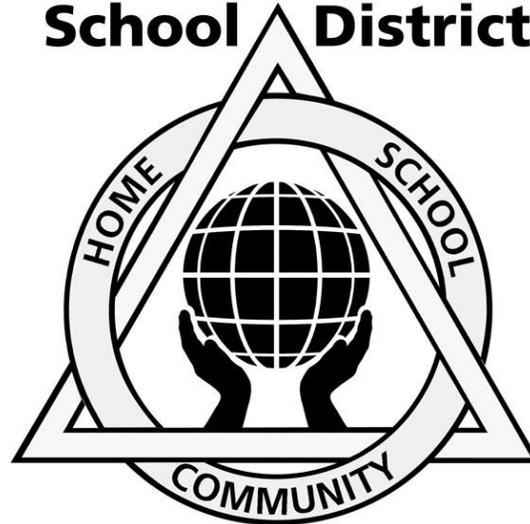


**Algebra III  
Mathematics Curriculum  
Francis Howell School District**

**Francis Howell  
School District**



**LEARNING TOGETHER**

**Board Approved: Draft**

## **Francis Howell School District Mission Statement**

Francis Howell School District is a learning community where all students reach their full potential.

## **Vision Statement**

Francis Howell School District is an educational leader that builds excellence through a collaborative culture that values students, parents, employees, and the community as partners in learning.

## **Values**

Francis Howell School District is committed to:

- Providing a consistent and comprehensive education that fosters high levels of academic achievement for all
- Operating safe and well-maintained schools
- Promoting parent, community, student, and business involvement in support of the school district
- Ensuring fiscal responsibility
- Developing character and leadership

## **Francis Howell School District Graduate Goals**

Upon completion of their academic study in the Francis Howell School District, students will be able to:

1. Gather, analyze and apply information and ideas.
2. Communicate effectively within and beyond the classroom.
3. Recognize and solve problems.
4. Make decisions and act as responsible members of society.

## **Mathematics Graduate Goals**

Upon completion of their mathematics study in the Francis Howell School District, students will be able to:

1. Communicate mathematically
2. Reason mathematically
3. Make mathematical connections
4. Use mathematical representations to model and interpret practical situations

## **Mathematics Rationale for Algebra III**

Algebra III is designed for students who struggle with Algebra II concepts to better prepare them for college level mathematics courses. The course will reinforce and build upon concepts introduced in Algebra II. The course will also prepare students for ACT and other placement tests.

### **Course Description for Algebra III**

This course will enhance the higher level thinking skills developed in Algebra II through a more in-depth study of those concepts and exploration of some pre-calculus concepts. Students will be challenged to increase their understanding of algebraic, graphical and numerical methods to analyze, translate and solve quadratic, polynomial, rational, exponential and logarithmic functions and/or relations. Modeling real world situations is an important part of the course.

#### **Curriculum Team**

Patty Bartell  
Carolyn Bien  
Sharon Spoede

Secondary Content Leader  
Director of Student Learning  
Chief Academic Office  
Superintendent

Keiren Greenhouse  
Travis Bracht  
Dr. Pam Sloan  
Dr. Renee Schuster

CURRICULUM MAP  
Semester Course  
Algebra III

Chapter	Concepts	Days
<b>Chp 1</b>	<b>Algebra, Mathematical Models, and Problem Solving</b>	
	1.4 Solving Linear Equations	1
	1.6 Properties of Integral Exponents – Whole Number Exponents ONLY	1
<b>Chp 2</b>	<b>Functions and Linear Functions</b>	
	2.1 Introduction to Functions	1
	2.2 Graphs of Functions	1
	2.3 The Algebra of Functions	1
	2.4 Linear Functions and Slope	1
	2.5 The Point-Slope Form of the Equation of a Line	2
	Review and Test	3
<b>Chp 3</b>	<b>Systems of Linear Equations</b>	
	3.1 Systems of Linear Equations in Two Variables	1
	3.2 Problem Solving and Business Applications Using Systems of Equations	3
	3.3 Systems of Linear Equations in Three Variables Applications	3
	3.5 Determinants and Cramer’s Rule – Optional	
	Review and Test	3
<b>Chp 4</b>	<b>Inequalities and Problem Solving</b>	
	4.1 Solving Linear Inequalities	1
	4.2 Compound Inequalities	2
	4.3 Equations and Inequalities	2
	4.4 Linear Inequalities in Two Variables	1
	Review and Test	3
	<b>Trigonometry</b>	
	Ratios	2
	Pythagorean Identity	2

	Right Triangle Trigonometry and Applications	2
	Special Right Triangles	2
	Review and Test	3
<b>Chp 5</b>	<b>Polynomials, Polynomial Functions, and Factoring</b>	
	5.1 Introduction to Polynomials and Polynomial Functions	1
	5.2 Multiplication of Polynomials	1
	5.3 Greatest Common Factors and Factoring by Grouping	2
	5.4 Factoring Trinomials	2
	5.5 Factoring Special Forms	2
	5.6 A General Factoring Strategy	2
	5.7 Polynomial Equations and Their Applications	2
	Review and Test	3
	<b>Semester Two</b>	
<b>Chp 6</b>	<b>Rational Expressions, Functions, and Equations</b>	
	6.1 Rational Expressions and Functions: Multiplying and Dividing	1
	6.2 Adding and Subtracting Rational Expressions	2
	6.3 Complex Rational Expressions	2
	6.4 Division of Polynomials	1
	6.5 Synthetic Division and the Remainder Theorem	1
	6.6 Rational Equations	1
	6.7 Formulas and Applications of Rational Equations	2
	Review and Test	3
<b>Chp 7</b>	<b>Radicals, Radical Functions, and Rational Exponents</b>	
	1.6 Properties of Integral Exponents – Contains Negative Rational Exponents if Needed	1
	7.1 Radical Expressions and Functions	1
	7.2 Rational Exponents	2
	7.3 Multiplying and Simplifying Radical Expressions	2
	7.4 Adding, Subtracting, and Dividing Radical Expressions	2
	7.5 Multiplying with More Than One Term and Rationalizing Denominators – Rationalize Square Roots and Cube Roots and Conjugates Involving Square Roots Only	2
	7.6 Radical Equations	2
	7.7 Complex Numbers	2
	Review and Test	3
<b>Chp 8</b>	<b>Quadratic Equations and Functions</b>	

	8.1	The Square Root Property and Completing the Square	2
	8.2	The Quadratic Formula	2
	8.3	Quadratic Functions and Their Graphs	2
	8.4	Equations Quadratic in Form	2
		Review and Test	3
<b>Chp 9</b>		<b>Exponential and Logarithmic Functions</b>	
	9.1	Exponential Functions	1
	9.2	Composite and Inverse Functions	1
	9.3	Logarithmic Functions	2
	9.4	Properties of Logarithms	2
	9.5	Exponential and Logarithmic Equations	3
	9.6	Exponential Growth and Decay: Modeling Data	2
		Review and Test	3
<b>Chp 10</b>		<b>Conic Sections and Systems of Nonlinear Equations</b>	
	10.1	Distance and Midpoint Formulas: Circles	1
	10.2	The Ellipse	2
	10.3	The Hyperbola – Supplement Translation	2
	10.4	The Parabola: Identifying Conic Sections – Supplement Focus and Directrix	3
	10.5	Systems of Nonlinear Equations in Two Variables	1
		Review and Test	3
<b>Chp 11</b>		<b>More on Polynomial and Rational Functions</b>	
	11.1	Polynomial Functions and Their Graphs	2
	11.2	Zeros of Polynomial Functions	2
	11.3	Rational Functions and Their Graphs	2
		Test and Review	3

All concepts will be taught with and without technology.  
ACT practice will be incorporated throughout the year.

