MATH 60 Course Notebook
Chapter #1

Integers and Real Numbers

Before we start the journey into Algebra, we need to understand more about the numbers and number concepts, which form the foundation of Algebra. We will see that the number zero, 0, is important in much of what we do. We will also discuss the magnitude of numbers or absolute value.

Section 1.1a: The Real Number Line and Inequalities

Objectives

- Identify types of numbers.
- Determine if a given number is greater than, less than, or equal to other given numbers.

Instruct

1. Draw a number line with values ranging from -10 to 10.

2. On which side of the number line are the negative numbers located?

3. As we move from right to left on the number line, do the numbers get bigger or smaller?

4. Based upon your answers to questions 3 and 4 above, is a negative number always bigger or smaller than a positive number?

5. Is the inequality $-4 < -2$ the same as $-2 > -4$? Why or why not?

6. Is $\frac{7}{9}$ a rational number? Why or why not?

7. Is $\sqrt{7}$ a rational number? Why or why not?

Practice

1. a) Plot the following set of numbers on a number line; b) then list the numbers in order from least to greatest using inequality symbols.
$$\{-2, 3, -5.5, -\frac{7}{2}\}$$

2. Determine if the following statement is true or false. $-7 > -4$

3. If it is false, rewrite it in the form of a true statement using an inequality symbol.

4. Graph the following set of integers on a number line. (All integers less than 2)

Section 1.1b: Introduction to Absolute Value

Objectives

- Determine the absolute value of integers.

Instruct

1. The absolute value of a number is defined to be the distance the number is from the number, _____ on the number line.

2. Translate using the correct symbol: the absolute value of -8.

3. Is the absolute value of a real number ever negative? Yes or No

Practice

1. Find the real numbers that satisfy the equation: $|x| = 12$

2. Is there any solution to: $|x| = -12$? Why or why not?

3. List the integers that are solutions to the following: $|x| < 3$

Section 1.2: Addition with Real Numbers

Objectives

- Add real numbers.

Instruct

1. The sum of two positive integers is _____ .
2. The sum of two negative integers is _____ .
3. The sum of a positive integer and a negative integer may be positive or negative, depending on which number is _____ from zero.
4. When adding integers with the same sign (either positive or negative) we _____ the absolute value of each number and assign the common sign to our answer.
5. When adding integers with unlike signs, we _____ their absolute values and assign the sign of the number with the larger absolute value to our answer.

Practice

1. Compute the sum: $5 + (-12)$

2. Compute the sum: $-3 + 5 + (-3)$

Section 1.3: Subtraction with Real Numbers

Objectives

- Find the additive inverse (opposite) of a real number.
- Subtract real numbers.
- Find the change in value between two numbers.
- Find the net change for a set of numbers.

Instruct

1. What is the additive inverse (opposite) of -8?
2. On slide 7 of "Instruct" the screen reads, "… to subtract b from a, add the _____ of b to a.
3. "In practice, the notation, a-b is thought of as _____ of _____ numbers." So, we can rewrite 5 – 13 as 5 + (-13)
4. "To find the **change in value** of two numbers, take the final value and _____ the beginning value.

Practice

1. Perform the indicated operation: -3 – (-5) – 9

2. Is x = -4 the solution to the equation: -5 + x = -9 : **YES/NO**

Section 1.4: Multiplication and Division with Real Numbers

Objectives

- Multiply real numbers.
- Divide real numbers.
- Calculate the average (or mean) of a set of numbers.

Instruct

1. The product of a positive number and a negative number is always _____ .
2. The product of two negative numbers is always _____ .
3. a) $0 \bullet x =$ _____ for all x. b) $\frac{x}{0}$ is _____ for all x.
4. The quotient of two numbers with opposite signs will be (choose one) positive; negative or depends.
5. How do you find the average of five numbers?

Practice

1. Find the following product: $3 \bullet 4 \bullet 0 =$ _____
2. $(-3)(2)(-4) =$ _____
3. Find the average of the following 5 numbers: -3, 5, 8, 2, 3

Section 1.8: Order of Operations

Objectives

- Follow the rules for order of operations to evaluate expressions.

