7.1	nth Roots and Rational Exponents
Objectives	1. Evaluate the n[th] roots of real numbers using both radical notation and rational exponent notation. 2. Use n[th] roots to solve real life problems.
	$\sqrt[n]{a}$ The **n[th]** root of **a** **n** is the *index* of the radical.
	Rational Notation ***Radical Notation*** $a^{m/n}$ $(\sqrt[n]{a})^m$ For example: $\mathbf{16^{3/2}}$ is equivalent to $(\sqrt[2]{\mathbf{16}})^3$
Rewrite the expression using rational exponent notation.	$\sqrt[4]{15}$ $(\sqrt[7]{6})^2$ $(\sqrt[8]{4})^{11}$
Rewrite the expression using radical notation.	$5^{1/3}$ $9^{3/7}$ $4^{2/5}$
Real n[th] Roots	Let **n** be an integer greater than 1 and let **a** be real number. 1. If **n** is odd, then **a** has ______ real n[th] root. $\sqrt[n]{a} = a^{1/n}$ 2. If **n** is even and **a>0**, then **a** has _____ real **n[th]** roots. $\pm\sqrt[n]{a} = \pm a^{1/n}$ 3. If **n** is even and **a=0**, then **a** has _____ **n[th]** root. $\sqrt[n]{0} = 0^{1/n}$ 4. If n is even and **a<0**, then **a** has _____ real **n[th]** roots.

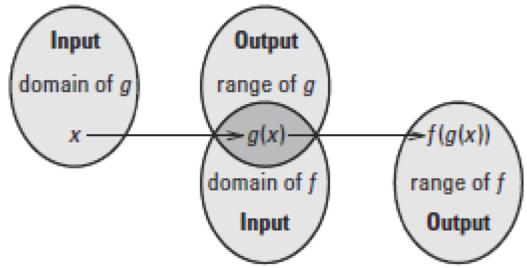
Find the indicated roots of a.	n = 3, a = -27 n = 2, a = 81 n = 6, a = 0
Rational Exponents	Let $a^{1/n}$ be an **n**[th] root of **a** and let **m** be a positive integer. • $a^{m/n} = \left(a^{1/n}\right)^m = \left(\sqrt[n]{a}\right)^m$ • $a^{-m/n} = \frac{1}{a^{m/n}} = \frac{1}{\left(a^{1/n}\right)^m} = \frac{1}{\left(\sqrt[n]{a}\right)^m} \quad a \neq 0$
Evaluate the expression without using a calculator.	$25^{3/2}$ $27^{-2/3}$ $16^{3/4}$
Solve the equation. Round answer to two decimal places when appropriate.	$3x^6 = 192$ $x^3 - 14 = 22$ $(x+3)^5 = 11$
A basketball has a volume of 455.6 cubic inches. The formula for the volume of a basketball is $V = \frac{4}{3}\pi r^3$. Find the radius of the basketball.	

7.2	Properties of Rational Exponents
Objectives	1. Use properties of rational exponents to evaluate and simplify expressions. 2. Use properties of rational exponents to solve real life problems.
	Properties of Rational Exponents **(Same rules as in Lesson 6.1)** **Property** **Example** 1. $a^m \cdot a^n = a^{m+n}$ 2. $(a^m)^n = a^{mn}$ 3. $(ab)^m = a^m b^m$ 4. $a^{-m} = \frac{1}{a^m} \quad a \neq 0$ 5. $\frac{a^m}{a^n} = a^{m-n} \quad a \neq 0$ 6. $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m} \quad b \neq 0$ **Rules for Radicals** 1. $\sqrt[n]{a \cdot b} = \sqrt[n]{a} \cdot \sqrt[n]{b}$ 2. $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

Simplify the expression.	$6^{1/2} \cdot 6^{1/3}$ $\left(27^{1/3} \cdot 6^{1/4}\right)^2$ $(4^3 \cdot 2^3)^{-1/3}$ $\dfrac{6}{6^{3/4}}$ $\left(\dfrac{18^{1/4}}{9^{1/4}}\right)^3$ $\sqrt[5]{16} \cdot \sqrt[5]{2}$ $\dfrac{\sqrt[3]{108}}{\sqrt[3]{4}}$ $\sqrt[4]{64}$ $\sqrt[3]{\dfrac{7}{9}}$
Adding and Subtracting Roots and Radicals	**Like radicals** have the same **index** and **radicand**. They can be added the same way like terms are added or subtracted. $6\left(2^{2/3}\right) + 4\left(2^{2/3}\right)$ $3\left(5^{3/4}\right) - \left(5^{3/4}\right)$