<b>Content Area: Mathematics</b>	<b>Course: Algebra III</b>	<b>Strand: Algebraic Relationships 1</b>
<b>Learner Objectives: Students will use algebraic, graphical, and numerical representations to analyze, compare, translate, and solve linear equations.</b>		

- Concepts:**
- A. Identify and compare functions
  - B. Describe the effects of parameter changes
  - C. Represent mathematical situations
  - D. Describe and use mathematical manipulation
  - E. Utilize equivalent forms
  - F. Analyze change

Students Should Know	Students Should Be Able to
<ul style="list-style-type: none"> <li>● Solve linear equations</li> <li>● Evaluate function values</li> <li>● Compute a line's slope</li> </ul>	<ul style="list-style-type: none"> <li>● Find the domain and range of functions and relations</li> <li>● Determine whether a relation is a function</li> <li>● Add, subtract, multiply, and divide functions and determine appropriate domain and range functions</li> <li>● Develop, write and graph equations of lines in slope-intercept, point-slope and standard form <ul style="list-style-type: none"> <li>○ a point and the slope</li> <li>○ two points</li> </ul> </li> <li>● Develop, write and graph given a point and the slope, two points or a point and a line, the equation of <ul style="list-style-type: none"> <li>○ parallel line</li> </ul> </li> </ul>

### Instructional Support

Student Essential Vocabulary					
Domain	Relation	Slope	Point-slope Form	Perpendicular	Standard Form
Range	Vertical Line Test	Slope-intercept Form	Parallel	Intercept	Function

Sample Learning Activities	Sample Assessments		
<p><b>Learning Activity #1 :</b></p> <p>Let <math>f(x) = x^2 + 4</math> and <math>g(x) = 2 - x</math>. Find each of the following.</p> <p>a) <math>(f - g)(x)</math></p> <p>b) <math>(f + g)(x)</math></p> <p>c) <math>(fg)(x)</math></p> <p>Solution:</p> <p>a) <math>(f - g)(x) = x^2 + x + 2</math></p> <p>b) <math>(f + g)(x) = x^2 - x + 6</math></p> <p>c) <math>(fg)(x) = -x^3 + 2x^2 - 4x + 8</math></p>	<p><b>Assessment #1:</b></p> <p>Let <math>f(x) = \frac{2}{x}</math> and <math>g(x) = \frac{3}{x-5}</math>. Determine the domain of <math>(f + g)(x)</math>.</p> <p>Solution:</p> <p><math>\{x \mid x \text{ is a real number and } x \neq 0 \text{ and } x \neq 5\}</math></p>		
<b>Activity's Alignment</b>	<b>Assessment's Alignment</b>		
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; text-align: center;">CONTENT</td> <td>MA5 Mathematical systems</td> </tr> </table>	CONTENT	MA5 Mathematical systems	
CONTENT	MA5 Mathematical systems		

PROCESS	1.6 Discover/evaluate relationships
DOK	2
INSTRUCTIONAL STRATEGIES	Homework and practice

**Learning Activity #2:**

Write equations in slope-intercept form of the lines passing through the point (-8, -10) and a) parallel to and b) perpendicular to the line whose equation is  $12x + 3y = 9$ .

Solution:

parallel:  $y = -4x - 42$

perpendicular:  $y = \frac{1}{4}x - 8$

Activity's Alignment	
CONTENT	MA4 Patterns and relationships
PROCESS	1.6 Discover/evaluate relationships
DOK	2
INSTRUCTIONAL STRATEGIES	Identifying similarities and differences

CONTENT	MA5 Mathematical systems
PROCESS	1.6 Discover/evaluate relationships
DOK	2
LEVEL OF EXPECTATION	Mastery level – 80%

**Assessment #2:**

The function  $V(t) = 3.6t + 140$  models the number of Super Bowl viewers,  $v(t)$ , in millions,  $t$  years after 1995. What is the slope of this model? Describe what this means in terms of rate of change.

Solution:

The slope is 3.6. The number of Super Bowl viewers is increasing at a rate of 3.6 million per year.

Assessment's Alignment	
CONTENT	MA4 Patterns and relationships
PROCESS	1.6 Discover/evaluate relationships
DOK	3
LEVEL OF EXPECTATION	Mastery level – 75%

Student Resources	Teacher Resources
2.1 Introduction to Functions 2.2 Graphs and Functions 2.3 The Algebra of Functions 2.4 Linear Functions and Slope 2.5 The Point-Slope Form of the Equation of a Line	Algebra for College Students – Sixth Edition; Blitzer, Robert; Pearson Prentice Hall; ©2009; ISBN #13:978-0-13-601974-9

<b>Identity Equity and Readiness</b>			
Gender Equity		Technology Skill	
Racial/Ethnic Equity		Research/Information	
Disability Equity		Workplace/Job Prep	

<b>Content Area: Mathematics</b>	<b>Course: Algebra III</b>	<b>Strand: Algebraic Relationships 2</b>
<b>Learner Objectives: Students will use and solve systems of equations.</b>		

**Concepts:** A. Utilize systems

<b>Students Should Know</b>	<b>Students Should Be Able to</b>
<ul style="list-style-type: none"> <li>● Determine whether an ordered pair is a solution of a system of linear equations</li> </ul>	<ul style="list-style-type: none"> <li>● Solve systems of two variables linear equations using               <ul style="list-style-type: none"> <li>○ graphing</li> <li>○ substitution</li> <li>○ elimination method</li> </ul> </li> <li>● Solve systems of three variable linear equations using elimination method</li> <li>● Solve real world problems with systems</li> </ul>

### Instructional Support

<b>Student Essential Vocabulary</b>					
Substitution	Elimination	Ordered Pair	Ordered Triple		

**Sample Learning Activities**

**Learning Activity #1 :**

Solve the system by the method of your choice.

$$y + 3 = \frac{3}{5}x$$

$$2x - y = -4$$

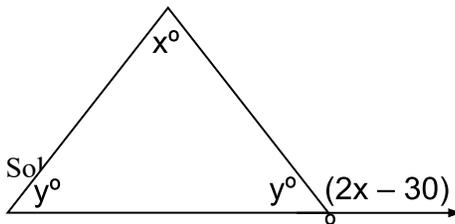
Solution: (-5, -6)

**Activity's Alignment**

CONTENT	MA5 Mathematical systems
PROCESS	3.3 Apply one's own strategies
DOK	2
INSTRUCTIONAL STRATEGIES	Homework and practice

**Learning Activity #2:**

Use the isosceles triangle to write and solve a system of equations, then find the measure of each angle.



**Sample Assessments**

**Assessment #1:**

Solve the system using the elimination method.

$$2x - y + z = 1$$

$$3x - 3y + 4z = 5$$

$$4x - 2y + 3z = 4$$

Solution: (0, 1, 2)

**Assessment's Alignment**

CONTENT	MA5 Mathematical systems
PROCESS	3.3 Apply one's own strategies
DOK	2
LEVEL OF EXPECTATION	Mastery level – 75%

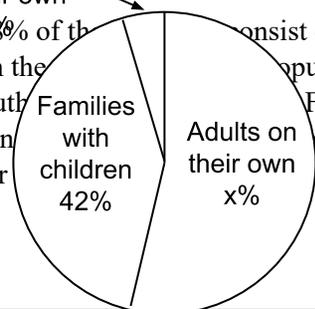
**Assessment #2:**

In 2007, there were approximately 730,000 homeless people in the United States. The circle graph shows the breakdown of the nation's homeless population:

**The United States Homeless Population**

Youths under 18 on their own

A total of 78% of the homeless population consist of people on their own. The difference in the population consisting of adults on their own and youths under 18 is 18%. Find the percentage of the U.S. homeless consisting of youths under 18 on their own and the percentage consisting of



Solution:

Adults on their own: 53%; youths under 18 on their own: 5%

Assessment's Alignment	
CONTENT	MA3 Data analysis
PROCESS	1.10 Apply information, ideas and skills
DOK	2
LEVEL OF EXPECTATION	Mastery level – 75%

Activity's Alignment	
CONTENT	MA2 Geometric and spatial sense
PROCESS	1.6 Discover/evaluate relationships
DOK	2
INSTRUCTIONAL STRATEGIES	Nonlinguistic representation