Instruct

1. In the mnemonic PEMDAS, what does each letter stand for? (List both the mnemonic and the mathematical operation)

P =

E =

M = D =

A = S =

2. Since M comes before D, does that mean we always multiply before we divide?

Practice

Evaluate using the proper order of operation.

1. $15 \div 3 \cdot (5 - 2) =$
2. $20 \cdot 2 \div 2^2 + 5(-2) =$
3. $16 \cdot 3 \div (2^2 - 5) =$
4. $5 - 3(2 - 8) - 4^2$

Section 1.9: Properties of Real Numbers

Objectives

- Apply the properties of real numbers to complete statements.
- Name the real number properties that justify given situations.

This lesson describes the properties we routinely use in mathematics, 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.

Chapter 2

Algebraic Expressions, Linear Equations and Applications

Section 2.1a: Variables and Algebraic Expressions

Objectives

Identify the following algebraic expressions:

- Variables
- Constants
- Terms
- Coefficients

Instruct

1. What is the difference between an expression and an equation?

2. Would $2x+5y=14$ be an example of an expression? **YES/NO**

3. How many terms are there in the following expression: $9-2x+3y-3z$?

4. In the expression, $a+b+5$ identify the variables and constants.

   Variables:

   Constant(s):

5. In the expression, $4y-x$ what is the coefficient associated with the y variable? What is the coefficient associated with the x variable?

   Coefficient of y variable: _____

   Coefficient of x variable: _____

Practice

1. Consider the following algebraic expression: 8x-3y + 4

   a. Identify each term.

   b. Indicate whether the term is a variable term or a constant term.

   c. For each variable term, identify the variable and the coefficient of the term.

Section 2.1b: Simplifying Expressions

Objectives

- Simplify algebraic expressions by combining like terms.
- Simplify algebraic expressions with parentheses by combining like terms.

Instruct

1. Are 2x and 5x like terms? Why or why not?

2. Are $2x^2$ and 6x like terms? Why or why not?

3. Identify the like terms in the expression $4x + 6xy - 7x^2y + 9y^2x$

4. Simplify the following expression $5 - 4y - 2 + 9y$

5. Define the Distributive Property (Law) and describe when it is used:

Practice

Simplify the following expressions.

1. $4x+6-2x+3$

2. $5+3x^2+2x-1-2x^2$

Section 2.1c: Evaluating Algebraic Expressions

Objectives

- Evaluate expressions for given values of the variables.

Instruct

1. Use parentheses around negative numbers when substituting. Why?

2. Evaluate the following for x=2

   a. x^2

   b. $-x^2$

   c. $(-x)^2$

Practice

Evaluate the following expressions. (Solve by using substitution)

1. $\frac{x-y}{6}$ for x=4 and y= -8

2. x^2+y^2-3 for x= -2 and y= 1

3. $-5x-7y-2$ for x=4 and y= -3

Section 2.2: Translating Phrases into Algebraic Expressions

Objectives

- Write algebraic expressions for word phrases.

Instruct

1. You may use different words or phrases to describe addition, subtraction, multiplication and division. List at least three different ways to describe each operation.

Addition	Subtraction	Multiplication	Division

**Keep in mind that addition and multiplication are commutative while subtraction and division are not. In other words, be very careful to *use the correct order* when working with subtraction and division.

Practice

Translate the following statements into algebraic expressions

1. Four more than a number.
2. Six less than twice a number.
3. The quotient of a number and six.
4. Three times the quantity of five less than x.

Section 2.3a: Solving Linear Equations using Addition and Subtraction

Objectives

- Solve linear equations of the form $x + b = c$

Instruct

1. What is an equation?
2. What is a solution to an equation?

3. Describe what it means to "satisfy an equation."

4. On slide 6 of Instruct, the text states the objective when solving a linear equation. Copy that objective below:

Practice:

Solve the following linear equations:

1. a) $x - 5 = 7$ b) $7x - 6x + 4 = 12$ c) $23.1 = 4.2 - 4.8x + 5.8x$

2. Solve the following linear equation: $x - \frac{5}{4} = \frac{1}{2}$

Section 2.3b: Solving Linear Equations using Multiplication and Division

Objectives

- Solve linear equations of the form $ax = c$

Instruct

1. If $\frac{3}{4}$ is multiplied by its reciprocal, what are the results?

2. Multiplying by a number's reciprocal is the same as dividing by _____. (slide 4)

3. $\frac{3x}{4}$ is equal to $\frac{3}{4}x$ **TRUE/FALSE**

Practice

1. Solve for x: -3x = 24

2. Solve for x: 8x – 5x = 17 + 4

3. Solve for x: $\frac{2x}{5} = \frac{5}{12}$

Section 2.4: Solving Linear Equations

Objective

- Solve equations of the form ax + b = c

Instruct

1. Often we will see problems in the form of "ax + b = c". The first step is to _____ like terms on _____ of the equation .

2. The first step in solving the equation 3x – 4 = 20 is to _____ .

3. When asked to solve an equation with fractions, we can eliminate the fractions by _____ .

Practice

Solve the following equations:

1. 3x + 2 = 18

2. 2y + 3.7 – 2.8y = 1.9

3. $\frac{3}{4}x + \frac{5}{6}x - \frac{2}{3} = \frac{5}{12}$

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 +_____ .

2. 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 _____.

3. The first step to solve the equation 3 + 2(3x + 5) = 6 – 2(x – 3) is to _____.

4. 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 the previous problems #2 and #3.

#2.

#3.

Chapter #3

Formulas and Linear Inequalities

Formulas are general rules or principles stated mathematically. In many fields such as business, economics, medicine and science formulas are used regularly. We will work with a few formulas in this chapter.

We will also look at solving inequalities. The techniques for solving inequalities are very similar to the techniques for solving equations. The key difference is that the solutions are often entire intervals of numbers versus single number solutions.

Also in this chapter, we will take these problem-solving skills and apply them to a variety of applications.

Section 3.1: Working with Formulas

Objectives

- Evaluate formulas for given values of the variables.
- Solve formulas for specified variables in terms of the other variables.
- Use formulas to solve a variety of applications.

Instruct

This lesson lists 10 formulas and describes how they are used. Many of these, you are probably already comfortable with. Write all 10 formulas and give a brief description of how each formula is used.

Formula	Use	Formula	Use
1.		2.	
3.		4.	
5.		6.	
7.		8.	
9.		10.	

Practice

The area of a trapezoid is 40 cm^2. One base is 3 cm long and the other is 5 cm long. What is the height of the trapezoid?

1. What is the formula for the Area of a trapezoid?

2. Use the formula to calculate the area.

Section 3.2: Formulas in Geometry

Objective

- Recognize and use appropriate geometric formulas for computations.

Instruct

1. Define "perimeter" and give an example.

2. What is the formula for area of a triangle?

3. What is the formula for the circumference and area of a circle?

   C = A =

Practice

1. Determine the perimeter of a rectangle with length 5 inches and width 3 inches.

2. Determine the area of a circle with radius 3 ft?

Section 3.3: Applications

Objectives

Solve the following types of problems using linear equations:

- Distance-rate-time problems.
- Simple interest problems.
- Average problems.
- Cost Problems.

Instruct

1. What do the letters in the formula D = R·T represent?

2. What do the letters in the formula I = P·r·t represent?

3. How do you find the average of a list of numbers?

Practice

1. Sam bought a book for $14.40. This was with a 20% discount from the original price. What was the original price?

2. Mackenzie runs through the countryside at a rate of 10 mph. She returns along the same route at 6 mph. If the total trip took 1 hour 36 minutes, how far did she run in total?

