

# Elementary Algebra, 3rd Edition

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**Chapter 0, a Pre-Algebra Review, is currently on-line only:**

**<http://bobprior.com/MAT52Ch0/MAT52Ch0.html>**

### **Chapter 1 Numbers and Algebra**

#### Sec 1.1 Definitions and Properties

Basic operations; evaluating an expression; Commutative and Associative Properties; and identities.

#### Sec 1.2 Real Numbers

Number lines; absolute value; defining number as having both value and direction; signed numbers; Real Numbers: natural, whole, integer, and rational; decimals as rational numbers; writing some repeating decimals as fractions; irrational numbers; undefined values.

#### Sec 1.3 Adding Integers

Representing integers on the number line; adding integers along the number line; finding sums mentally; and the Commutative Property of Addition.

#### Sec 1.4 Subtracting Real Numbers

The first three meaning of the dash (subtract, negative, and opposite of); the double negative; subtraction written as addition; subtraction and the Commutative Property; subtraction and the double negative; adding and subtracting signed fractions and decimals; and applications with real numbers.

#### Sec 1.5 Multiplying and Dividing Real Numbers

Developing rules for multiplying integers; the fourth meaning of the dash (- 1 times); developing more rules for multiplying integers; product of more than two integers; division of signed numbers; and negatives in a fraction.

#### Sec 1.6 The Factor Game

This is a game of multiplying and adding integers that is a preparation, eventually, for factoring trinomials.

#### Sec 1.7 The Order of Operations

Grouping symbols; the Order of Operations (refresher); exponents and negative numbers; negative square roots; square root of a negative number; Order of Operations and negative numbers; double quantities; the fraction bar as a grouping symbol; replacement values; and formulas.

#### Sec 1.8 Algebraic Expressions: Like Terms

Basic definitions of algebraic expressions (variable, constant, coefficient, term); replacement values; combining like terms.

#### Sec 1.9 Algebraic Expressions: The Distributive Property

Multiplying a term by an integer; and the Distributive Property. .

#### Sec 1.10 Translating between English and Algebra;

The Main Operation; translating between English and Algebra; and translations and the Main Operation.

## **Chapter 2 Linear Equations and Inequalities**

- Sec 2.1 **Solving the Standard Form Equation**  
Expressions and equations; linear equations; solution; isolating the variable; balancing an equation; Addition and Multiplication Properties of Equality; and solving the standard form equation,  $ax + b = c$ .
- Sec 2.2 **Solving Linear Equations with more than Two Operations**  
Solving and the Main Operation; equations with more than one variable term; and Reducing equations to standard form.
- Sec 2.3 **Solving Equations Containing Fractions and Decimals**  
Complete set of guidelines for solving linear equations; equations with fractions; with decimals; and with parentheses.
- Sec 2.4 **Problem Solving**  
The legend; translating from English to algebra and setting up equations.
- Sec 2.5 **Solving Proportions**  
Definitions of ratio and proportion; solving proportions; cross multiplication; solving applications involving proportions.
- Sec 2.6 **Graphing inequalities**  
Words of comparison; inequality symbols; translating inequalities from English to Algebra; the number line; infinity symbol; visualizing inequalities; graphing inequalities on a number line; switching sides of an inequality; and replacing values in an inequality to identify solutions.
- Sec 2.7 **Solving Inequalities**  
Solving linear inequalities: switching sides; multiplying by  $-1$ ; and complete guidelines.

## **Chapter 3 Applications**

- Sec 3.1 **Literal Equations: Rewriting Formulas**  
Identifying the variable of interest; variable constants and coefficients; moving terms across the equal sign; solving literal equations.
- Sec 3.2 **Applications Involving One Unknown Value**  
Guidelines for solving applications; setting up the legend for one unknown value; setting up a diagram and a chart; identifying a formula; and solving applications.
- Sec 3.3 **Applications Involving More Than One Unknown Value**  
Setting up the legend for two unknown values; setting up a diagram and a chart; and solving applications.
- Sec 3.4 **Proportion Applications**  
Setting up a proportion chart; applications with proportions; proportions with two unknown values; and similar triangles.
- Sec 3.5 **The Percent Equation**  
Percent and percentage; percents in equations; solving the percent equation, “What percent of A is B?”; solving percent equations using proportions; and solving sales tax and commission applications.
- Sec 3.6 **Percent Applications**  
Applications involving the simple interest formula,  $I = Prt$ ; find the unknown amount of time, the unknown principal, and the unknown rate of interest; and interest from two investments.