Student Resources	Teacher Resources
3.1 Systems of Linear Equations in Two Variables 3.2 Problem Solving and business Applications Using Systems of Equations 3.3 Systems of Linear Equations in Three Variables	Algebra for College Students – Sixth Edition; Blitzer, Robert; Pearson Prentice Hall; ©2009; ISBN #13:978-0-13-601974-9

Identity Equity and Readiness			
Gender Equity		Technology Skill	
Racial/Ethnic Equity		Research/Information	
Disability Equity		Workplace/Job Prep	

<b>Content Area: Mathematics</b>	<b>Course: Algebra III</b>	<b>Strand: Algebraic Relationships 3</b>
<b>Learner Objectives: The student will use symbolic algebra to solve linear inequalities.</b>		

- Concepts:**
- A. Represent mathematical situations
  - B. Utilize equivalent forms

Students Should Know	Students Should Be Able to
<ul style="list-style-type: none"> <li>• Solve linear equations</li> <li>• Graph on a number line and coordinate graph</li> </ul>	<ul style="list-style-type: none"> <li>• Write and interpret solutions in set builder notation and/or interval notation</li> <li>• Solve and graph inequalities               <ul style="list-style-type: none"> <li>○ linear</li> <li>○ compound</li> <li>○ absolute value (using boundary points)</li> <li>○ systems</li> </ul> </li> </ul>

### Instructional Support

Student Essential Vocabulary					
Interval Notation	Set Builder Notation	Intersection	Union	Infinite	Boundary Points
Compound Inequalities	Open Interval	Closed Interval	Absolute Value		

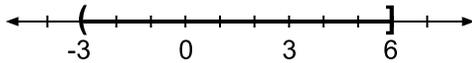
**Sample Learning Activities**

**Learning Activity #1 :**

Solve the compound inequality. Use a graph to show the solution set and express the solution in both set-builder notation and interval notation.

$$3x - 12 \leq 6 \text{ and } 3x + 1 > -8$$

Solution:



$$\{x \mid -3 < x \leq 6\}; (-3, 6]$$

**Activity's Alignment**

CONTENT	MA1 Number sense
PROCESS	1.6 Discover/evaluate relationships
DOK	2
INSTRUCTIONAL STRATEGIES	Nonlinguistic Representations

**Sample Assessments**

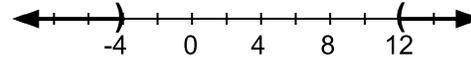
**Assessment #1:**

Solve and graph the solution set on a number line.

$$\left| 3 - \frac{3}{4}x \right| > 6$$

Solution:

$$\{x \mid x < -4 \text{ or } x > 12\} \text{ or } (-\infty, -4) \cup (12, \infty)$$



**Assessment's Alignment**

CONTENT	MA1 Number sense
PROCESS	1.6 Discover/evaluate relationships
DOK	2
LEVEL OF EXPECTATION	Mastery level – 85%

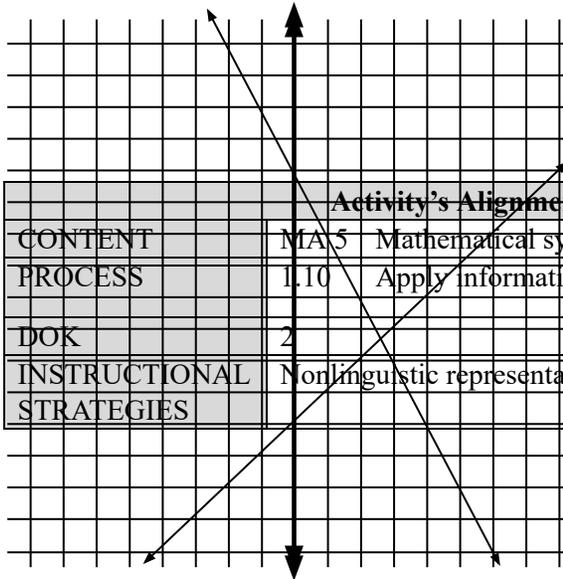
**Learning Activity #2:**

Graph the solution set of the system.

$$2x + y < 4$$

$$3y - 3x \leq -12$$

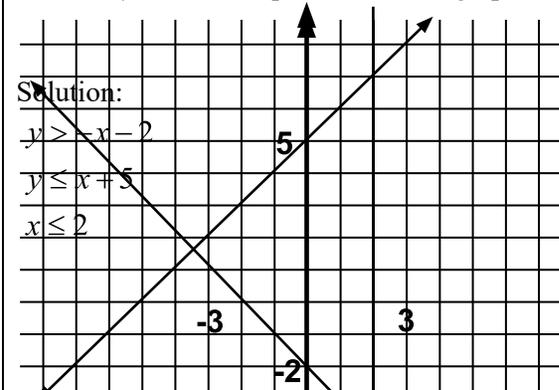
Solution:



Activity's Alignment	
CONTENT	MA.5 Mathematical systems
PROCESS	1.10 Apply information, ideas and skills
DOK	2
INSTRUCTIONAL STRATEGIES	Nonlinguistic representations

**Assessment #2:**

Write a system of inequalities for the graph.



Solution:

$$y > x + 5$$

$$y \leq -x - 2$$

$$x \leq 2$$

Assessment's Alignment	
CONTENT	MA.5 Mathematical systems
PROCESS	1.10 Apply information, ideas and skills
DOK	2
LEVEL OF EXPECTATION	Mastery level – 85%

Student Resources	Teacher Resources
4.1 Solving Linear Inequalities 4.2 Compound Inequalities 4.3 Equations and Inequalities 4.4 Linear Inequalities in Two Variables	Algebra for College Students – Sixth Edition; Blitzer, Robert; Pearson Prentice Hall; ©2009; ISBN #13:978-0-13-601974-9

<b>Identity Equity and Readiness</b>			
Gender Equity		Technology Skill	
Racial/Ethnic Equity		Research/Information	
Disability Equity		Workplace/Job Prep	

<b>Content Area: Mathematics</b>	<b>Course: Algebra III</b>	<b>Strand: Algebraic Relationships 4</b>
<b>Learner Objectives: Students will analyze characteristics and properties of two-three-dimensional geometric shapes and develop mathematical arguments about geometric relationships</b>		

**Concepts:** A: Describe and use geometric relationships

<b>Students Should Know</b>	<b>Students Should Be Able to</b>
<ul style="list-style-type: none"><li>Apply the trigonometric ratios (sine, cosine, tangent)</li></ul>	<ul style="list-style-type: none"><li>Use trigonometric relationships with right triangles to determine lengths and angle measures (G1A.2, MA.2, 3.2, DOK 2)</li></ul>

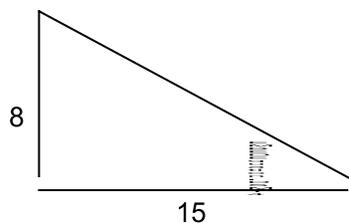
**Instructional Support**

<b>Student Essential Vocabulary</b>					
Geometric	Opposite	Angle of Elevation	Hypotenuse	Angle of Depression	Reference Angle
Trigonometric	Adjacent	Sine	Cosine	Tangent	Angle Measures

<b>Sample Learning Activities</b>	<b>Sample Assessments</b>
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### Learning Activity #1 :

Use the right triangle to find the ratios for  $\sin\theta$ ,  $\cos\theta$ , and  $\tan\theta$



Solution: use Pythagorean's theorem to find the hypotenuse.

$$8^2 + 15^2 = c^2$$

$$64 + 225 = c^2$$

$$289 = c^2$$

$$c = 17$$

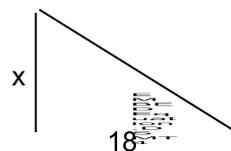
$$\sin\theta = \frac{\text{opposite leg}}{\text{hypotenuse}} \quad \cos\theta = \frac{\text{adjacent leg}}{\text{hypotenuse}} \quad \tan\theta = \frac{\text{opposite leg}}{\text{adjacent leg}}$$

$$\sin\theta = \frac{8}{17} \quad \cos\theta = \frac{15}{17} \quad \tan\theta = \frac{8}{15}$$

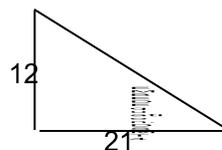
### Assessment #1:

Use trigonometric functions to find the value of x

1.



