



Gulfport School District
Mathematics Instructional Strategies-Algebra I



Check Grade Level K ___ 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6 ___ 7 ___ 8 x 9 x 10 x 11 ___ 12 ___

Competency: 2 Content Standard(s): g
Add, subtract, multiply, and divide polynomial expressions. (DOK 1)

Vocabulary: Polynomials, vertical and horizontal formats, Punnett Square

Teaching Strategy(ies):

Tactile Learners: Use algebra tile manipulatives to add, subtract, and multiply polynomials. Use FOIL/distributive property methods for multiplying.

Visual Learners: Students will practice using the vertical and horizontal formats. Refresh students' skills on adding/subtracting "like" terms and multiplying and dividing exponents. Then have the students simplify the polynomial expressions.

Addition and Subtraction:

$$\begin{array}{r} \text{Vertical: } 5x^2 - 6x + 3 \\ + -8x^2 + 10x - 7 \\ \hline -3x^2 + 4x - 4 \end{array}$$

$$\begin{array}{l} \text{Horizontal: } (2x^2 + 7x - 1) - (-4x^2 + 8) \\ 2x^2 + 7x - 1 + 4x^2 - 8 = 6x^2 + 7x - 9 \end{array}$$

*** Note: Students will change the second polynomial expression by distributing the -1 to each term.

Multiplication: $(x+3)(x+2)$

$$\text{Horizontal: } (x+3)(x+2) = x^2 + 2x + 3x + 6 = x^2 + 5x + 6$$

FOIL: First-Outside-Inside-Last

Vertical:

$$\begin{array}{r} (x+3) \\ \bullet (x+2) \\ \hline 2x+6 \\ x^2+3x \\ \hline x^2+5x+6 \end{array}$$

The Punnett Square is also used for multiplying polynomials.

•	x	3	
	x^2	$3x$	
x			
	$2x$	6	
2			

The students will place the factors on the left and top of the square. Instruct them to multiply (as done on a multiplication chart) to fill in each square. Combine "like" terms and simplify to find the solution.

$$x^2 + 3x + 2x + 6 = x^2 + 5x + 6$$

Materials: Algebra tile manipulatives, Punnett Square

Competency: 2 Content Standard(s):

g

Vocabulary: Area formula, factors, binomials, and trinomials

Teaching Strategy(ies):

Remind students that the area of a rectangle is found by multiplying the length times the width.

“If you are given the area as a trinomial, simply factor into two binomials to find the length and width. If the area and one side is given, factor to find the missing side. This method can be used instead of long division.”

Example: A rectangular area is represented as $6x^2 - x - 15$. If one side of the rectangle is $2x + 3$, what is the other side?

$$\frac{6x^2 - x - 15}{2x + 3}$$

“To find the other side, divide the area by the given side.”

Step 1: Insert the given factor ($2x + 3$) into the numerator.

$$\frac{(2x + 3)(\quad)}{2x + 3}$$

Step 2: Fill in the second set of parentheses. The $3x$ is needed to complete the $6x^2$ part of the trinomial. You need a -5 to give you -15 in the last term. Make sure the sum of the middle terms equals the sum of $-1x$.

$$\frac{(2x + 3)(3x - 5)}{2x + 3}$$

Step 3: The completed second binomial is the unknown side. Cancel out the two binomials that are the same.

Solution: $3x - 5$

Materials: whiteboard/Promethean

Competency: 2 Content Standard(s): g

Vocabulary: Distributive property, monomial, binomial, trinomial, polynomial, review of multiplying exponents

Teaching Strategy(ies):

The following strategy enhances the understanding of multiplying polynomials by a monomial, using the distributive property. The students also use it to demonstrate **“Football Foil”** (multiplying binomials). **This is a perfect opportunity to involve your sports-minded students!!!**

Students will **role-play** football players throwing the football. Ask for volunteers. The first person represents the quarterback. In front of the class, the quarterback passes the football to each player. Discuss how the quarterback is distributing the football. Next, write a polynomial expression on the board, such as **$2x(4x^2 - 6x + 8)$** . Pass out mini-lapboards and markers. Each volunteer will now represent a term from the problem. Be sure to include extra students to hold each part of the parenthesis. Using a piece of string, show how the $2x$ is first multiplied with $4x^2$, then $-6x$, and finally 8 . The result of multiplying each term by $2x$ is written on the board.

