

# MATH 65 COURSE NOTEBOOK

## Review Sections from Math 60

### Section 2.5: More Linear Equations: $ax + b = cx + d$

#### Objective

- Solve equations of the form  $ax + b = cx + d$ .
- Understand the terms *conditional equations*, *identities* and *contradictions*.

#### Instruct

1. These equations can look messy at first. Carefully simplify each side of the equation first. Then use the Addition Property of Equality to get the variable on one side of the equal sign and the constant term on the other. Then use the Multiplication Property of Equality to get the variable coefficient to +\_\_\_\_.

1. The first step to solve the equation  $\frac{3}{4}x + \frac{5}{6}x - \frac{2}{3} = \frac{5}{12} - \frac{1}{6} + \frac{1}{6}x$  is to \_\_\_\_\_.

2. The first step to solve the equation  $3 + 2(3x + 5) = 6 - 2(x - 3)$  is to \_\_\_\_\_.

3. Complete the chart and include an example of each type of term.

Type of Equation	Number of Solutions	Example

#### Practice

Solve the equations given in problems #2 and #3 above.

#2.

#3.

## Section 4.3: Graphing Linear Equations in Slope-Intercept Form

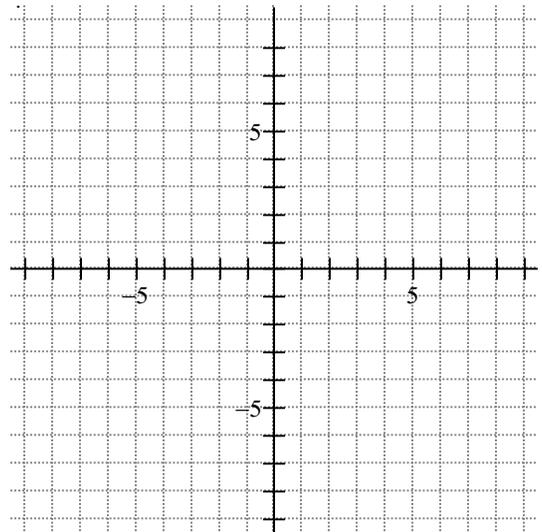
### Objectives

- Interpret the slope of a line as a rate of change.
- Find the slope of lines given two points.
- Find the slopes of and graph horizontal and vertical lines.
- Find the slopes and y-intercepts of lines and then graph the lines.
- Write the equations of lines given the slopes and y-intercepts.

### Instruct

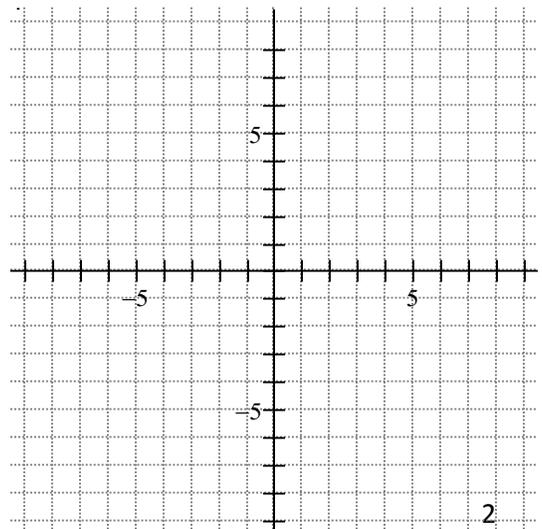
1. In the equation for the Slope-Intercept form:  $y = mx + b$ 
  - a) What does the letter **m** represent?
  - b) What does the letter **b** represent?
2. Slope is given by the ratio  $\frac{\text{rise}}{\text{run}}$ . What is the formula we use to find the slope if given two ordered pairs?

3. When graphed, the equation  $y = 4$  is a \_\_\_\_\_ line. Graph  $y=4$ .
4. When graphed, the equation  $x = -2$  is a \_\_\_\_\_ line. Graph  $x=-2$  on the same grid as #3.

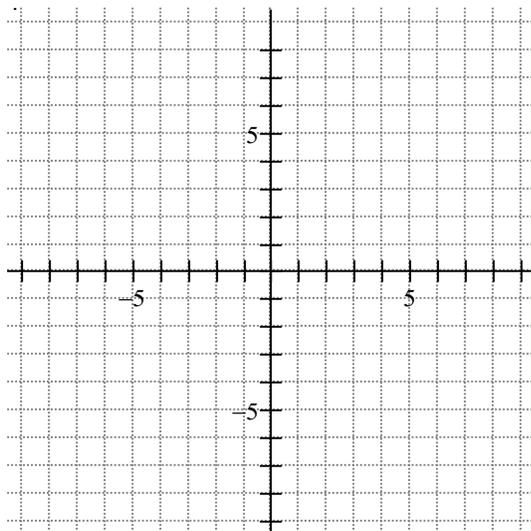


### Practice

1. Find the slope determined by the following ordered pairs: (6, 7) and (3, 2)
2. Graph the linear equation using the slope and y-intercept:  $y = -3x + 3$