2.



Solutions:

$$1. \quad \tan 32^\circ = \frac{x}{18}$$

$$x = 18 \tan 32^\circ$$

$$x = 11.25$$

$$2. \quad \tan x^\circ = \frac{12}{21}$$

$$\tan^{-1}(12/21)$$

$$\text{use 2}^{\text{nd}} \text{ key} \quad x = 29.7^\circ$$

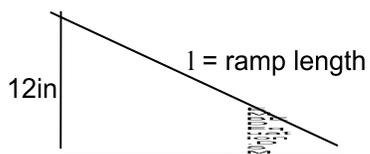
Activity's Alignment	
CONTENT	MA2 Geometric and spatial sense
PROCESS	3.2 Apply strategies of others
DOK	2
INSTRUCTIONAL STRATEGIES	Similarities and differences

Assessment's Alignment	
CONTENT	MA2 Geometric and spatial sense
PROCESS	3.2 Apply strategies of others
DOK	2
LEVEL OF EXPECTATION	Mastery Level – 85%

**Learning Activity #2:**

A skateboard ramp will have a height of 12 inches and the angle between the ramp and the ground should be  $15^\circ$ . Draw and label a sketch of this situation. Find the length ( $l$ ) of the ramp.

Solution:



$$\sin 15^\circ = \frac{12}{l}$$

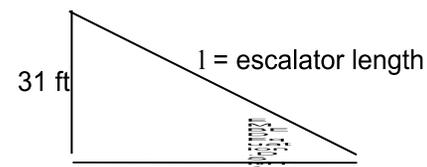
$$l = \frac{12}{\sin 15^\circ}$$

$$l = 46.4in$$

**Assessment #2:**

An escalator at the mall must lift customers to height of 31 feet. If the angle of elevation is  $26^\circ$ , what will be the length of the escalator?

Solution:



$$\sin 26^\circ = \frac{31}{l}$$

$$l = \frac{31}{\sin 26^\circ}$$

$$l = 70.7ft$$

**Activity's Alignment**

CONTENT	MA2 Geometric and spatial sense
PROCESS	3.2 Apply strategies of others
DOK	2
INSTRUCTIONAL STRATEGIES	Nonlinguistic representation

**Assessment's Alignment**

CONTENT	MA2 Geometric and spatial sense
PROCESS	3.2 Apply strategies of others
DOK	2
LEVEL OF EXPECTATION	Mastery Level – 80%

**Student Resources**

Supplement

**Teacher Resources**

**Identity Equity and Readiness**

Gender Equity		Technology Skills	
Racial/Ethnic Equity		Research/Information	
Disability Equity		Workplace/Job Prep	



<b>Content Area: Mathematics</b>	<b>Course: Algebra III</b>	<b>Strand: Algebraic Relationships 5</b>
<b>Learner Objectives: Students will use algebraic, graphical, and numerical methods to simplify polynomials and solve polynomial equations.</b>		

- Concepts:**
- A. Describe and use mathematical manipulation
  - B. Utilize equivalent forms

Students Should Know	Students Should Be Able to
<ul style="list-style-type: none"> <li>• Understand Greatest Common Factor (GCF)</li> </ul>	<ul style="list-style-type: none"> <li>• Simplify, add, subtract, and multiply polynomials</li> <li>• Determine the factors of polynomials               <ul style="list-style-type: none"> <li>○ GCF</li> <li>○ differences of square</li> <li>○ factor by grouping</li> <li>○ sum and difference of cube</li> <li>○ factor trinomials with any leading coefficient</li> </ul> </li> <li>• Solve quadratic equations by factoring</li> </ul>

### Instructional Support

Student Essential Vocabulary					
Factor	Degree of a Polynomial	Zero-product Principal	Leading Coefficient	Degree of a Term	GCF
Trinomial	Binomial				

Sample Learning Activities	Sample Assessments
<p><b>Learning Activity #1 :</b></p> <p>Correct the following problems:</p> <ol style="list-style-type: none"> <li><math>(12x - 1.7) - (15x + 6.2) = 12x - 1.7 - 15x + 6.2 = -3x + 4.5</math></li> <li><math>(3x - 2.4) + (11x + 3.8) = 3x - 2.4 + 11x + 3.8 = 14x + 6.2</math></li> <li><math>7y(3z - 2) + 1 = 21yz - 14y + 7y = 21yz - 7y</math></li> <li><math>2x + 3x(12 - x) = 5x(12 - x) = 60x - 5x^2</math></li> </ol> <p><b>Solution:</b></p> <ol style="list-style-type: none"> <li><math>(12x - 1.7) - (15x + 6.2) = 12x - 1.7 - 15x - 6.2 = -3x - 7.9</math></li> <li><math>(3x - 2.4) + (11x + 3.8) = 3x - 2.4 + 11x + 3.8 = 14x + 1.4</math></li> <li><math>7y(3z - 2) + 1 = 21yz - 14y + 1</math></li> <li><math>2x + 3x(12 - x) = 2x + 36x - 3x^2 = 38x - 3x^2</math></li> </ol>	<p><b>Assessment #1:</b></p> <p>Perform each indicated operation.</p> <ol style="list-style-type: none"> <li><math>(-y^2 + 6y - 1) + (3y^2 - 4y - 10)</math></li> <li><math>(5z^4 - 6z^2 + z + 1) - (7z^4 - 2z + 1)</math></li> <li>Subtract <math>(x - 5)</math> from <math>(x^2 - 6x + 2)</math></li> <li><math>(2x^2 + 6x - 5) + (5x^2 - 10x)</math></li> <li><math>(5x - 3)^2</math></li> <li><math>(5x^2 - 14x - 3) / (5x + 1)</math></li> <li><math>(2x^4 - 3x^2 + 5x - 2) / (x + 2)</math></li> <li><math>(4x - 3)(5x + 2)</math></li> <li><math>5x^2(6x + 7)</math></li> <li><math>(x - 2)(x^2 + 2x + 4)</math></li> </ol> <p><b>Solution:</b></p> <ol style="list-style-type: none"> <li><math>2y^2 + 2y - 11</math></li> <li><math>-2z^4 - 6z^2 + 3z</math></li> <li><math>x^2 - 7x + 7</math></li> <li><math>7x^2 - 4x - 5</math></li> </ol>

5.  $25x^2 - 30x + 9$

6.  $x - 3$

7.  $2x^3 - 4x^2 + 5x - 5 + \frac{8}{x+2}$

8.  $20x^2 - 7x - 6$

9.  $30x^3 + 35x^2$

10.  $x^3 - 8$

Activity's Alignment	
CONTENT	MA1 Number sense
PROCESS	1.6 Discover/evaluate relationships
DOK	2
INSTRUCTIONAL STRATEGIES	Homework and practice

Assessment's Alignment	
CONTENT	MA1 Number sense
PROCESS	1.6 Discover/evaluate relationships
DOK	2
LEVEL OF EXPECTATION	Mastery level – 90%

**Learning Activity #2:**

Determine whether each statement is true or false. If the statement is false, make the necessary change(s) to produce a true statement..

1.  $4x^2 - 121 = (2x - 11)^2$

2.  $x^3 + 27 = (x + 3)(x^2 + 6x + 9)$

3.  $x^3 - 64 = (x - 4)^3$

4.  $9x^2 + 30x + 25 = (3x + 5)^2$

**Assessment #2:**

Multiple Choice: Select the correct answer.