Adding and Subtracting Roots and Radicals	$\sqrt[5]{7}+5\sqrt[5]{7}$ $\sqrt[4]{64}+\sqrt[4]{4}$
Simplify the Expressions Involving Variables	$\sqrt[3]{27x^9}$ $(16x^4y^2)^{1/2}$ $\sqrt[5]{\frac{x^5}{y^{10}}}$ $\frac{18xy^{2/3}}{6x^{1/4}z^{-3}}$ $\sqrt[4]{12x^4y^9z^{14}}$ $\sqrt[3]{\frac{y^2}{x^5}}$
Adding and Subtracting Variable Expressions	$5\sqrt[3]{x}-3\sqrt[3]{x}$ $5x^2y^{1/2}+7x^2y^{1/2}$ $2\sqrt[4]{6x^5}-x\sqrt[4]{6x}$
The weight W in tons of a whale is a function of its length L in feet can be approximated by $W=0.1077L^{3/2}$. Approximate the weight of a whale with a length of 49.17 feet.	

7.3	**Power Functions and Function Operations**
Objectives	1. Perform operations with functions including power functions. 2. Use power functions and function operations to solve real life problems.
Key Terms	Power Function Domain
	Operations on Functions **Operation** / **Definition** / **Example:** $\boldsymbol{f(x) = 3x,\ g(x) = x + 3}$ **Addition** $h(x) = f(x) + g(x)$ ________________ **Subtraction** $h(x) = f(x) - g(x)$ ________________ **Multiplication** $h(x) = f(x) \cdot g(x)$ ________________ **Division** $h(x) = \frac{f(x)}{g(x)}$ ________________
Use the given functions to perform the indicated operations and state the domain.	$f(x) = 3x^{1/3}$ *and* $g(x) = 2x^{1/3}$ $f(x) + g(x)$ Domain____________ $f(x) - g(x)$ Domain____________ $f(x) \cdot g(x)$ Domain____________ $\frac{f(x)}{g(x)}$ Domain____________

Composition of Functions	The **composition** of the function f with the function g is: $h(x) = f(g(x))$ The **domain** of **h** is the set of all x-values such that x is the domain of **g** and **g(x)** is in the domain of **f.** 
Use the given functions to find the indicated composition and state the domain.	$f(x) = 2x^{-1} \text{ and } g(x) = x + 3$ $f(g(x))$ Domain___________ $g(f(x))$ Domain___________ $f(f(x))$ Domain___________ $g(g(x))$ Domain___________
A clothing store advertises a 50% off sale. For one day only, the store offers an additional savings of 25%.	Use composition of functions to find the total percent of discount. What would be the sale price of a $40 sweater?

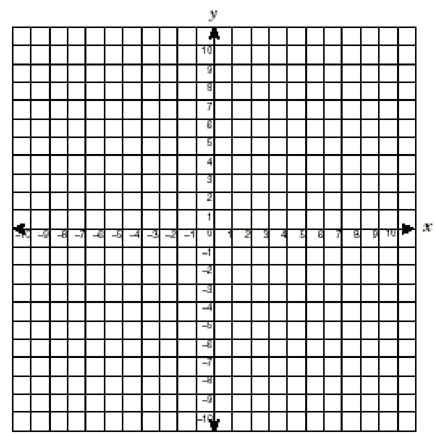
7.4	**Inverse Functions**
Objectives	1. Find inverses of linear functions. 2. Find inverses of nonlinear functions.
Key Term	Inverse Relation

Original Relation

x	-2	-1	0	1	2
y	6	3	0	-3	-6

Inverse Relation

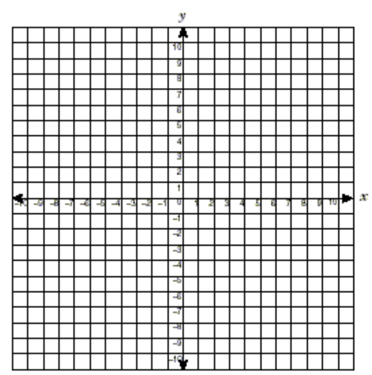
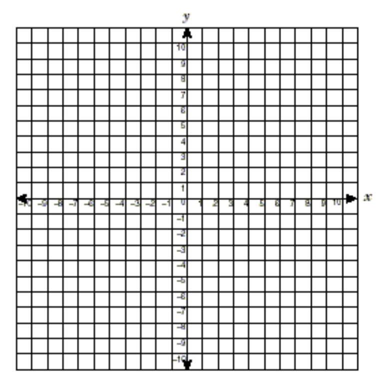
x	6	3	0	-3	-6
y	-2	-1	0	1	2