Section 3.4: Solving Linear Inequalities

Objectives

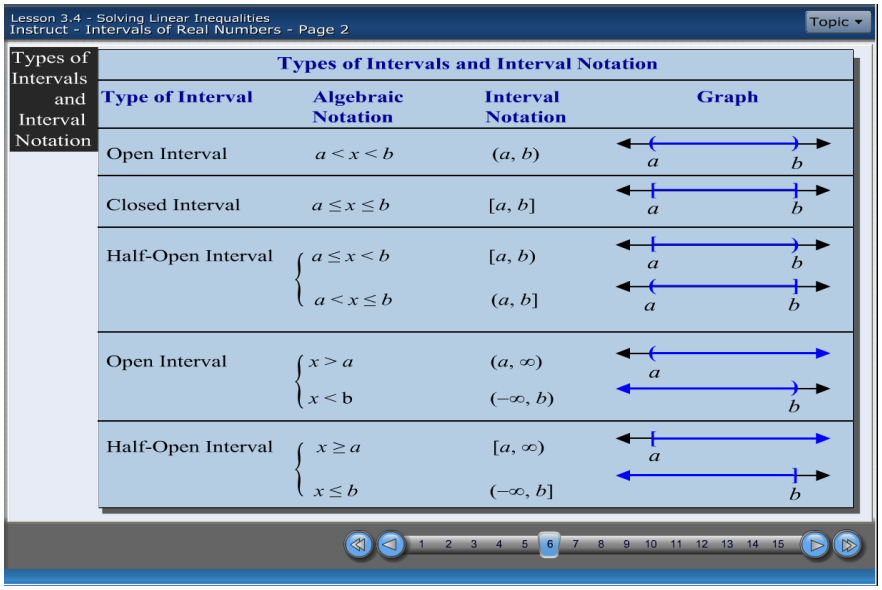
- Understand and use **set-builder notation**.
- Understand and use **interval notation**.
- Solve linear inequalities.
- Solve compound inequalities.

Instruct

1. On a number line graph, what algebraic notation is used to indicate a) an open-interval and b) a half-open interval?

2. We will use the symbol for infinity, ∞ and -∞, regularly. It is important to understand that ∞ is not a number, but rather is used to _____ .

Below is an important screen shot from the Instruct section. Study this page, write notes on it, refer to it, and in general work to understand all the notations and vocabulary.



3. Solving Linear Inequalities is very similar to solving linear equations with one important exception, which is...

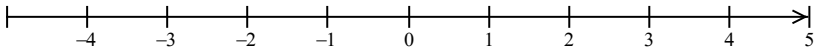
Practice

1. Solve the following inequality: $17 - 2x > 3 + 5x$

2. The following inequality is in "algebraic notation" $-3 \leq x < 2$.

   a) Put this inequality in "interval notation".

   b) Graph this inequality on the number line below.



Chapter 4

Linear Equations (only)

Chapter 4 is about graphing and writing linear equations along with identifying their parts. There are many notations to learn with many useful applications.

Section 4.1: Introduction to the Cartesian Coordinate System

Objective

- Find ordered pairs that satisfy given equations.
- Graph ordered pairs in the Cartesian coordinate system.
- Name ordered pairs corresponding to points on graphs.

Instruct

1. What does it mean when we say an ordered pair satisfies the equation?

2. What does one-to-one correspondence between points in a plane and ordered pairs mean?

3. The solution of a linear equation has an x-coordinate and a y-coordinate, which can be written as an ordered pair**. True /False**

4. The order of the numbers in an ordered pair is not critical. **True/False**

5. Draw a sketch of a Cartesians Coordinate System and label all parts *(see slide 6).*

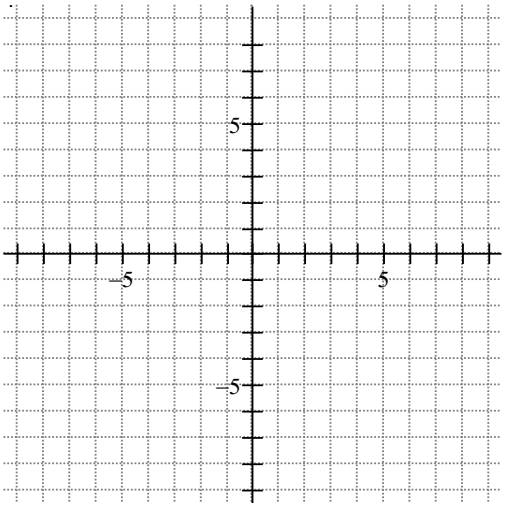
Practice

1. Pick the ordered pair that satisfies the equation 5 = 2x - y

    a. (5, 5)
    b. (-2, 9)
    c. (-4, 3)
    d. (1, 3)

2. Consider the equation, y = 2x +4. Complete the T-table and plot the ordered pairs on the graph below.

x	y
0	
-3	
	6



Section 4.2: Graphing Linear Equations by Plotting Points

Objective

- Plot points that satisfy a linear equation and draw the corresponding line.
- Recognize the standard form of a linear equation in two variables: Ax + By = C
- Find the x-intercept and y-intercept of a line and graph the corresponding line.