1. Which factorization of  $10x^2 - 2x - 2$  is correct?

a.  $2(5x^2 - x + 1)$

b.  $2(5x^2 - x)$

c.  $2(5x^2 - x - 2)$

d.  $2(5x^2 - x - 1)$

2. Which factorization of  $x^4 + 5x^3 - x^2$  is correct?

a.  $-1(x^4 + 5x^3 + x^2)$

b.  $x^2(x^2 + 5x^3 - x^2)$

5.  $x^2 + 36 = (x + 6)(x - 6)$

Solution:

1. false;  $(2x - 11)(2x + 11)$
2. false;  $(x + 3)(x^2 - 3x + 9)$
3. false;  $(x - 4)(x^2 + 4x + 16)$
4. true
5. false; prime

Activity's Alignment	
CONTENT	MA1 Number sense MA4 Patterns and relationships
PROCESS	1.6 Discover/evaluate relationships
DOK	3
INSTRUCTIONAL STRATEGIES	Cooperative learning

c.  $x^2(x^2 + 5x - 1)$

d.  $5x^2(x^2 + 5x - 5)$

Find all positive and negative integers for b so the expression is factorable.

3.  $x^2 + bx + 6$
4.  $x^2 + bx - 10$

Solution:

1. d
2. c
3. -5, 5, -7, 7
4. -3, 3, -9, 9

Assessment's Alignment	
CONTENT	MA1 Number sense MA4 Patterns and relationships
PROCESS	1.6 Discover/evaluate relationships
DOK	2
LEVEL OF EXPECTATION	Mastery level – 80%

Student Resources	Teacher Resources
5.1 Introduction to Polynomials and Polynomial Functions 5.2 Multiplication of Polynomials 5.3 Greatest Common Factors and Factoring by Grouping 5.4 Factoring Trinomials 5.5 Factoring Special Forms	Algebra for College Students – Sixth Edition; Blitzer, Robert; Pearson Prentice Hall; ©2009; ISBN #13:978-0-13-601974-9

5.6	A General Factoring Strategy	
5.7	Polynomial Equations and Their Applications	

Identity Equity and Readiness			
Gender Equity		Technology Skill	
Racial/Ethnic Equity		Research/Information	
Disability Equity		Workplace/Job Prep	

<b>Content Area: Mathematics</b>	<b>Course: Algebra III</b>	<b>Strand: Algebraic Relationships 6</b>
<b>Learner Objectives: Students will use algebraic, graphical, and numerical methods to simplify rational expressions and solve rational equations.</b>		

- Concepts:**
- A. Describe and use mathematical manipulation
  - B. Utilize equivalent forms

<b>Students Should Know</b>	<b>Students Should Be Able to</b>
<ul style="list-style-type: none"> <li>• Find Lowest Common Denominator (LCD)</li> <li>• Rational expression</li> <li>• Rational function</li> <li>• Long division algorithm</li> </ul>	<ul style="list-style-type: none"> <li>• Simplify, add, subtract, multiply and divide rational expressions</li> <li>• Simplify complex rational expressions (complex fraction)</li> <li>• Solve rational equations</li> </ul>

### Instructional Support

<b>Student Essential Vocabulary</b>					
LCD	Rational Function	Rational Expression	Synthetic Division	Remainder Theorem	Polynomial Long Division

Sample Learning Activities	Sample Assessments
<p><b>Learning Activity #1 :</b></p> <p>Determine whether each statement is true or false. If the statement is false, make the necessary change(s) to produce a true statement.</p> <p>1. <math>\frac{x^2 - 25}{x - 5} = x - 5</math></p> <p>2. <math>\frac{x^2 + 7}{7} = x^2 + 1</math></p> <p>3. The restrictions on the values of x when performing the division <math>\frac{f(x)}{g(x)} \div \frac{h(x)}{k(x)}</math> are <math>g(x) \neq 0</math>, <math>k(x) \neq 0</math>, and <math>h(x) \neq 0</math>.</p> <p>4. <math>\frac{2}{x+3} + \frac{3}{x+4} = \frac{5}{2x+7}</math></p> <p>5. <math>\frac{a}{b} + \frac{a}{c} = \frac{a}{b+c}</math></p> <p><b>Solution:</b></p> <p>1. false; <math>\frac{x^2 - 25}{x - 5} = \frac{(x - 5)(x + 5)}{x - 5} = x + 5</math></p> <p>2. false; prime or <math>\frac{1}{7}x^2 + 1</math></p> <p>3. true</p>	<p><b>Assessment #1:</b></p> <p>In the polynomial, find the second numerator that makes the statement true.</p> <p>1. <math>\frac{x^2 - 4}{x^2 - 7x + 10} \cdot \frac{?}{2x^2 + 11x + 14} = 1</math></p> <p><b>Solution:</b></p> <p>1. <math>(x - 5)(2x + 7)</math></p>

4. false;  $\frac{2}{x+3} + \frac{3}{x+4} = \frac{2(x+4)}{(x+3)(x+4)} + \frac{3(x+3)}{(x+3)(x+4)}$

$$= \frac{2x+8}{(x+3)(x+4)} + \frac{3x+9}{(x+3)(x+4)} = \frac{5x+17}{(x+3)(x+4)}$$

5. false;  $\frac{a}{b} + \frac{a}{c} = \frac{ac+ab}{bc}$

Activity's Alignment	
CONTENT	MA 4 Patterns and relationships
PROCESS	1.6 Discover/evaluate relationships
DOK	2
INSTRUCTIONAL STRATEGIES	Identifying similarities and differences

**Learning Activity #2:**

Which division problems are candidates for the synthetic division process?

1.  $(5x^2 - 3x + 2) \div (x + 2)$

2.  $(x^4 - 6) \div (x^3 + 3x + 2)$

3.  $(x^7 - 2) \div (x^5 + 1)$

4.  $(3x^2 + 7x - 1) \div (x - \frac{1}{3})$

**Assessment's Alignment**

CONTENT	MA4 Patterns and relationships
PROCESS	1.6 Discover/evaluate relationships
DOK	2
LEVEL OF EXPECTATION	Mastery level – 85%

**Assessment #2:**

Perform the indicated operation and/or simplify.

1.  $\frac{22x+8}{11x+4}$

2.  $\frac{7x+28}{2x+4} \div \frac{x^2+2x-8}{x^2-2x-8}$

3.  $\frac{2}{x^2-16} - \frac{3x}{x^2+8x+16} + \frac{3}{x+4}$

Solution:

1. yes                      3. no  
 2. no                        4. yes

$$\frac{x^2 + 5x - 6}{\frac{4x + 3}{(x + 6)^2}}$$

4.

$$(4x^4 - 3x^3 - x - 1) \div (x + 3)$$

5.

Solution:

1. 2

$$2. \frac{7(x - 4)}{2(x - 2)}$$

$$3. \frac{2(7x - 20)}{(x - 4)(x + 4)}$$

$$4. \frac{2(x - 1)}{x + 6}$$

$$5. 4x^3 - 15x^2 + 45x - 136 + \frac{407}{x + 3}$$

Activity's Alignment	
CONTENT	MA1 Number sense
PROCESS	1.6 Discover/evaluate relationships
DOK	1
INSTRUCTIONAL STRATEGIES	Homework and practice

Assessment's Alignment	
CONTENT	MA4 Patterns and relationships
PROCESS	1.6 Discover/evaluate relationships
DOK	2
LEVEL OF EXPECTATION	Mastery level – 80%

Student Resources		Teacher Resources
6.1	Rational Expressions and Functions: Multiplying and Dividing	Algebra for College Students – Sixth Edition; Blitzer, Robert; Pearson Prentice Hall; ©2009; ISBN #13:978-0-13-601974-9
6.2	Adding and Subtracting Rational Expressions	
6.3	Complex Rational Expressions	
6.4	Division of Polynomials	
6.5	Synthetic Division and the Remainder Theorem	
6.6	Rational Equations	

Identity Equity and Readiness			
Gender Equity		Technology Skill	
Racial/Ethnic Equity		Research/Information	
Disability Equity		Workplace/Job Prep	

<b>Content Area: Mathematics</b>	<b>Course: Algebra III</b>	<b>Strand: Algebraic Relationships 7</b>
<b>Learner Objectives: Students will use algebraic, graphical and numerical methods to analyze and solve radical equations.</b>		