When using this activity for multiplying binomials, the first binomial will be represented by the quarterback and the back-up quarterback. The second polynomial will be represented by two more players. After the quarterback distributes the ball to the two players, he becomes injured. Therefore, the back-up quarterback takes over and distributes the football to the two players. Now write a “binomial • binomial” problem on the board, such as $(3x - 8)(x + 5)$. The volunteer students will each write a term on the lap-boards. Students will now demonstrate the distributive method using the string. A student will write the class responses to $3x \bullet x$, $3x \bullet 5$, $-8 \bullet x$, and $-8 \bullet 5$. Have the class simplify to find the final solution.

Another variation includes multiplying binomials and larger polynomials. The distributive property will become an instant success! If a football is not available, try wadded paper!



Materials: football, string, mini-lapboards, markers, and classroom board

Competency: 2 Content Standard(s): h

Factor polynomials by using Greatest Common Factor (GCF) and **factor quadratics that have only rational roots. (DOK 1)**

Vocabulary: Factors and Greatest Common Factor

Teaching Strategy(ies):

Students will factor $6t^2 + 25t + 11$ using the Punnett Square.

$6t^2$	
	11

1. Enter the first and last terms into the box.

2. Multiply the first and last terms to find the product. ($6 \cdot 11 = 66$)

Find the factors of the product that equal the sum of the middle term.

Factors of 66 :

Sum of the Factors:

$$1 \times 66$$

$$2 \times 33$$

$$\underline{3 \times 22 = 66}$$

$$6 \times 11$$

$$\underline{3 + 22 = 25 \text{ (Middle Term)}}$$

3. Fill in the other two sections of the square.

Then determine the GCF of each row and column.

$$\bullet \quad \mathbf{3t} \quad \mathbf{+ 11}$$

	$6t^2$	$22t$
$2t$		
$+1$	$3t$	11

4. The factors are $(2t + 1)(3t + 11)$.

Materials: Diagrams to Factor Quadratic Trinomials



Gulfport School District
Mathematics Instructional Strategies- Algebra I



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Competency: 1 Content Standard(s): a

Apply properties of real numbers to simplify algebraic expressions, including polynomials. (DOK 1)

Vocabulary: Algebraic expressions, exponents, monomials, binomials, trinomials, polynomials, and combining "like-terms"

Teaching Strategy(ies):

Tactile: Students are given a variety of different objects, such as a collection of CDs. Have students group the objects according to "like" characteristics. Students should draw conclusions that variables are grouped in the same way. Suggestion: Use refrigerator magnets containing numbers and letters to also group.

Materials: Objects to be grouped, such as CDs, coins, alphabet and number refrigerator magnets

Competency: 1 Content Standard(s): a

Apply properties of real numbers to simplify algebraic expressions, including polynomials. (DOK 1)

Vocabulary: Algebraic expressions, exponents, monomials, binomials, trinomials, polynomials, and combining "like-terms"

Teaching Strategy(ies):

Using a game format like Jeopardy, students will be given a simplified expression, such as "The answer is $2x^3$." The students will then read the given questions on index cards, such as "What is $2x(x^2)$?", and simplify the expression to justify the answer. Students will be challenged to create their own solutions and have classmates create multiple expressions that will equal the given answer.