Instruct

1. The independent variable is assigned to the first component of the ordered pair and the dependent variable is assign to the second component. **True/False**

2. Ax + By = C is called _____ .

3. How many ordered pairs, (x, y) do you need to draw a graph of a linear equation?

4. What is the x coordinate at the y-intercept? (____, Y)

5. What is the y coordinate at the x-intercept? (X, ____)

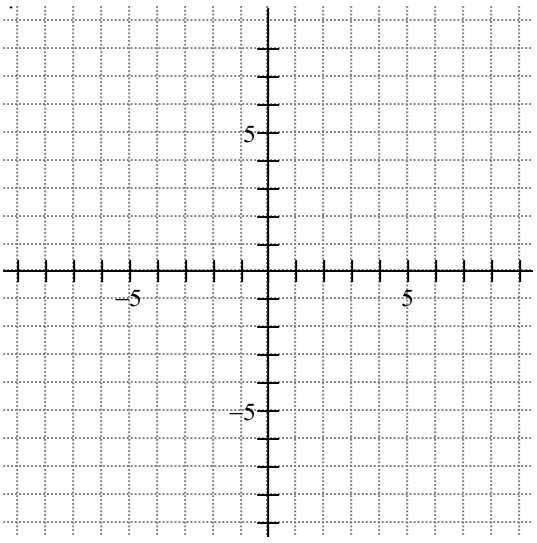
Practice

1. Consider the linear equation 5x - 4y = 10. Find the y-intercept and x-intercept and one other point. Plot your ordered pairs (x, y) and then draw a line through the points on your graph.

Y- intercept: (A) (_____, _____)

X- intercept: (B) (_____, _____)

Another point (C) (_____, _____)
Your choice



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 a line 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

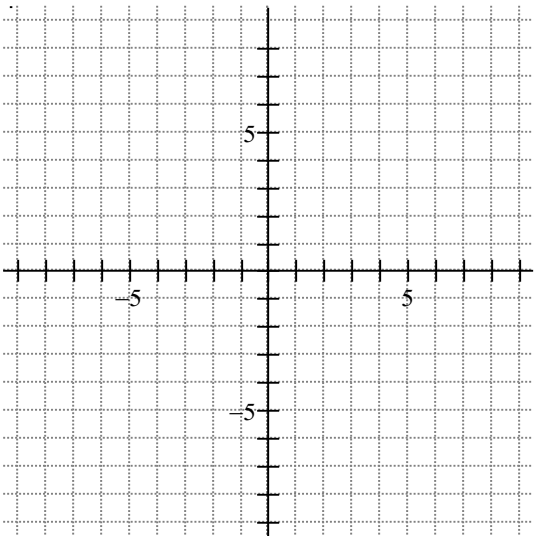
   a) What does the letter **m** represent?

   b) What does the letter **b** represent?

2. Slope is given by the ratio $\frac{rise}{run}$. 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.

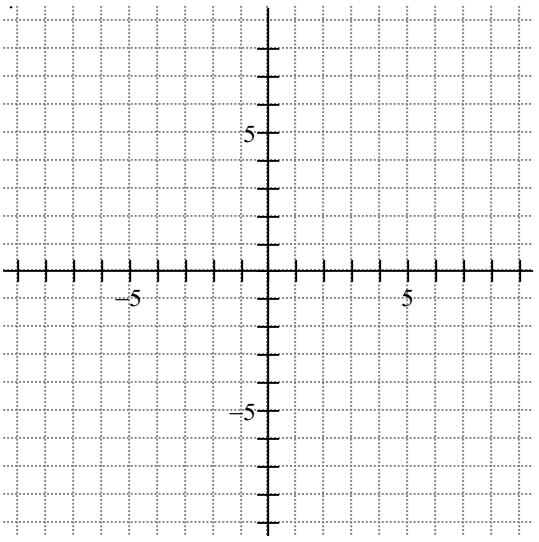
4. When graphed, the equation x = -2 is a _____ line. Graph x=-2 on the same grid as #3.