- Concepts:**
- A. Utilize equivalent forms
  - B. Describe and use mathematical manipulation

Students Should Know	Students Should Be Able to
<ul style="list-style-type: none"> <li>• Radical expression</li> <li>• Radical equations</li> </ul>	<ul style="list-style-type: none"> <li>• Simplify radicals with different indices</li> <li>• Add, subtract, multiply and divide radicals</li> <li>• Solve equations that contain radicals or radical expressions</li> <li>• Add, subtract, multiply, and divide complex numbers</li> <li>• Simplify expressions with rational exponents</li> <li>• Simplify radical expressions using rational exponents</li> </ul>

### Instructional Support

Student Essential Vocabulary					
Cube Root	Radical Expression	Radical Equation	Forward Index	Radicand	Rationalize
Imaginary Number	Conjugate	Radical Notation	Rational Exponent		

Sample Learning Activities	Sample Assessments
<p><b>Learning Activity #1 :</b></p> <p>Determine whether each statement is true or false. If the statement is false, make the necessary change(s) to produce a true statement.</p> <ol style="list-style-type: none"> <li>The domain of <math>f(x) = \sqrt[3]{x-4}</math> is <math>[4, \infty)</math>.</li> <li><math>2\sqrt{5} \cdot 6\sqrt{5} = 12\sqrt{5}</math></li> <li><math>\sqrt[3]{4} \cdot \sqrt[3]{4} = 4</math></li> <li><math>\sqrt{12} = 2\sqrt{3}</math></li> <li><math>\sqrt{5} + \sqrt{5} = \sqrt{10}</math></li> <li><math>4\sqrt{3} + 5\sqrt{3} = 9\sqrt{3}</math></li> <li><math>\frac{\sqrt{-8}}{\sqrt{2}} = -2</math></li> <li>The first step in solving <math>\sqrt{x+6} = x+2</math> is to square both sides obtaining <math>x+6 = x^2+4</math>.</li> <li>The equation <math>\sqrt{x+4} = -5</math> and <math>x+4 = 25</math> have the same solution set.</li> <li>The equation <math>-\sqrt{x} = 9</math> has no solution.</li> </ol>	<p><b>Assessment #1:</b></p> <ol style="list-style-type: none"> <li>A mathematics teacher recently purchased a birthday cake for her son with the inscription  Happy <math>\left(2^{\frac{5}{2}} \cdot 2^{\frac{3}{4}} \div 2^{\frac{1}{4}}\right)h</math> Birthday.  How old is the son?</li> <li>The birthday boy in Problem 1, excited by the inscription on the cake, tried to wolf down the whole thing. Teacher Mom, concerned about the possible metamorphosis of her son into a blimp, exclaimed,  <math display="block">\frac{8^{\frac{-4}{3}} + 2^{-2}}{16^{\frac{-3}{4}} + 2^{-1}}</math> “Hold on! It is your birthday so why not take <math>\frac{1}{4}</math> of the cake? I’ll eat half of what’s left over.”  How much of the cake did the mom eat?</li> </ol> <p><b>Solution:</b></p> <ol style="list-style-type: none"> <li>8 years old</li> <li><math>\frac{1}{4}</math> of the cake</li> </ol>

Solution:

1. false; The domain is all real numbers.

2. false;  $2\sqrt{5} \cdot 6\sqrt{5} = 60$

3. false;  $\sqrt[3]{4} \cdot \sqrt[3]{4} = \sqrt[3]{16}$

4. true

5. false;  $\sqrt{5} + \sqrt{5} = 2\sqrt{5}$

6. true

7. false;  $\frac{\sqrt{-8}}{\sqrt{2}} = 2i$

8. false; You would obtain  $x + 6 = x^2 + 4x + 4$

9. false;  $\sqrt{x+4} = -5$  has no real solution.  $x + 4 = 25$  has a solution of 21.

10. true

Activity's Alignment	
CONTENT	MA1 Number sense
PROCESS	1.6 Discover/evaluate relationships
DOK	2
INSTRUCTIONAL STRATEGIES	Homework and practice

Assessment's Alignment	
CONTENT	MA1 Number sense
PROCESS	1.6 Discover/evaluate relationships
DOK	2
LEVEL OF EXPECTATION	Mastery level – 70%

**Assessment #2:**

Perform the indicated operations and simplify if possible.

**Learning Activity #2:**

Find and correct the error.

$$1. \quad \frac{\sqrt[3]{64}}{\sqrt{64}} = \sqrt[3]{\frac{64}{64}} = \sqrt[3]{1} = 1$$

$$2. \quad \frac{\sqrt[4]{16}}{\sqrt{4}} = \sqrt[4]{\frac{16}{4}} = \sqrt[4]{4}$$

$$3. \quad \sqrt{5x-1} + 4 = 7$$

$$(\sqrt{5x-1} + 4)^2 = 7^2$$

$$5x - 1 + 16 = 49$$

$$5x = 34$$

$$x = \frac{34}{5}$$

$$4. \quad \sqrt{-9} + \sqrt{-16} = \sqrt{-25}$$

$$= i\sqrt{25}$$

$$= 5i$$

$$5. \quad (\sqrt{-9})^2 = \sqrt{-9} \cdot \sqrt{-9}$$

$$= \sqrt{81}$$

$$= 9$$

**Solution:**

$$1. \quad \frac{\sqrt[3]{64}}{\sqrt{64}} = \frac{4}{8} = \frac{1}{2}$$

$$1. \quad \sqrt{125x^3} - 3\sqrt{20x^3}$$

$$2. \quad \sqrt{3}(\sqrt{16} - \sqrt{2})$$

$$3. \quad (\sqrt{x} + 1)^2$$

$$4. \quad (\sqrt{2} - 4)(\sqrt{3} + 1)$$

$$5. \quad (\sqrt{5} + 5)(\sqrt{5} - 5)$$

$$6. \quad -\sqrt{-8}$$

$$7. \quad (12 - 6i) - (12 - 3i)$$

$$8. \quad (6 - 2i)(6 + 2i)$$

$$9. \quad (4 + 3i)^2$$

$$10. \quad \frac{1 + 4i}{1 - i}$$

**Solution:**

$$1. \quad -x\sqrt{5x}$$

$$2. \quad 4\sqrt{3} - \sqrt{6}$$

$$2. \quad \frac{\sqrt[4]{16}}{\sqrt{4}} = \frac{2}{2} = 1$$

$$3. \quad \begin{aligned} \sqrt{5x-1} + 4 &= 7 \\ \sqrt{5x-1} &= 3 \\ (\sqrt{5x-1})^2 &= 3^2 \\ 5x - 1 &= 9 \\ 5x &= 10 \\ x &= 2 \end{aligned}$$

$$4. \quad \begin{aligned} \sqrt{-9} + \sqrt{-16} &= 3i + 4i \\ &= 7i \end{aligned}$$

$$5. \quad \begin{aligned} (\sqrt{-9})^2 &= \sqrt{-9} \cdot \sqrt{-9} \\ &= 3i \cdot 3i \\ &= 9i^2 \\ &= -9 \end{aligned}$$

Activity's Alignment	
CONTENT	MA1 Number sense
PROCESS	1.6 Discover/evaluate relationships
DOK	2
INSTRUCTIONAL STRATEGIES	Homework and practice

$$3. \quad x + 2\sqrt{x} + 1$$

$$4. \quad \sqrt{6} - 4\sqrt{3} + \sqrt{2} - 4$$

$$5. \quad -20$$

$$6. \quad -2i\sqrt{2}$$

$$7. \quad -3i$$

$$8. \quad 40$$

$$9. \quad 7 + 24i$$

$$10. \quad \frac{-3 + 5i}{2}$$

Assessment's Alignment	
CONTENT	MA1 Number sense
PROCESS	1.6 Discover/evaluate relationships
DOK	2
LEVEL OF EXPECTATION	Mastery level – 85%