3. Graph the linear equation  $x = 3$  and label three ordered pairs on the graph.



Pair: (A) (\_\_\_\_\_, \_\_\_\_\_)

Pair: (B) (\_\_\_\_\_, \_\_\_\_\_)

Pair: (C) (\_\_\_\_\_, \_\_\_\_\_)

## Section 4.4a: Finding the Equation of a Line

### Objectives

- Graph a line given its slope and one point on the line.
- Find the equation of a line given its slope and one point on the line using the formula:  
 $y - y_1 = m(x - x_1)$ .
- Find the equation of a line given two points on the line.

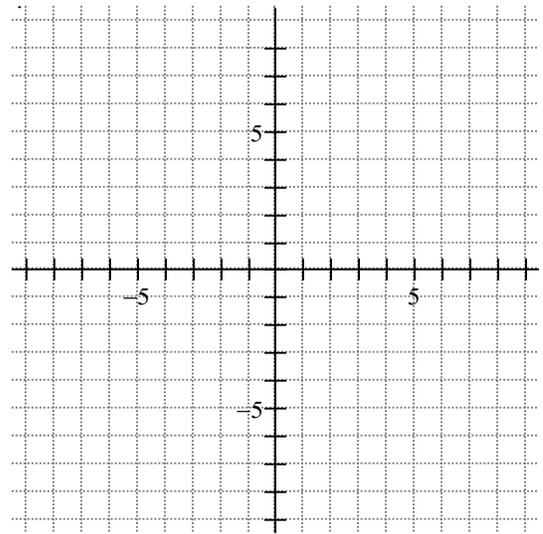
### Instruct

1. The slope-intercept form of the equation of a line is: \_\_\_\_\_ where  $m$  is the slope and  $(0, b)$  is the  $y$ -intercept.
2. The point-slope form of the equation of a line is: \_\_\_\_\_ where  $m$  is the slope and  $(x_1, y_1)$  is a given point on the line.
3. The point-slope form, the slope-intercept form, and the standard form are all acceptable and correct ways to write the equation of a line. **True/ False**

### Practice

1. Find the equation (in slope-intercept form) of the line passing through the points with the given coordinates  $(3, 3)$  and  $(-2, -4)$ .

2. Sketch the graph of a line with slope  $m = \frac{3}{2}$  and passes through the point  $(2, 1)$ .



## Chapter #8

### Systems of Linear Equations

In this chapter, a student will learn about two-by-two linear systems of equations. The three types of linear systems - Dependent, Independent, and Inconsistent - are described and solved graphically and algebraically. Linear systems are also used to solve application problems involving money,  $D = r \cdot t$ , mixtures, or amounts and costs.

#### Section 8.1: Solving Systems of Linear Equations by Graphing

##### Objectives

- Determine if given points lie on both lines in specified systems of equations.
- Estimate, by graphing, the coordinates of the intersection of a system of linear equations with one solution.
- Use a graphing calculator to solve a system of linear equations.

### Instruct

Click on the word **graphically**, when available, to see the graph of the lines.

1. A solution of a system of linear equations is an ordered pair (or point) that

\_\_\_\_\_.

2. To determine whether a particular ordered pair is \_\_\_\_\_, substitute

\_\_\_\_\_.

\_\_\_\_\_.

3. What do you know about the slope of two lines that form an inconsistent system?

4. A linear system of equations that has infinite solutions is called a(n) \_\_\_\_\_ system.

5. A linear system of equations that has only one solution is called a(n) \_\_\_\_\_ system.

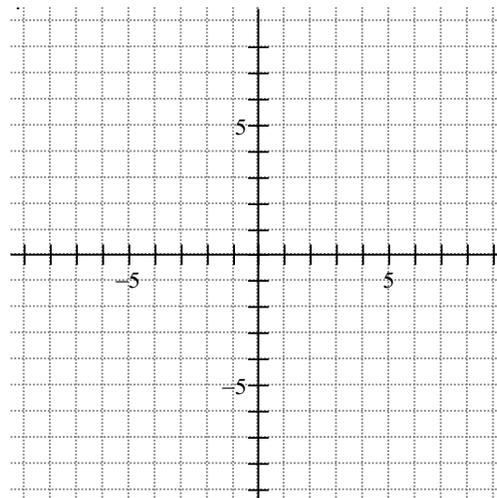
6. A linear system of equations that has no solution is called a(n) \_\_\_\_\_ system.