## Chapter 4 Graphing Lines

### Sec 4.1 The Cartesian Coordinate System

Equations with two variables; ordered pairs; the  $x$ - $y$  plane, including axes, origin, quadrants, and axial points; preparing to graph lines; identifying points on a line; and horizontal and vertical lines.

### Sec 4.2 Graphing Lines

Collinear points; graphing lines in both  $ax + by = c$  form and  $y = mx + b$  form.

### Sec 4.3 Features of a Line

$x$ - and  $y$ -intercepts; Slope =  $\frac{\text{rise}}{\text{run}}$ ; finding slope based on points on a line; intro to slope-intercept form of a line; identifying the slope and  $y$ -intercept from the equation  $y = mx + b$ ; graphing using the slope and  $y$ -intercept.

### Sec 4.4 The Slope Formula

Identifying the slope from two points on a graphed line (counting rise and run); creating the equation from a graphed line ( $y$ -intercept and one other point); the slope formula; and writing the equation of the line based on the  $y$ -intercept and one other point (when slope formula is required).

### Sec 4.5 The Equation of a Line

Writing the equation of a line, knowing the slope and one point, by solving for  $b$ ; and writing the equation of a line knowing two points.

### Sec 4.6 Standard Form Equation

The Standard Form of a line,  $Ax + By = C$ ; from standard form to slope-intercept form; finding, and graphing lines from, the  $x$ - and  $y$ -intercepts; and horizontal and vertical lines and their slopes and equations.

### Sec 4.7 Parallel and Perpendicular Lines

Parallel lines; graphing parallel lines; equations of parallel lines; perpendicular lines; graphing perpendicular lines; and equations of perpendicular lines.

### Sec 4.8 Linear Inequalities in Two Variables

Solving linear inequalities in one variable, a new technique; half plane; border line; test point; and graphing linear inequalities in two variables.

## Chapter 5 Systems of Linear Equations

### Sec 5.1 The Graphing Method

Finding the point of intersection between two lines; defining a system of linear equations; and solutions: consistent, inconsistent, and dependent.

### Sec 5.2 The Substitution Method

The Substitution Method.

### Sec 5.3 The Elimination Method

Addition Property of Equality; Adding equations together to create another linear equation; the Elimination Method: (1) direct addition and (2) multiplying to prepare for direct addition; dependent and inconsistent systems; and fractional solutions.

### Sec 5.4 Applications

A legend with two variables; and Applications: river currents, head wind/tailwind, value problems, and ticket problems.

## **Chapter 6 Exponents and Polynomials**

### **Sec 6.1 Rules of Exponents**

Exponent as repeated multiplication; the first power; the product rule; zero power; the quotient rule; zero power rule; the distributive property for exponents; and power to a power.

### **Sec 6.2 Rules of Negative Exponents**

Understanding negative exponents; rule of negative exponents; negative exponents and fractions; and using negative exponents with other exponent rules.

### **Sec 6.3 Scientific Notation**

Base-10 and negative exponents; working with powers of 10; scientific notation; the coefficient; writing large numbers in scientific notation; writing small numbers in scientific notation; expanding from scientific notation; adjusting the coefficient; and multiplying and dividing with scientific notation.

### **Sec 6.4 Introduction to Polynomials**

Definitions related to polynomials: terms, coefficient, constant, degree of term, descending order, lead term, degree of polynomial; monomials, binomials, etc.; combining like terms; and evaluating polynomials for given replacement value.

### **Sec 6.5 Adding and Subtracting Polynomials**

The distributive property (multiplier of 1 and -1); adding polynomials; and subtracting polynomials.

### **Sec 6.6 Multiply Polynomials**

The product of two monomials; squaring a monomial; the product of a monomial and a polynomial; and the product of two polynomials.

### **Sec 6.7 Multiplying Binomials**

The FOIL method; multiplying binomials in one step; squaring a binomial; recognizing perfect squares; conjugates; difference of squares; and recognizing conjugates

### **Sec 6.8 Dividing Polynomials**

Dividing one monomial by another; dividing a polynomial by a monomial; and dividing a polynomial by a binomial using long division. (Within this section, there are five subsections that prepare the student for long division.)