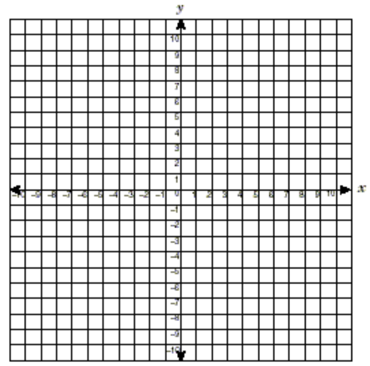
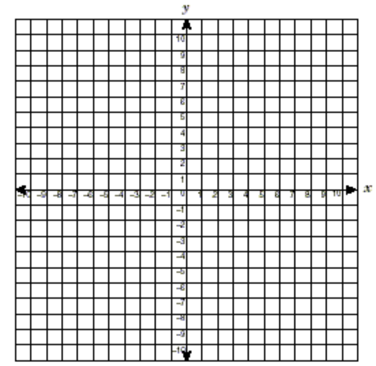
Find the equation of the inverse relation.

$y = 3x - 1$

$y = -4x + 8$

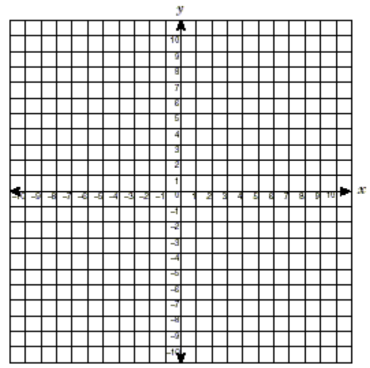
Inverse Functions	Functions f and g are inverse function of each other provided: $f(g(x)) = x \quad \boldsymbol{and} \quad g(f(x)) = x$ The function g is denoted by f^{-1}, and read as “ f inverse”
Verify that the two functions are inverses of each other.	$f(x) = 3x - 1 \; and \; f^{-1}(x) = \frac{1}{3}x + \frac{1}{3}$ $f(x) = 3x^3 + 1 \quad and \quad f(x) = \left(\frac{x-1}{3}\right)^{1/3}$
Finding Inverses of Nonlinear functions	$\boldsymbol{y = x^2 \; and \; y = \pm\sqrt{x}}$ $\quad$ $\boldsymbol{y = x^3 \; and \; y = \sqrt[3]{x}}$   **Horizontal Line Test** If **NO** horizontal line intersects the graph of a function $\boldsymbol{f}$ more than once, then the inverse of $\boldsymbol{f}$ is itself a function.

Find the Inverse of the Power Function.	$f(x) = \frac{1}{4}x^2 \quad , \quad x \geq 0$ $f(x) = \frac{1}{3}x^3 + 2$ $f(x) = x^6 \ , \quad x \geq 0$ $f(x) = \frac{1}{2}x^5 - 1$

7.5	**Graphing Square Root and Cube Root Functions**
Objectives	1. Graph square root and cube root functions.
Key Terms	Radical Functions
Base Graphs	$\boldsymbol{y = a\sqrt{x}}$  **Domain** $x \geq 0$ **Range** $y \geq 0$ $\boldsymbol{y = a\sqrt[3]{x}}$  **Domain: All real numbers** **Range: All real numbers**
	Graphs of Radical Functions To graph $\boldsymbol{y = a\sqrt{x-h} + k}$ or $\boldsymbol{y = a\sqrt[3]{x-h} + k}$ follow these steps. 1. Sketch the graph of $\boldsymbol{y = a\sqrt{x}}$ or $\boldsymbol{y = a\sqrt[3]{x}}$. 2. Shift the graph **h** units **horizontally** and **k** units **vertically**.
Describe how to obtain the graph of g from the graph of f.	$g(x) = \sqrt{x+10}, \quad f(x) = \sqrt{x}$ $g(x) = 3\sqrt{x-5} + 6, \quad f(x) = 3\sqrt{x}$ $g(x) = -\sqrt[3]{x} + 2, \quad f(x) = \sqrt[3]{x}$

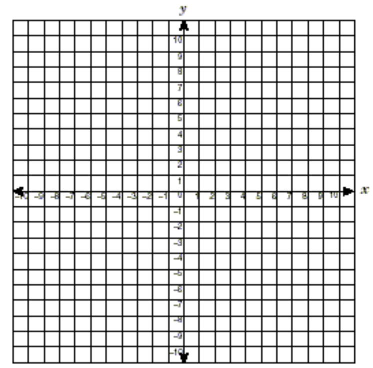
Graph the function, then state the domain and range.