### Practice

1. Graphically solve the following system of linear equations.

$$y = x - 2$$

$$2y = x + 1$$



## Section 8.2: Solving Systems of Linear Equations by Substitution

### Objectives

- Solve systems of linear equations by using the method of substitution.

### **Instruct**

Copy the steps to solve a system of linear equations by substitution

1.

2.

3.

4.

### **Practice**

1. Solve the following system of equations by substitution. Indicate if the system is Consistent, Inconsistent, or Dependent.

$$2x + 3y = 3$$

$$X - 2y = 5$$

2. Solve the following system of equations by substitution. Indicate if the system is consistent, inconsistent, or dependent.

$$6x - 3y = 8$$

$$y = 2x + 5$$

## **Section 8.3: Solving Systems of Linear Equations by Addition**

### **Objectives**

- Solve systems of linear equations by using the method of addition.
- Use systems of equations to find the equation of a line through two given points.

### **Instruct**

1. Under what conditions is solving a system of equations by substitution not recommended?
2. To use the Addition Method, we want to write the equations in "standard form" which really means to simply line up the \_\_\_\_\_.
3. When adding the two equations together, our goal is for one of the variables to be eliminated, thus reducing the problem to one of solving a single equation with only \_\_\_\_\_ variable.

### **Practice**

1. Solve the following system of equations by addition. Indicate if the system is consistent, inconsistent, or dependent.

$$3x + 2y = 4$$

$$2x - 3y = 7$$

2. 2. Solve the following system of equations. Indicate if the system is consistent, inconsistent, or dependent.

$$4x + 3y = 1$$

$$2y = 3x + 12$$

# Chapter 5

## Exponents and Polynomials

In order for us to be successful in math, we must get comfortable when using variables in expressions and in our equations. One of the first steps in becoming comfortable with variables is to practice writing exponents with variables and then use our skills with exponents to manipulate polynomial operations. Chapter 6 starts with learning the rules of exponents and ends with us learning operations on polynomials. Take your time with this section and make sure to complete many practice problems. The more experience you gain with using exponents and polynomials the easier math will become.

### Section 5.1: Simplifying Integer Exponents I

#### Objectives

- Simplify expressions by using properties of integer exponents.
- Recognize which property of exponents is used to simplify an expression.

#### Instruct

1. Define EXPONENT and give an example.
2. Given  $5^3$  the 5 is called the \_\_\_\_\_ and the 3 is called the \_\_\_\_\_.
3.  $5^0 = 0$                       TRUE/FALSE
4. The expression  $0^0$  is \_\_\_\_\_.

5. Section 5.1 discusses five important properties of exponents (there is a great summary in Section 5.2a). List each property by name and explain, in your own words, how each property works.

1)

2)

3)

4)

5)

### Practice

1. Simplify the following.

a)  $x^0 + (-2y)^0$

b)  $\frac{-12x^{-3}y}{4x^{-2}y^4}$

c)  $(-5a^2b^5)(6a^3c)$

## Section 5.2a: Simplifying Integer Exponents II

### Objectives

- Simplify powers of expressions by using the properties of integer exponents.

### Instruct

1. If “a” is a nonzero number and the variables **m** and **n** are integers, then  $(a^m)^n = a^{mn}$  represents which rule of exponents?
2. By using the Power of a Product rule we get  $(5a)^2 = 5a^2$ . **TRUE/FALSE.**

3. What are the two basic shortcuts to use with negative exponents and fractions?

### Practice

1. Simplify the following expression and write your answer with positive exponents:

a)  $\left(\frac{(3x^{-1})^2}{25y^3}\right)\left(\frac{5x^2}{6y^{-2}}\right)$

b)  $\left(\frac{a}{-3b}\right)^{-2}$

## Section 5.2b: Scientific Notation

### Objectives

- Write decimal numbers in scientific notation.
- Write numbers in scientific notation as decimal numbers.
- Perform operations with decimal numbers by using scientific notation

### Instruct

1. Scientific Notation is used to write very large or very small numbers as the product of a number greater than or equal to 1 and less than 10 and an integer power of 10. **TRUE/FALSE**
2. Is  $0.000000069 = 69 \times 10^{-9}$  written in correct scientific notation? Why or why not?

3. Since multiplying  $10^6$  is the same as multiplying by 1,000,000, what is multiplying by  $10^{-6}$  the same as what?

### Practice

1. Write  $2.758 \times 10^5$  in decimal form.

2. Write 0.09651 in scientific notation.

## Section 5.3: Identifying and Evaluating Polynomials

### Objectives

- Define a polynomial.
- Classify a polynomial as a monomial, binomial, trinomial, or a polynomial with more than three terms.
- Evaluate a polynomial for given values of the variable.