Materials: Index cards with answers and questions



Gulfport School District
Mathematics Instructional Strategies-Algebra I



Check Grade Level K ___ 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6 ___ 7 ___ 8 x 9 x 10 x 11 ___ 12 ___

Competency: 1 Content Standard(s): b

Use matrices to solve mathematical situations and contextual problems. (DOK 2)

Vocabulary: Matrix, matrices, elements, rows, columns, dimensions, scalar, factors

Teaching Strategy(ies):

To introduce elements, rows, columns, and dimensions, guide students to determine how many ways the desks in the classroom can be arranged. Example: Given twenty-four classroom desks, arrange by rows and columns using the factors of 24(1 by 24, 2 by 12, 3 by 8, and 4 by 6). Several students may move the desks. Algebra tiles may also be used to represent the arrangements.

The above activity may be used to teach that matrices must have the same dimensions in order to add and subtract.

Materials: Classroom desks, algebra tile manipulatives

Competency: 1 Content Standard(s): b

Vocabulary: Matrix, matrices, elements, rows, columns, dimensions

Teaching Strategy(ies):

After reviewing adding and subtracting matrices, have students use matrices to solve real –world problems such as finding new prices in the movie theater.

Example:

The movie theater has a new owner. The owner has decided to change the prices in the concession area. The price of the popcorn will increase by \$0.50 and the candy by \$0.75. The drink prices will by decreased by \$0. 25.

Set up a matrix arrangement to find the new cost of the refreshments.

$$\begin{bmatrix} & S & M & L \\ \text{Popcorn} & \$2.75 & 4.50 & 5.25 \\ \text{Candy} & 1.50 & 2.25 & 2.75 \\ \text{Drink} & 2.50 & 3.25 & 4.25 \end{bmatrix} + \begin{bmatrix} S & M & L \\ 0.50 & 0.50 & 0.50 \\ 0.75 & 0.75 & 0.75 \\ -0.25 & -0.25 & -0.25 \end{bmatrix} = \begin{bmatrix} \text{New Prices} \\ ? & ? & ? \\ ? & ? & ? \\ ? & ? & ? \end{bmatrix}$$

Materials: Matrices



Gulfport School District
Mathematics Instructional Strategies-Algebra I



Check Grade Level K ___ 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6 ___ 7 ___ 8 x 9 x 10 x 11 ___ 12 ___

Competency: 2 Content

Standard(s): b _____ Solve and graph absolute value equations and inequalities in one variable. (DOK 2)

Vocabulary: Absolute value equations and inequalities, conjunction, and disjunction

Teaching Strategy(ies):

Stress that the absolute value expression must be isolated before separating into two equations or inequalities and cannot equal a negative. If the original problem begins with a less than sign, its graph will connect in the middle, representing a conjunction, and will be expressed with "and". If the problem begins with a greater than sign, its graphed solution will be disconnected, representing a disjunction, and its solution will be expressed with "or".

$|x + 3| = -5$
No Solution

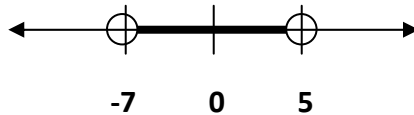
$$|x + 1| < 6$$

$$x + 1 < 6 \text{ and } x + 1 > -6$$

$$\begin{array}{r} \underline{-1} \quad \underline{-1} \\ x + 0 < 5 \end{array} \quad \begin{array}{r} \underline{-1} \quad \underline{-1} \\ x + 0 > -7 \end{array}$$

$$x < 5 \text{ and } x > -7$$

$$-7 < x < 5$$



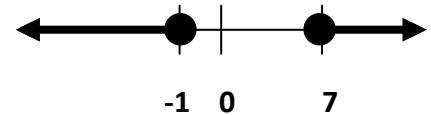
$$|x - 3| \geq 4$$

$$x - 3 \geq 4 \text{ or } x - 3 \leq -4$$

$$\begin{array}{r} \underline{+3} \quad \underline{+3} \\ x - 0 \geq 7 \end{array} \quad \begin{array}{r} \underline{+3} \quad \underline{+3} \\ x - 0 \leq -1 \end{array}$$

$$x \geq 7 \text{ or } x \leq -1$$

$$x \leq -1 \text{ or } x \geq 7$$



Materials: Absolute Value Equations / Inequalities and Graphs



Gulfport School District
Mathematics Instructional Strategies



Check Grade Level K___ 1___ 2___ 3___ 4___ 5___ 6___ 7___ 8_x 9_x 10_x 11___ 12___