Student Resources		Teacher Resources
7.1	Radical Expressions and Functions	Algebra for College Students – Sixth Edition; Blitzer, Robert; Pearson Prentice Hall; ©2009; ISBN #13:978-0-13-601974-9
7.2	Rational Exponents	
7.3	Multiplying and Simplifying Radical Expressions	
7.4	Adding, Subtracting, and Dividing Radical Expressions	
7.5	Multiplying with More Than One Term and Rationalizing Denominators	
7.6	Radical Equations	
7.7	Complex Numbers	

Identity Equity and Readiness			
Gender Equity		Technology Skill	
Racial/Ethnic Equity		Research/Information	
Disability Equity		Workplace/Job Prep	

<b>Content Area: Mathematics</b>	<b>Course: Algebra III</b>	<b>Strand: Algebraic Relationships 8</b>
<b>Learner Objectives: Students will use algebraic, graphical, and numerical methods to analyze, compare, translate, and solve quadratic equations.</b>		

- Concepts:**
- A. Describe the effects of parameter changes
  - B. Utilize equivalent forms
  - C. Represent mathematical situation

Students Should Know	Students Should Be Able to
<ul style="list-style-type: none"> <li>● Factoring</li> <li>● Solve equations using factoring</li> </ul>	<ul style="list-style-type: none"> <li>● Solve quadratic equations               <ul style="list-style-type: none"> <li>○ complete the square</li> <li>○ factoring</li> <li>○ square root property</li> <li>○ quadratic formula</li> </ul> </li> <li>● Solve equations that are quadratic in form</li> <li>● Graph a quadratic function identifying               <ul style="list-style-type: none"> <li>○ vertex</li> <li>○ axis of symmetry</li> <li>○ maximum or minimum values</li> </ul> </li> </ul>

### Instructional Support

Student Essential Vocabulary					
Quadratic Form	Axis of Symmetry	Square Root Property	Quadratic	Vertex	Maximum Value
Minimum Value	Complete the Square				

Sample Learning Activities	Sample Assessments
<p><b>Learning Activity #1 :</b></p> <p>1. Solve each equation by factoring:  a) <math>m^2 - 64 = 0</math>      b) <math>2x^3 - 10x^2 = -12x</math></p> <p>2. Solve each equation by the square root method:  a) <math>2x^2 + 14 = 0</math>      b) <math>(2x - 5)^2 + 16 = 0</math></p> <p>3. Solve each equation by completing the square:  a) <math>p^2 + 2p = 4</math>      b) <math>p^2 - 7p - 1 = 0</math></p> <p>4. Solve each equation by the quadratic formula:  a) <math>2x^2 - 4x - 3 = 0</math>      b) <math>\frac{1}{6}x^2 + x + \frac{1}{3} = 0</math></p> <p>5. Solve each equation using any method:  a) <math>p^4 - 3p^2 - 4 = 0</math>      b) <math>(3x + 2)^2 - 2(3x + 2) = 3</math></p> <p><b>Solution:</b></p> <p>1.    a) <math>m = \pm 8</math>                      2.    a) <math>x = \pm i\sqrt{7}</math>            b) <math>x = 0, 2, 3</math>                    c) <math>x = \frac{5 \pm 4i}{2}</math></p> <p>3.    a) <math>p = -1 \pm \sqrt{5}</math>                4.    a) <math>x = \frac{2 \pm \sqrt{10}}{2}</math>            b) <math>p = \frac{7}{2} \pm \frac{\sqrt{53}}{2}</math>                b) <math>x = -3 \pm \sqrt{7}</math></p>	<p><b>Assessment #1:</b></p> <p>1. Solve the equation by factoring:  <math>6r^2 - r = 2</math></p> <p>2. Solve the equation by the square root method:  <math>(x + 1)^2 = 12</math></p> <p>3. Solve the equation by completing the square:  <math>2x^2 - 8x + 6 = 0</math></p> <p>4. Solve the equation by the quadratic formula:  <math>x = -3x^2 - 3</math></p> <p>5. Solve the equation using any method:  <math>x - 5\sqrt{x} + 6 = 0</math></p> <p><b>Solution:</b></p> <p>1.    <math>r = -\frac{1}{2}, \frac{2}{3}</math></p> <p>2.    <math>x = -1 \pm 2\sqrt{3}</math></p> <p>3.    <math>x = 1, 3</math></p> <p>4.    <math>x = \frac{-1 \pm i\sqrt{35}}{6}</math></p>

5. a)  $p = \pm 2, \pm i$

b)  $x = 4, 9$

Activity's Alignment	
CONTENT	MA 4 Patterns and relationships
PROCESS	1.10 Apply information, ideas and skills
DOK	2
INSTRUCTIONAL STRATEGIES	Identifying similarities and differences

**Learning Activity #2:**

Given each quadratic function, find the following:

- a) vertex
- b) axis of symmetry
- c) a sketch of the graph of the function

1.  $f(x) = (x - 2)^2 - 5$

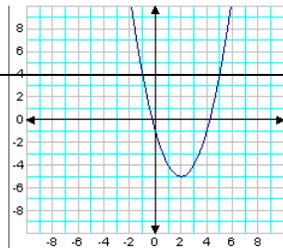
2.  $y - 1 = -(x - 1)^2$

Given each quadratic function, without graphing, determine the following:

- a) whether the function has a maximum value or a minimum value
- b) the maximum value of the minimum value and where it occurs
- c) domain and range of the function

3.  $f(x) = x^2 + 8x + 15$

4.  $h(x) = 5x^2 - 10x + 3$



5. b)  $x = -1, \frac{1}{3}$

Assessment's Alignment	
CONTENT	MA4 Patterns and relationships
PROCESS	1.10 Apply information, ideas and skills
DOK	2
LEVEL OF EXPECTATION	Mastery level – 80%

**Assessment #2:**

Given each quadratic function, find the following:

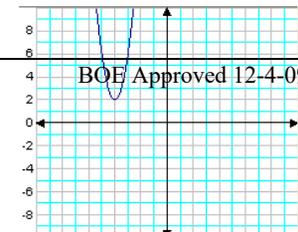
- a) vertex
- b) axis of symmetry
- c) a sketch of the graph of the function

1.  $g(x) = 4(x + 4)^2 + 2$

Given each quadratic function, without graphing, determine the following:

- a) whether the function has a maximum value or a minimum value
- b) the maximum value or the minimum value and where it occurs
- c) domain and range of the function

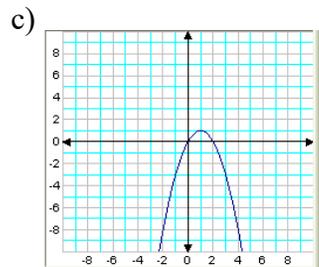
2.  $g(x) = -x^2 + 10x + 15$



Solution:

1. a) (2, -5) c)  
b)  $x = 2$

2. a) (1, 1)  
b)  $x = 1$



3. a) minimum value  
b) minimum value: -1 @  $x = -4$   
c) domain:  $(-\infty, \infty)$   
range:  $[-1, \infty)$
4. a) minimum value  
b) minimum value: -2 @  $x = 1$   
c) domain:  $(-\infty, \infty)$   
range:  $[-2, \infty)$

Solution:

2. a) (-4, 2) c)  
b)  $x = -4$

2. a) maximum value  
b) maximum value: 30 @  $x = 5$   
c) domain:  $(-\infty, \infty)$   
range:  $(-\infty, 30]$

Activity's Alignment	
CONTENT	MA4 Patterns and relationships

Assessment's Alignment	
CONTENT	MA4 Patterns and relationships

PROCESS	1.6 Discover/evaluate relationships	PROCESS	1.6 Discover/evaluate relationships
DOK	2	DOK	2
INSTRUCTIONAL STRATEGIES	Nonlinguistic representation	LEVEL OF EXPECTATION	Mastery level – 90%

Student Resources		Teacher Resources	
8.1	The Square Root Property and Completing the Square	Algebra for College Students – Sixth Edition; Blitzer, Robert; Pearson Prentice Hall; ©2009; ISBN #13:978-0-13-601974-9	
8.2	The Quadratic Formula		
8.3	Quadratic Functions and Their Graphs		
8.4	Equations Quadratic in Form		