### Instruct

2. Define TERM and give an example.
3. Define CONSTANT TERM and give an example.
4. The number written in front of a variable in a term is called the \_\_\_\_\_ of the variable.
5. We classify polynomials by how many terms each expression has. A MONOMIAL has \_\_\_\_\_ term, a BINOMIAL has \_\_\_\_\_ terms, a TRINOMIAL has \_\_\_\_\_ terms and any expression with more than three terms we call a polynomial.
6. Describe how to determine the degree of the polynomial and show an example.
7. To evaluate a polynomial we need to a value (a number) for the variable(s). We can then rewrite the expression by replacing (substituting) the variable with the given value wherever it occurs. We then follow the order of operations to evaluate. **True/False**

### Practice

1. Simplify each of the following polynomials by combining like terms. Then write the polynomials in descending order, also determine the degree and type of the polynomial.

a)  $3x^4 - 7x^4$

b)  $4y^2 + 5y - 10 - y^2$

2. Evaluate the following trinomial at  $x = 5$ .  $-10x - 4x^2 - 2$

## Section 5.4: Adding and Subtracting Polynomials

### Objectives

- Add polynomials.
- Subtract polynomials.
- Simplify expressions by removing grouping symbols and combining like terms.

### Instruct

1. The sum of two or more polynomials is found by \_\_\_\_\_.
2. A negative sign written in front of a polynomial in parentheses means take the opposite of the entire polynomial by changing the sign of every term inside the parentheses. **True/False**
3. When adding or subtracting polynomials in a vertical format it is recommended to first rewrite the polynomial in \_\_\_\_\_ order.

### Practice

1. Perform the indicated operations by removing the parentheses and combining like terms.
  - a.  $(7x - y) + (x + 3 - 2y) =$
  - b.  $(-a^2 + 9 + a) - (-a + 9) =$
  - c.  $(-5x + 6) - (6 - 5x) =$

## Section 5.5: Multiplication with Polynomials

### Objectives

- Multiply a polynomial by a monomial.
- Multiply two polynomials.

### Instruct

1.  $-4x(9x^2 - 5) = -36x^3 + 20x$  is an example of how we use the \_\_\_\_\_ property to multiply each term of a binomial by the monomial.

### Practice

1. Consider the following multiplication problems. Then use the distributive property and /or the product rule of exponents to multiply the polynomials.

a)  $(-2x^3 + 5)(-4x) =$

b)  $(7x^2)(2x^2 - 2x + 3) =$

c)  $(x + 7)(x + 7) =$

d)  $(x - 2)(3x^2 - x + 4) =$

## Section 5.6a: The FOIL Method

### Objectives

- Multiply two binomials using the FOIL method.

### Instruct

As you work through the problems pay close attention to how the FOIL method works. We will be using this method later in reverse when we factor polynomials. Therefore, it is important that you understand how this works.

1. What do each of the letters represent in FOIL when we multiply two binomials using the FOIL Method?

F →

O →

I →

L →

### Practice

1. Multiply the following binomials by using the FOIL method. Make sure you simplify your answer by combining like terms.

a)  $(x + 3)(4x - 2) =$

b)  $(3x - 1)(x - 4)$

c)  $(2x + y)(3x - 5y)$

## Section 5.6b: Special Products

### Objectives

- Multiply binomials using the FOIL method.
- Multiply binomials, finding products that are the difference of squares.
- Square binomials, finding products that are perfect trinomials.
- Identify the difference of two squares and perfect square trinomials.

**This lesson looks at special products of polynomials, but there is no assignment for this section. It is a "Bonus" section, so you can earn bonus points by completing this assignment in Hawkes.**

## Section 5.7a: Division by a Monomial

### Objectives

- Divide polynomials by monomials.

### Instruct

1. What is a rational expression? (*the definition will work here*)

2. To divide a polynomial by a monomial we simply separate the terms and divide each term in the \_\_\_\_\_ by the monomial in the \_\_\_\_\_.

### **Practice**

1. Simplify the expressions by first dividing the following polynomials.

a)  $\frac{10x^2 - 5x}{5x} =$

b)  $\frac{-3x^3 + 6x^2 + 12x}{3x}$

## **Chapter #6**

### **Factoring Polynomials and Solving Quadratic Equations**

In the previous chapter, we combined polynomials with addition, subtraction, and multiplication. This chapter concentrates on pulling apart polynomials through factoring. There are four basic factoring techniques explored in this chapter: 1) factoring greatest common factors, 2) factoring by grouping, 3) factoring by trial and error, and 4) factoring with special formulas. One common skill used to solve equations, especially quadratic equations, is to factor. At the end of the chapter you will solve quadratic equations.