## **Chapter 7 Factoring**

### **Sec 7.1 Factoring Polynomials: The Greatest Common Factor**

Factors and multiplication; the greatest common factor (GCF); distributing monomials; factoring out a common monomial factor; and factoring when the lead term is negative.

### **Sec 7.2 Factoring by Grouping**

Factoring out a common binomial factor; Factor by Grouping; and the Factor Game (from Section 1.7).

### **Sec 7.3 Factoring Trinomials, $a > 1$**

Factoring trinomials and "FOIL;" identifying the Key and Sum numbers of the Factor Game; using the Factor Game with Factor by Grouping to factor trinomials of the form  $ax^2 + bx + c$ ,  $a > 1$ ; and prime polynomials.

Sec 7.4 **Factoring Trinomials,  $a = 1$**   
Factoring trinomials when  $a = 1$ , the one-step method (with Factor Game); prime polynomials; and first factoring out a GCF.

Sec 7.5 **Factoring Strategies**  
Perfect square trinomials,  $a = 1$ ; perfect square trinomials,  $a > 1$ ; factor difference of squares into conjugates; and factoring completely—more than two factors.

## **Chapter 8 Rational Expressions**

Sec 8.1 **Rational Expressions**  
Undefined values (0 in denominator); show division with remainder of 0; simplifying fractions; and opposite factors (such as  $x - 3$  and  $3 - x$ ).

Sec 8.2 **Multiplying and Dividing Rational Expressions**  
Multiplying fractions and dividing fractions.

Sec 8.3 **Adding and Subtracting Like Fractions**  
Common denominators; adding rational expressions with common denominators; subtracting rational expressions with common denominators; and negatives in the denominator.

Sec 8.4 **Adding and Subtracting with Unlike Denominators**  
Unlike denominators; creating the common “target” denominator; adding and subtracting unlike fractions; and negatives in the denominator.

Sec 8.5 **Complex Fractions**  
Two ways to write division (as a fraction and with the  $\div$ ); single fraction in numerator and denominator; two methods to simplify complex fractions; more than one fraction in numerator and/or denominator.

## **Chapter 9 Radicals**

Sec 9.1 **Simplifying Radicals**  
Perfect squares/non-perfect squares; the product rule of radicals; simplifying radicals; multiplying two radicals; and squaring the square root; and the quotient rule of radicals.

Sec 9.2 **Adding and Subtracting Radicals**  
Adding and subtracting like radicals; adding and subtracting some radicals with unlike radicands; and simplifying radical expressions of the form  $\frac{b + \sqrt{d}}{2a}$ . (Two techniques are presented: (1) splitting the fraction into two fractions, and (2) simplifying while maintaining a single fraction.

Sec 9.3 **Multiplying Radical Expressions**  
The product of a monomial and a binomial (radical expression); the product of a two binomials; and conjugates.

Sec 9.4 **Dividing Radicals**  
Why we rationalize the denominator; rationalizing the denominator with a single radical; and rationalizing the denominator with a binomial radical expression.

## **Chapter 10 Quadratic and Rational Equations**

### **Sec 10.1 Solving Quadratic Equations by Factoring**

Quadratic equation defined; solving linear equations of the form  $ax + b = 0$ ; the Zero-Product Principle; solving quadratic equations by factoring; and solving quadratic equations not already equal to 0.

### **Sec 10.2 The Quadratic Formula**

The quadratic formula; substituting values into the quadratic formula; the discriminant; and solving equations using the quadratic formula.

### **Sec 10.3 Quadratic Applications**

Area of a rectangle; area of a right triangle; the Pythagorean Theorem; and height of free-falling object.

### **Sec 10.4 Rational Equations**

Undefined values: quadratic denominators; review of solving equations with fractions; and solving rational equations.

### **Sec 10.5 Rational Applications: Work Problems**

Rate of work; working together; working against; and completing 1 full task.

## **Appendix (Available upon request for Fall 2011)**

### **Sec A.1 Completing the Square**

Understanding perfect square trinomials; solving equations of the form  $(ax + b)^2 = c$ ; completing the square in an equation of the form  $ax^2 + bx + c = 0$ ; and developing the quadratic formula by completing the square.