f(x) = \sqrt[3]{x-5} + 2$
9. $f(x) = \left(\dfrac{x-7}{-2}\right)^3 + 5$

10. a

| $x$ | $f^{-1}(x)$ |
|---|---|
| 0.5 | -2 |
| 1.5 | -1 |
| 4.5 | 0 |
| 13.5 | 1 |
| 40.5 | 2 |

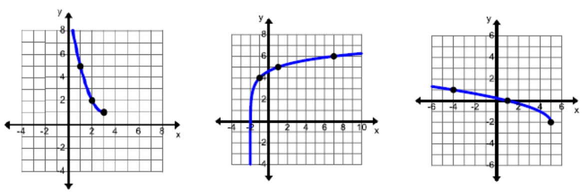
b

| $x$ | $f^{-1}(x)$ |
|---|---|
| 1 | 5 |
| 3 | 6 |
| 4 | 9 |
| 5 | 14 |
| 6 | 21 |

c

| $x$ | $f^{-1}(x)$ |
|---|---|
| 1.7 | -17 |
| 1.6 | -12 |
| 1.5 | -9 |
| 1.4 | -7 |
| 1 | -3 |

11



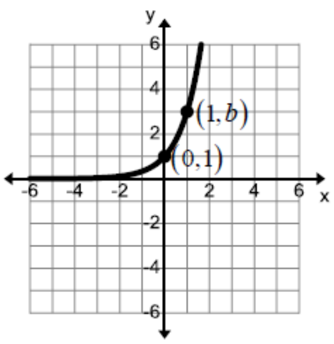
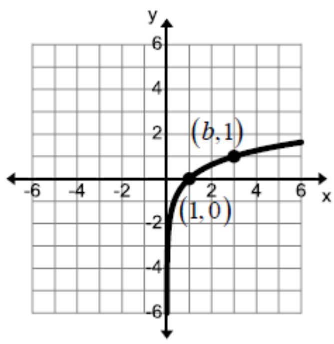
12. $x \le 0$ or $x \ge 0$

13. $x \le -5$ or $x \le -5$

14. $x \le -6$ or $x \ge -6$

# Lesson 5.2 Objectives

I can use basic properties of logarithms to solve problems

| Exponential | Logarithmic |
| --- | --- |
| $f(x)=b^x$, $b \neq 0$, $b \neq 1$ | $f(x)=\log_b x$, $b \neq 0$, $b \neq 1$ |
|  |  |
| Domain: $(-\infty,\infty)$<br>Range: $(0,\infty)$<br>Horizontal Asymptote: $y=0$<br>Intercept: $(0,1)$<br>End Behavior: $\lim_{x\to\infty} f(x)=\infty$; $\lim_{x\to-\infty} f(x)=0$ | Domain: $(0,\infty)$<br>Range: $(-\infty,\infty)$<br>Vertical Asymptote: $x=0$<br>Intercept: $(1,0)$<br>End Behavior: $\lim_{x\to\infty} f(x)=\infty$; $\lim_{x\to 0^+} f(x)=-\infty$ |

Two main types of logarithmic functions:

Common Log: $\log_{10}(x) = \log(x)$

Natural Log: $\log_{e}(x) = \ln(x)$

Definition of a Logarithm

$\log_b x = c$ if and only if $b^c = x$

$\ln x = c$ if and only if $e^c = x$

**Example 1:**
Rewrite each of the following in exponential form.

$\log_b x = c$ if and only if $b^c = x$

a. $\log_4 64 = 3$

$4^3 = 64$

b. $\log_5 \frac{1}{25} = -2$

$5^{-2} = \frac{1}{25}$

c. $\log_{65} 1 = 0$

$65^0 = 1$

**Example 2:**
Rewrite each of the following in logarithmic form.

$\log_b x = c$ if and only if $b^c = x$

a. $3^4 = 81$

$\log_3(81) = 4$

b. $10^{-2} = \frac{1}{100}$

$\log_{10}\left(\frac{1}{100}\right) = -2$

c. $6^1 = 6$

$\log_6(6) = 1$

# Basic Properties of Logarithms

where b>0, b≠1, x>0, and c is a real number

1. $\log_b 1 = 0$
2. $\log_b b = 1$
3. $\log_b b^c = c$
4. $b^{\log_b x} = x$

1. $\ln 1 = 0$
2. $\ln e = 1$
3. $\ln e^c = c$
4. $e^{\ln x} = x$

**Example 3:**
Use the properties of logarithms to evaluate the expression without a calculator.

a. $\log_{10} 10^{-4}$

$= -4$

$\log_b b^c = c$

b. $\cancel{e}^{\ln 6}$

$= 6$

c. $\log_3 1$

$= 0$

d. $\log_{50} 50$

$= 1$

**Change of Base Formula for Logarithms**

Most calculators only have $\log x$ and $\ln x$. In order to evaluate logarithms with a different base, you will need the change of base formula.

$$\log_b x = \frac{\log x}{\log b},\ b \neq 1 \quad \text{or} \quad \log_b x = \frac{\ln x}{\ln b},\ b \neq 1$$

$$\log_4(17) = \frac{\log(16)}{\log(4)} = \frac{\ln(16)}{\ln(4)}$$

Evaluate.

4. $\log_2 5$ $\quad\quad$ $\log_4 16$ $\quad\quad$ $\log 65$ $\quad\quad$ $\ln 6$

$\frac{\log(5)}{\log(2)} = 2.32$ $\quad\quad$ $2$ $\quad\quad$ $1.81$ $\quad\quad$ $1.79$

**Product Rule**

$\log_b(xy) = \log_b x + \log_b y$

$\ln(xy) = \ln x + \ln y$

**Quotient Rule**

$\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$

$\ln\left(\frac{x}{y}\right) = \ln x - \ln y$

**Power Rule**

$\log_b(x)^c = c\log_b x$

$\ln(x)^c = c\ln x$

Expand the following expressions.

$\sqrt[2]{x} = x^{1/2}$

a. $\log \frac{a^4 b}{c^5}$

$\log(a^4) + \log b - \log(c^5)$

$4\log(a) + \log(b) - 5\log(c)$

b. $\ln \sqrt[2]{m^3 n}$

$\ln(m^{3/2} n^{1/2})$

$\ln m^{3/2} + \ln n^{1/2}$

$\boxed{\frac{3}{2}\ln m + \frac{1}{2}\ln n}$

c. $\log \frac{2w^4 h^3}{a^2 b^5}$

$\log 2 + 4\log w + 3\log h - 2\log a - 5\log b$

Condense the following expressions.

$$5^{-2} = \frac{1}{5^2} = \frac{1}{25}$$

a. $\ln(x+1) - 3\ln(x-2)$

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

b. $\ln a - \frac{3}{2}\ln b + 7\ln c - 5\ln d$

$$\ln\left(a\, b^{-3/2}\, c^{7}\, d^{-5}\right)$$

$$\ln\left(\frac{a\, c^{7}}{b^{3/2}\, d^{5}}\right)$$