#### **Section 6.1a: Greatest Common Factor of Two or More Terms**

##### **Objective**

- Find the greatest common factor of a set of terms.

**This lesson looks at common factors of polynomials. There is no assignment for this section.**

#### **Section 6.1b: Greatest Common Factor of a Polynomial**

##### **Objective**

- Factor polynomials by finding the **greatest common factor**.

### Instruct

1.  $5k + 15 = 5(k + 3)$  is an example of what property?
2.  $-10a^4b + 15a^4 = 5a^4(-2b + 3)$  and  $-10a^4b + 15a^4 = -5a^4(2b - 3)$  are both correct factorizations.  
**TRUE/FALSE**

### Practice

1. Factor the given polynomial by finding the greatest common monomial factor (or the negative of the greatest common monomial factor).
  - a)  $45 + 15x^2$
  - b)  $-3m^2n + 6mn - 3mn^2$
2. Simplify the expression. Assume no denominator is equal to zero.  $\frac{12k^6m}{-3k^2m}$

## Section 6.1c: Factoring Expressions by Grouping

### Objective

- Factor polynomials by grouping.

### Instruct

1. In the previous two sections, we factored out monomials. Now, we will factor out binomials or other polynomials. Give an example of a binomial.
2. Consider the polynomial,  $6x^2(4x + 3) - 2(4x + 3)$ . Write down the binomial that is common to both terms in the polynomial.
3. How many terms should a polynomial contain if you are going to factor by grouping?

### **Practice**

1. Write down the binomial that is common in both terms of the following expressions.

a)  $3x(a + b) + 4(a + b)$

b)  $4k^3(y - 4) - m(y - 4)$

2. Factor each expression by factoring out the common binomial.

a)  $m(x + 1) + 7(x + 1)$

b)  $k(b^2 + 1) - (b^2 + 1)$

3. Completely factor the expression by grouping.  $3x^2 - 12x + xy - 4y$

## **Section 6.2: Factoring Trinomials: Leading Coefficient 1**

### **Objective**

- Factor trinomials with a leading coefficient of 1 (of the form  $x^2 + bx + c$ ).
- Factor out a common monomial factor and then factor the remaining factor, a trinomial with leading coefficient 1.

### **Instruct**

1. In the previous chapter, you learned to multiply two binomials by using the FOIL method. Write down the word associated with each letter in the word FOIL.

F = \_\_\_\_\_

O = \_\_\_\_\_

I = \_\_\_\_\_

L = \_\_\_\_\_

2. To factor a trinomial with leading coefficient of 1, find two factors of the \_\_\_\_\_ term whose sum is the coefficient of the \_\_\_\_\_ term.
  
3. Finding the two factors to use when factoring a trinomial with leading coefficient "1", is considered by many to be a **trial and error** method. Use this method to find two factors whose product is -20 and whose sum is -8.
  
4. Considering the signs of the constant (last) term of the trinomial,  $x^2 + bx + c$ , along with the sign of the coefficient of the middle term, can help speed up the **trial and error** method.
  - a) If the sign of the constant term,  $c$ , is \_\_\_\_\_ then both factors must have the same sign.
  - b) Both are \_\_\_\_\_ if  $b$  is positive.
  - c) Both are \_\_\_\_\_ if  $b$  is negative.
  - d) If  $c$  is \_\_\_\_\_, then one factor must be negative and one factor must be positive.
  
5. Always remember, when factoring a polynomial, to look for a common \_\_\_\_\_ factor first. If there is one, be sure to include it with your final answer.

**Practice**

1. For the two numbers listed, find two factors of the first number such that their product is the first number and their sum is the second number. List these two factors.
  - a) 30, 17
  
  - b) 54, -15
  
2. Factor each trinomial given by the trial and error method.
  - a.  $k^2 + 3k - 15$
  - b.  $a^2 + 5a + 4$

3. Factor the trinomial. (Hint: look for a common monomial factor first.)

$$3x^2 - 36x + 105$$

## Section 6.3a: Factoring Trinomials by Trial and Error

### Objective

- Factor trinomials by using reverse FOIL (or trial-and-error method).

This lesson deals gives you a variety of expressions to factor. It is good practice so you might want to investigate. This lesson is not assigned, however, it is a bonus lesson to earn bonus points.

## Section 6.3b: Factoring Trinomials by Grouping

### Objective

- Factor trinomials using the ac-method.