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

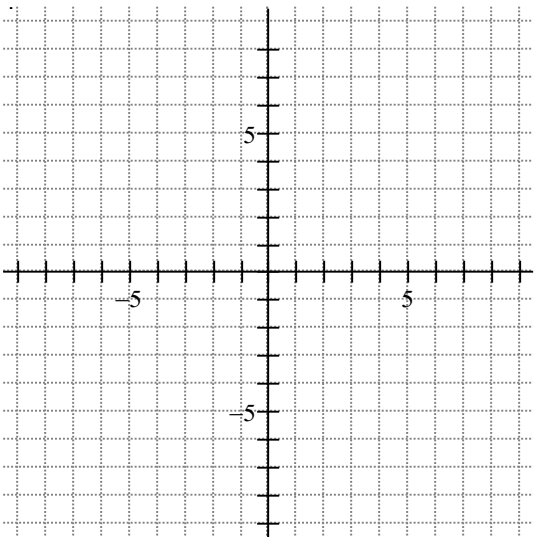


3. Graph the linear equation x = 3 and label three ordered pairs on the graph.

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.

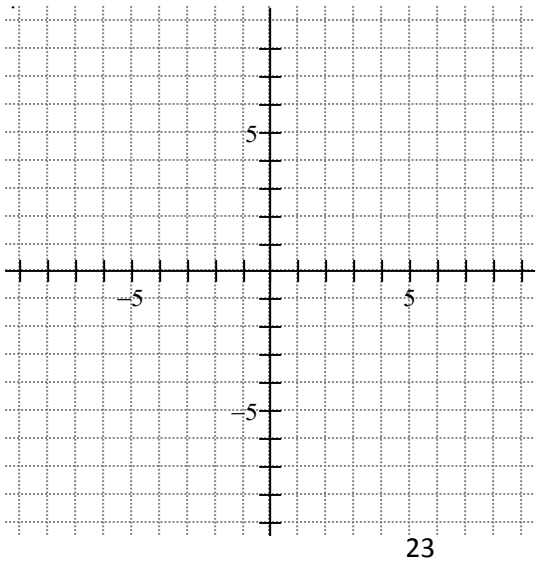
2. The point-slope form of the equation of a line is: _____ where m is the slope and (x_1, y_1) is a given point on the line.

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 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. $5^0 = 0$ **YES/NO**

4. The expression 0^0 is _____.

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

   1)

   2)

   3)

   4)

   5)

Practice

Simplify the following.

1. $x^0 + (-2y)^0$

2. $\dfrac{-12x^{-3}y}{4x^{-2}y^4}$

3. $\left(-5a^2b^5\right)\left(6a^3c\right)$

Section 5.2a: Simplifying Integer Exponents II

Objectives

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

This lesson describes the properties we routinely use in mathematics, but there is no assignment for this section. Math 65 covers this lesson.

Section 5.2b: Scientific Notation

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

This lesson describes the properties we routinely use in mathematics, but there is no assignment for this section. Math 65 covers this lesson.

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

1. Define TERM and give an example.

2. Define CONSTANT TERM and give an example.

3. The number written in front of a variable in a term is called the _____ of the variable.

4. 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.

5. Describe how to determine the degree of the polynomial and show an example.

6. To evaluate a polynomial we need 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

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.

1. $3x^4 - 7x^4$

2. $4y^2 + 5y - 10 - y^2$

3. 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.

This lesson describes the properties we routinely use in mathematics, but there is no assignment for this section. It is a "Bonus" section, so you can earn bonus points by completing this assignment.

Section 5.5: Multiplying Polynomials

Objectives

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

This lesson describes the properties we routinely use in mathematics, but there is no assignment for this section. It is a "Bonus" section, so you can earn bonus points by completing this assignment.