$y = \sqrt{x+1}$



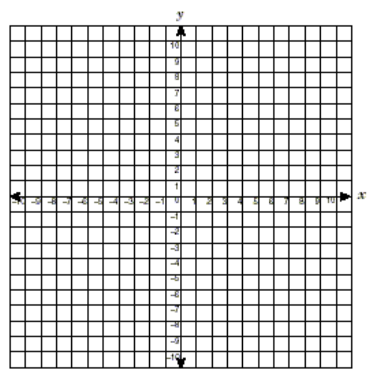
Domain ___________
Range _____________

$y = 2\sqrt{x+3} - 1$



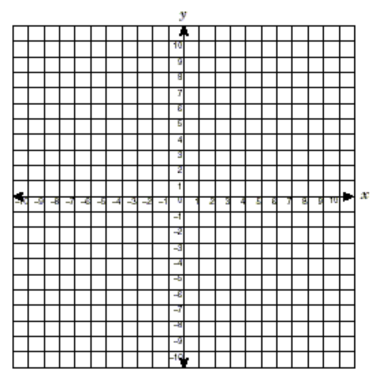
Domain___________
Range_____________

$y = \sqrt[3]{x} + 4$



Domain ___________
Range _____________

$y = \sqrt[3]{x-4} + 3$



Domain___________
Range_____________

7.6	Solving Radical Equations
Objectives	1. Solve equations that contain radicals or rational exponents. 2. Use radical equations to solve real life problems.
Key Terms	Radical Equation Extraneous Solutions
Solving a Radical Equation	Eliminate the radicals or rational exponents to obtain a polynomial equation by raising each side of the equation to the same power. **** Always check for extraneous solutions.****
Solve the equation. Check for extraneous solutions.	$\sqrt[4]{x} = 3$ $x^{5/2} = 32$ $\sqrt[3]{3x} + 6 = 10$ $4x^{2/3} - 6 = 10$ $2\sqrt{7x+4} - 1 = 7$ $3(x+1)^{4/3} = 48$

Solve the equation. Check for extraneous solutions.	$\sqrt{x-2}=x-2$ $x-6=\sqrt{3x}$ $\sqrt[3]{x+4}=\sqrt[3]{2x-5}$ $6\sqrt{x}-\sqrt{x-1}=0$
Beauford Wind Scale (Table on p. 440) **What wind speed corresponds to a B=7 "moderate gale" on the Beauford Wind Scale?**	Use $B=1.69\sqrt{s+4.45}-3.49$

7.7	Statistics and Statistical Graphs
Objectives	1. Use measures of central tendency and measures of dispersion to describe data sets. 2. Use box and whisker plots and histograms to represent data graphically.
Measures of Central Tendency	Mean Median Mode
Measures of Dispersion	Range Standard Deviation $\sigma = \sqrt{\frac{(x_1-\bar{x})^2+(x_2-\bar{x})^2+\cdots+(x_n-\bar{x})^2}{n}}$
Find the Measures of Central Tendency	**Test Scores:** **44, 52, 53, 62, 70, 71, 71, 72, 74, 75, 75, 75, 76, 76, 78, 80 81, 82, 82, 84, 85, 86, 90, 92 93, 96, 97** Mean: Median: Mode:

Find the Measures of Dispersion	**Test Scores:** **44, 52, 53, 62, 70, 71, 71, 72, 74, 75, 75, 75, 76, 76, 78, 80 81, 82, 82, 84, 85, 86, 90, 92 93, 96, 97** Range: Standard Deviation:
Statistical Graphs	**Box and Whisker** 1. Order the data from least to greatest. 2. Find the minimum and maximum values. 3. Find the median. 4. Find the upper and lower quartiles. 5. Plot the five numbers below a number line. 6. Draw the box, the whiskers, and a line segment through the median.
Draw a box and whisker plot for the Test Score data.	

Statistical Graphs	**Histogram** 1. Is a special type of bar graph. 2. Data is grouped into intervals of equal width. 3. The number of data in each interval is the frequency. 4. To draw a histogram, begin by making a frequency distribution.
Draw a histogram for the Test Score Data. Make a frequency distribution first using intervals of equal width. Use 6 intervals beginning with 40-49.	**Test Scores: 44, 52, 53, 62, 70, 71, 71, 72, 74, 75, 75, 75, 76, 76, 78, 80 81, 82, 82, 84, 85, 86, 90, 92 93, 96, 97**