### Instruct

- In the previous section, you learned about factoring a trinomial,  $ax^2 + bx + c$ , by the trial and error method. This method is the reverse of multiplying binomials by FOIL. This section teaches you the ac-method, which is factoring by \_\_\_\_\_.
- List the steps to factor a trinomial,  $ax^2 + bx + c$ , by the ac-method.
  - Multiply \_\_\_\_\_.
  - Find two integers whose product is \_\_\_\_\_ and whose sum is \_\_\_\_\_.
  - Rewrite the \_\_\_\_\_ (bx) using the numbers found in part (b) as coefficients.
  - Factor by \_\_\_\_\_ the first two terms and the last two terms.
  - Factoring out the common \_\_\_\_\_ factor to find two binomial factors for your trinomial  $ax^2 + bx + c$ .

**Practice**

1. Completely factor the following trinomials.

a)  $4m^2 - 11m - 3$

b)  $9w^3 - 2w^2 - 7w$

**Section 6.4a: Special Factorizations - Squares**

**Objective**

- Factor the difference of two squares.
- Factor perfect square trinomials.

**Instruct**

1. Write down the names of these three special products:

Special Product	Special Product Name
$(a + b)(a - b) = a^2 - b^2$	_____

$(a + b)^2 = a^2 + 2ab + b^2$	_____
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$(a - b)^2 = a^2 - 2ab + b^2$	_____
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2. Give an example of a perfect square trinomial.

3. Give an example of a polynomial that is the difference of two squares.

### **Practice**

1. Indicate (yes or no) if the given polynomial has a special factorization. If it does, state whether it is a perfect square trinomial or the difference of two squares

a)  $9m^2 - 16k^2$

b)  $a^2 - 6a + 9$

c)  $q^2 + 4p^2$

2. Factor the polynomial using special factorization.

$$25x^2 - 36y^2$$

## **Section 6.4b: Special Factorizations - Cubes**

### **Objective**

- Factor the sums and differences of Cubes.

**This lesson deals with the factorization of cubes. It is good practice so you might want to investigate.**

**This lesson is not assigned, however, it is a bonus lesson to complete for extra points.**

## **Section 6.5: Additional Factoring Practice**

### **Objective**

- Review general guidelines for factoring polynomials.

## Instruct

Complete the following general guideline for factoring polynomials from slide 3-4 of Instruct.

1. Look for a \_\_\_\_\_.

2. Check the number of \_\_\_\_\_.

a) Two terms

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

b) Three terms

1. \_\_\_\_\_

2. \_\_\_\_\_

a) \_\_\_\_\_

b) \_\_\_\_\_

3. \_\_\_\_\_

a) \_\_\_\_\_

b) \_\_\_\_\_

c) \_\_\_\_\_

d) \_\_\_\_\_

c) Four terms

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3. Check the \_\_\_\_\_ of factoring any of the factors.

Checking: \_\_\_\_\_.

## **Section 6.6: Solving Quadratic Equations by Factoring**

### Objective

- Solve quadratic equations by factoring.
- Write equations given the root.

## **Instruct**

1. Copy the Zero-Factor Property.

Complete the following sentences to use the factorization principle to solve a quadratic equation:

1. Add or subtract \_\_\_\_\_
  2. Factor \_\_\_\_\_
  3. Set each \_\_\_\_\_
  4. Check \_\_\_\_\_.
2. Which is the first step when solving this quadratic equation a) factor an x from each term on the left-hand side, b) or, add 8 to each side of the equation?

$$3x^2 - 10x = -8$$

## **Practice**

1. Solve the following equations by factoring.

a.  $4m^2 - 11m - 3 = 0$

b.  $9w^2 = 2w + 7$

c.  $9x^2 - 1 = 0$

## Section 6.7: Applications of Quadratic Equations

### Objective

- Use quadratic equations to solve problems related to numbers, geometry, and consecutive integers.
- Solve problems related to the Pythagorean theorem.

This is a good lesson to see how we can use factoring to solve problems. This section is not assigned, so you do not need to complete 6.7. Math 95 covers this topic.

# Chapter #7

## Rational Expressions

This chapter concentrates on working with rational expressions. You have been adding, subtracting, multiplying, dividing, and factoring polynomials in the previous two chapters. Now we concentrate our attention on the quotient of two polynomials. After performing some arithmetic on these expressions, we solve some equations involving rational expressions and finish with some applications. Working with fractions can be challenging for some folks, so work hard and stay persistent throughout the chapter.

### Section 7.1a: Defining Rational Expressions

#### Objective

- Identify rational expressions.
- Determine the values for which a given rational expression is undefined.
- Reduce rational expressions to lowest terms.

#### Instruct:

1. Give an example of a rational expression.
2. Describe the process you would use in order to determine the values of the variable that make a rational expression undefined.

3. Using the example you wrote down in #1, determine the values of the variable that makes the rational expression undefined. Be sure you are using the process you outlined in #2.
4. If only the numerator of a fraction is equal to zero, the fraction is \_\_\_\_\_.
5. If only the denominator of a fraction is equal to zero, the fraction is \_\_\_\_\_.