Competency: 2 Content Standard(s): j

Justify why some polynomials are prime over the rational number system. (DOK 2)

Vocabulary: Prime, discriminant, and perfect square polynomials

Teaching Strategy(ies):

Introduce:

1. Use the discriminant, $b^2 - 4ac$, to determine if the quadratic polynomial is factorable. If the discriminant is not a perfect square, the polynomial is prime (and cannot be factored.)

In standard form, label coefficients A, B, and C. Solve.

Example: $x^2 + 6x + 2$ $A = 1, B = 6, C = 2$

$b^2 - 4ac = (6)^2 - 4(1)(2) = 36 - 8 = 28$ Prime (not a perfect square)

Example: $x^2 - 7x + 6$ $A = 1, B = -7, C = 6$

$b^2 - 4ac = (-7)^2 - 4(1)(6) = 49 - 24 = 25$ Factorable (perfect square)

2. The **sum** of two perfect squares is prime. Example: $x^2 + 25$ (It cannot be factored because it is prime.)

Materials: Discriminant formula and quadratic polynomials

Competency: 2 Content Standard(s): i

Vocabulary: Prime Polynomials

Teaching Strategy(ies):

Additional method to determine if the given polynomials are factorable:

First review integer rules. Then ask, "What positive or negative sign must be multiplied by the first sign to end with the last sign of the polynomial?"

Students will justify on index cards how the order of the positive and negative signs of quadratic trinomials will determine the factors.

Examples: Case One:

$$x^2 + bx + c$$

$$(+)(+) = +$$

Case Two:

$$x^2 - bx + c$$

$$(-)(-) = +$$

Case Three:

$$x^2 + bx - c$$

$$(+)(-) = -$$

Case Four:

$$x^2 - bx - c$$

$$(-)(+) = -$$

Materials: index cards, colored pens or pencils



Gulfport School District
Mathematics Instructional Strategies-Algebra 1



Check Grade Level K ___ 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6 ___ 7 ___ 8 x 9 x 10 x 11 ___ 12 ___

Competency: 4 Content Standard(s): a

Solve real-world problems involving formulas for perimeter, area, distance, and rate. (DOK 2)

Vocabulary: Perimeter, area, distance, and rate formulas

Teaching Strategy(ies):

Introduce real-world applications of formulas.

Example: Use the Distance Formula ($d = rt$):

The distance from Gulfport to Jackson is 160 miles. Driving 60 miles per hour, how long will it take for you to be within 30 miles from Jackson?

Challenge students to create real-world problems, including illustrations, and share with classmates. Begin with basic formulas and increase the level of difficulty, such as finding the area of shaded/unshaded regions.

Example: The area of a square is 49cm^2 . Find the perimeter.

- Steps: 1. To find the length of one side, first substitute the given area into the equation.
2. Use the square root to find the length of one side.

$$A = s^2$$

$$49 = s^2$$

$$\sqrt{49} = \sqrt{s^2}$$

$$7 = s$$

3. To find the perimeter, multiply the length of the side times four.

$$P = 4s$$

$$P = 4(7)$$

$$P = 28 \text{ cm}$$



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Mathematics Instructional Strategies-Algebra