### **Practice**

1. Find the restricted value(s) of x for the given rational expression.

$$\frac{x+3}{x-5}$$

$$\frac{4x-5}{x^2-16}$$

## **Section 7.1b: Multiplication and Division of Rational Expressions**

### **Objective**

- Multiply rational expressions.
- Divide rational expressions.

**This is a good lesson to see how we can use factoring to solve problems. This section is not assigned.**

## **Section 7.2: Addition and Subtraction with Rational Expressions**

### **Objective**

- Add rational expressions.
- Subtract rational expressions.

**This lesson explains how rational expressions are added or subtracted. As with numerical fractions, this is done by finding a common denominator. Feel free to peruse this lesson, but it is not assigned.**

## Section 7.3: Complex Fractions

### Objective

- Simplify complex fractions.

This lesson explains how to deal with complex algebraic fractions and expressions. These fractions have fractions in either the numerator or denominator or both. That is, these are fractions with fractions. Again, feel free to check it out, but this lesson is not assigned.

## Section 7.4a: Solving Equations: Ratios and Proportions

### Objective

- Solve Proportions.

### Instruct

1. A ratio between a and b can be written “a to b”. Write this ratio in two other forms.
2. Finish the following sentence: A proportion is an equation \_\_\_\_\_.
3. One of two conditions must be true in using a proportion to solve a problem. What are these two conditions?
  - 1.
  - 2.

### Practice

1. Solve the proportion:  $\frac{4x}{7} = \frac{x+5}{3}$

2. Solve the proportion and state any restrictions on x:  $\frac{x+9}{2x-6} = \frac{7}{2}$

3. On a city map, 2 inches represents 5 miles. If the distance between two parks is 3 inches, what is the actual distance between the two parks?

## Section 7.4b: Solving Equations with Rational Expressions

### Objective

- Solve other equations with rational expressions.

### Instruct

1. One approach to solving an equation containing fractions is to “clear” the fractions. Do this by multiplying all terms on both sides of the equation by the \_\_\_\_\_ of the denominators.
2. Write down the four steps to solve an equation containing rational expressions.
  1. Find ...
  - 2.
  - 3.
  - 4.

### Practice

1. State the restrictions on the variable on the following equation. Do NOT solve the equation.

$$\frac{a-5}{a} + 3 = \frac{2}{a-3}$$

2. Solve the rational equation:  $\frac{-3}{x-3} + \frac{2}{x+7} = 1$

3. Doug is able to drive 420 miles on 20 gallons of gasoline in his Volkswagen Microbus. If he can maintain this fuel efficiency, how many gallons must he use to drive 1155 miles?

## Section 7.5: Applications Involving Rational Expressions

### Objectives

- Solve applied problems related to fractions.
- Solve applied problems related to work.
- Solve applications involving distance, rate, and time.

**This lesson deals with applications of rational expressions (fractions) and contains several good applications you might want to investigate. However, this lesson is not assigned.**

## Section 7.6: Applications: Variation

### Objective

- Understand direct, inverse, and combined variation.
- Know how to solve applied problems, dealing with direct variation, inverse variation, and combined variation.

**This lesson deals with specific applications of rational expressions (fractions) concerning direct and indirect variation. You might want to investigate. This lesson is not assigned, however, it is a bonus lesson you may complete for extra points.**

# Chapter #9

## Real Numbers and Radicals

The real number system is not complete without studying the powerful math tool we call a Radical. Remember math tools often come in pairs. Multiplication and division work as a team to undo order of operation. Adding and subtracting also undo each other. Some of you have previously learned that exponents and radicals work together in a similar pattern. Some of you will find this concept new. Chapter 9 is all about how we can manipulate radicals in our expressions, equations and word problems. This is an interesting subject which needs careful attention to details. We use radicals in many different forms in math and it is important you get comfortable with them.

### Section 9.1: Evaluating Radicals

#### Objectives

- Evaluate square roots.
- Evaluate cube roots.
- Use a calculator to evaluate square and cube roots.

#### Instruct

1. A number is squared when \_\_\_\_\_.
2. If an integer is squared, the result is called a \_\_\_\_\_.
3. Complete a chart of Perfect Squares for integers from 1 to 20 (see slide 3).
4. Is it possible to find the square root of a negative number and get a real number answer? **Yes or No.** If “no”, explain why.

### Practice

1. Evaluate the radical expressions below. If the result is irrational, round your answer to two decimal places. If there is no real number solution, write "non-real number".

a)  $\sqrt{120}$

b)  $\sqrt{-9}$

c)  $\sqrt{49}$

d)  $\sqrt[3]{-27}$

## Section 9.2: Simplifying Radicals

### Objectives

- Simplify radicals, including square roots and cube roots.

### Instruct

1. What are the two properties of square roots? Show an example of both multiplication and division.
  
2. When are square roots and cube roots considered to be in simplest form?
  
3. To avoid confusion we will assume the variables under the radical sign will represent only \_\_\_\_\_.
4. When simplifying square roots with even powers of variables, we look for even exponents by \_\_\_\_\_ the exponent by \_\_\_\_\_.
5. When simplifying square roots with odd powers of variables, we factor the expression into two terms, one with \_\_\_\_\_ and the other with an \_\_\_\_\_ exponent.

6. There are two approaches to simplifying radical expressions in the form of a single fraction in the denominator. What are these two methods?

Method 1:

Method 2:

### Practice

1. Simplify the following expressions:

a)  $-\sqrt{\frac{18}{25}}$

b)  $\sqrt[3]{27x^9y^4}$

## Section 9.3: Rational Exponents

### Objective

- Understand the meaning of  $n^{\text{th}}$  root.
- Translate expressions using radicals into expressions using rational exponents and translate expressions using rational exponents into expressions using radicals.
- Simplify expressions using the properties of rational exponents.
- Evaluate expressions of the form  $a^{m/n}$  with a calculator.

**This lesson deals with specific applications of rational exponents. That is, exponents that are fractions. What could that mean? You may want to investigate. This lesson is not assigned.**

## Section 9.4a: Addition and Subtraction of Radicals

### Objectives

- Add and subtract radical expressions.

**This lesson deals with adding and subtracting radicals. This lesson is not assigned.**



3. List the steps to solve an equation containing a radical expression:

Step 1:

Step 2:

Step 3:

Step 4:

**Practice**

1. Solve the radical equations; be sure to check for extraneous roots:

a)  $x + 1 = \sqrt{x + 7}$

b)  $5 + \sqrt{2x - 3} = 8$

**Section 9.6, 9.7 & 9.8 are covered in Math 95**

# Chapter #10

## Quadratic Equations

A large part of this course has been the study of quadratic equations. We spent a great deal of time learning to factor quadratic expressions and then equations so that we could use the factoring technique to solve quadratic equations. However, many times it is not practical to factor quadratics as the system does not always work in a straightforward manner. In this chapter, we will study other techniques for solving quadratic equations.

### Section 10.1a: Quadratic Equations: The Square Root Method

#### Objectives

- Solve quadratic equations using the definition of the square root.

#### Instruct

1. When solving a quadratic equation by factoring we must first set the equation equal to \_\_\_\_\_.
2. If  $x^2 = c$ , then  $x =$  \_\_\_\_\_.

#### Practice

\*\*NOTE: When solving a quadratic equation by the square root method be sure to isolate the squared term before taking the square root.

1. Solve the following equations.

a)  $(x - 5)^2 = 10$

b)  $4(x + 2)^2 = 15$

c)  $(2x - 5)^2 = 25$

### Section 10.1b: Quadratic Equations: Completing the Square

#### Objectives

- Solve quadratic equations by completing the square.
- Find polynomials with given roots.

**This is a good place to learn this useful “Algebra Procedure” which is occasionally used in future math classes. This section is not assigned.**

## Section 10.2: Quadratic Equations: The Quadratic Formula

### Objectives

- Write quadratic equations in standard form.
- Identify the coefficients of quadratic equations in standard form.
- Solve quadratic equations by using the quadratic formula.
- Determine the nature of the solutions (one real, two real, or no real solutions) for quadratic equations using the discriminant.

### Instruct

1. The development of the quadratic equation is shown on slides 3 and 4 of the instruct portion. It will be hard to follow if you have not spent time in section 3.2. However, you should commit this formula to memory. Write the formula below.

If  $ax^2 + bx + c = 0$ , then  $x =$

2. Define “Discriminant” and write the expression for the discriminant?

3. What does a negative discriminant indicate?

### Practice:

1. Use the quadratic formula to solve:  $2x^2 - 5x = 4$ . (First set the equation equal to zero.)

2. Determine the discriminant for the following:  $4x^2 - 12x + 9 = 0$

3. Based on the value of the discriminant in problem #2, the equation has how many REAL solutions?

## Section 10.3: Applications: Quadratic Equations

### Objectives

- Solve applied problems by using quadratic equations.

### Instruct

1. What is the last step in the given strategy to solve word problems? Why is this important?
  
2. In a right triangle with legs “a” and “b” and hypotenuse “c”, the Pythagorean Theorem states:  
 $a^2 + b^2 = \underline{\hspace{2cm}}$
3. In a right triangle, the hypotenuse is ALWAYS the longest side. **True or False**

### Practice

1. A baseball diamond is a square with 60 ft. sides. How far is it from second base to home plate?