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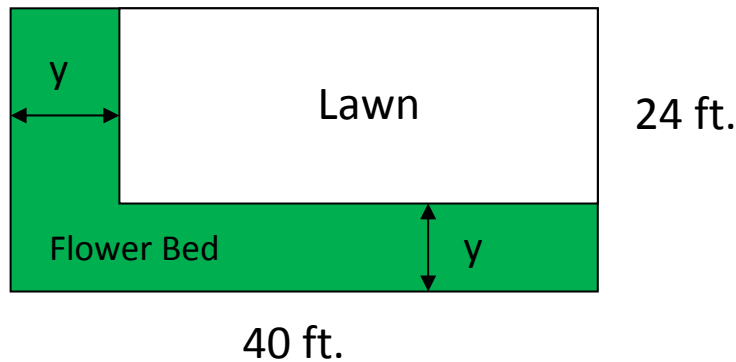
Competency: 4 Content Standard(s): c
Represent polynomial operations with area models. (DOK 2)

Vocabulary: Area, shaded and unshaded regions

Teaching Strategy(ies):

After discussing finding the area of shaded and unshaded polynomials without variables, introduce the following :

Which expression can be used to find the area, in square feet, of the flower bed?



“Think of this as the whole minus the part. Find the area of the large object. Next, find the area of the small object. Then subtract the two.”

Whole	-	Part
Area of the Large Object	-	Area of the Small Object
$A = lw$	-	$A = lw$
$A = (40)(24)$	-	$A = (40 - y)(24 - y)$
$A = 960$	-	$(960 - 64y + y^2)$
$A = 960 - 960 + 64y - y^2$		
$A = 64y - y^2$		

Materials: Area Model

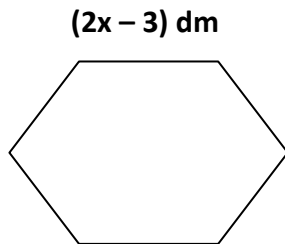
Competency: 4 Content Standard(s): c
Represent polynomial operations with area models.(DOK 2)

Vocabulary: perimeter, regular hexagon

Teaching Strategy(ies):

“One way to find the perimeter is to add all sides. With shapes having the same side measurements, multiply the number of sides by the length of the side.”

Find the perimeter of a regular hexagonal game table.



$$P = 6s$$

$$P = 6(2x - 3) \quad \text{*Use distributive property to multiply.}$$

$$P = (12x - 18) \text{ dm}$$

Materials: Area Model



Gulfport School District
Mathematics Instructional Strategies - Algebra 1



Check Grade Level K ___ 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6 ___ 7 ___ 8 x 9 x 10 x 11 ___ 12 ___

Competency: 2 Content Standard(s): a

Solve, check and graph multi-step equations and inequalities in one variable, including rational coefficients in mathematical and real-world situations.(DOK 2)

Vocabulary: “Undo”- using the inverse operation; linear equations, and linear inequalities, distributive

Teaching Strategy(ies):

Stress to students that in solving equations and inequalities, you actually “undo” the operations.

Example: $2(x - 7) - 8 = 6$

- Steps:*
1. Distributive
 2. Combine “Like” Terms
 3. Solve.

Materials: Linear Equations

Competency: 2 Content Standard(s): a

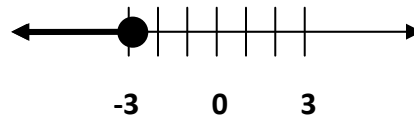
*Solve, check and **graph** multi-step equations and **inequalities** in one variable, including rational coefficients in mathematical and real-world situations.(DOK 2)*

Vocabulary: “Undo”- using the inverse operation; linear equations, and linear inequalities

Teaching Strategy(ies):

*Guide students in understanding that expressions such as $-3 \geq x$ mean the same as $x \leq -3$. One teaching strategy for **graphing** is to explain that it may be easier to rewrite the solution and place the variable on the left. Once the variable is on the left, shade in the direction of the arrow on the number line. If the inequality includes an equal sign, be sure to shade in the circle. (The closed circle represents a solution.) Otherwise, leave the circle open. (An open circle indicates the number is not part of the solution.)*

Graph the solution to the inequality $\frac{1}{3}x - 5 \geq \frac{2}{3}x - 4$. (Solution: $x \leq -3$)



Materials: Number lines