Identity Equity and Readiness			
Gender Equity		Technology Skill	
Racial/Ethnic Equity		Research/Information	
Disability Equity		Workplace/Job Prep	

<b>Content Area: Mathematics</b>	<b>Course: Algebra III</b>	<b>Strand: Algebraic Relationships 9</b>
<b>Learner Objectives: Students will solve real world problems involving logarithmic and exponential functions as well as draw and analyze graphs and find inverse functions.</b>		

- Concepts:**
- A. Identify and compare functions
  - B. Describe the effects of parameter changes
  - C. Apply properties of operations
  - D. Describe and use mathematical manipulation

<b>Students Should Know</b>	<b>Students Should Be Able to</b>
<ul style="list-style-type: none"> <li>• Definition of a function</li> <li>• Solve an equation</li> <li>• Solve explicitly for a given value</li> <li>• Substitution</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate and graph exponential and logarithmic functions</li> <li>• Find the inverse and composition of functions</li> <li>• Solve exponential and logarithmic functions and applications</li> </ul>

### Instructional Support

<b>Student Essential Vocabulary</b>					
Exponential	Logarithmic	One-to-one	Inverse Function	Composite Function	Natural Logarithm
Common Logarithm	Change of Base Property	Exponential Growth	Exponential Decay		

Sample Learning Activities

Sample Assessments

Learning Activity #1 :

Find a)  $(f \circ g)(x)$ , b)  $(g \circ f)(x)$ , and c)  $(f \circ g)(3)$ . Be sure you simplify each expression as much as possible.

$$f(x) = x^2 + 1$$

$$f(x) = -2x$$

1.  $g(x) = 5x$

2.  $g(x) = x^3 + x - 2$

Find  $f(g(x))$  and  $g(f(x))$  for each pair of functions. Use that information to determine whether the functions  $f$  and  $g$  are inverses of one another.

$$f(x) = 2x + 1$$

$$f(x) = x^3 - 5$$

3.  $g(x) = \frac{x-1}{2}$

4.  $g(x) = \sqrt[3]{x} + 5$

Solution:

1. a)  $25x^2 + 1$   
 b)  $5x^2 + 5$   
 c) 226

2. a)  $-2x^3 - 2x + 4$   
 b)  $-8x^3 - 2x - 2$   
 c) -56

3. a)  $f(g(x)) = x$

4. a)

$$f(g(x)) = (\sqrt[3]{x} + 5)^3 - 5$$

b)  $g(f(x)) = \sqrt[3]{x^3 - 5} + 5$

b)

$$g(f(x)) = x$$

c)  $f$  and  $g$  are not inverses

c)  $f$  and  $g$  are inverses

Assessment #1:

Find a)  $(f \circ g)(x)$ , b)  $(g \circ f)(x)$ , and c)  $(f \circ g)(3)$ . Be sure you simplify each expression as much as possible.

$$f(x) = 2x - 3$$

1.  $g(x) = x + 7$

Find  $f(g(x))$  and  $g(f(x))$  for each pair of functions. Use that information to determine whether the functions  $f$  and  $g$  are inverses of one another.

$$f(x) = x^3 + 6$$

2.  $g(x) = \sqrt[3]{x} - 6$

Solution:

1. a)  $2x + 11$   
 b)  $2x + 4$   
 c) 17

2. a)  $f(g(x)) = x$   
 b)  $g(f(x)) = x$   
 c)  $f$  and  $g$  are inverses

Activity's Alignment	
CONTENT	MA4 Patterns and relationships
PROCESS	1.6 Discover/evaluate relationships
DOK	2
INSTRUCTIONAL STRATEGIES	Generating and testing hypotheses

**Learning Activity #2:**

Graph each function.

- $f(x) = 2^x$
- $f(x) = \left(\frac{1}{2}\right)^{(x+2)} - 1$
- $f(x) = \log_4(x + 2)$
- $f(x) = \ln x - 2$

Solve each equation.

- $3^x = 27$
- $2^{x+1} = 5^x$
- $\log_4(3x + 1) = 3$

Assessment's Alignment	
CONTENT	MA4 Patterns and relationships
PROCESS	1.6 Discover/evaluate relationships
DOK	2
LEVEL OF EXPECTATION	Mastery level – 85%

**Assessment #2:**

Graph each function.

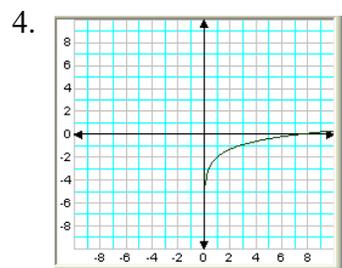
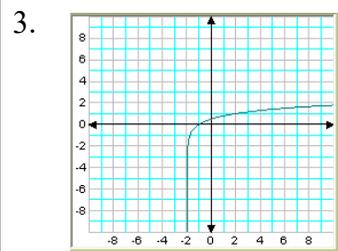
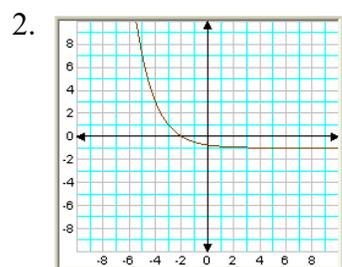
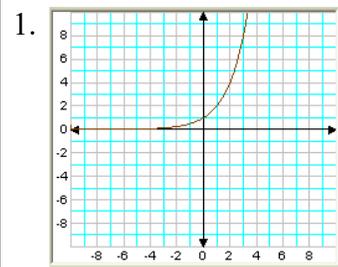
- $f(x) = 3^{(x-1)}$
- $f(x) = \ln(1 - x)$

Solve each equation.

- $4^{3x-7} = 32^{2x}$
- $\log_2 x - \log_2(3x + 5) = 4$

8.  $\log_4 x - \log_4(x + 7) = 1$

Solution:



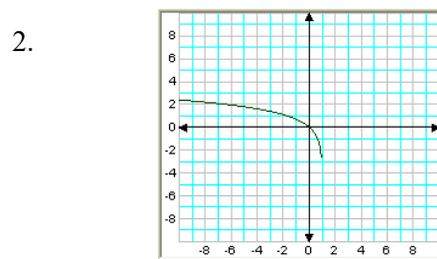
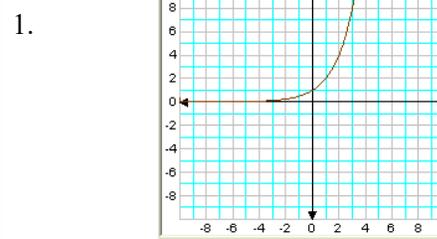
5.  $x = 3$

6.  $x \approx 0.756$

7.  $x = 21$

8.  $\phi$

Solution:



3.  $x = -\frac{7}{2}$

4.  $x = \frac{-7 \pm \sqrt{33}}{2}$

<table border="1"> <thead> <tr> <th colspan="2">Activity's Alignment</th> </tr> </thead> <tbody> <tr> <td>CONTENT</td> <td>MA2 Geometric and spatial sense</td> </tr> <tr> <td>PROCESS</td> <td>1.6 Discover/evaluate relationships</td> </tr> <tr> <td>DOK</td> <td>2</td> </tr> <tr> <td>INSTRUCTIONAL STRATEGIES</td> <td>Nonlinguistic representation</td> </tr> </tbody> </table>		Activity's Alignment		CONTENT	MA2 Geometric and spatial sense	PROCESS	1.6 Discover/evaluate relationships	DOK	2	INSTRUCTIONAL STRATEGIES	Nonlinguistic representation	CONTENT	MA2 Geometric and spatial sense
		Activity's Alignment											
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		DOK	2										
INSTRUCTIONAL STRATEGIES	Nonlinguistic representation												
PROCESS	1.6 Discover/evaluate relationships												
DOK	2												
LEVEL OF EXPECTATION	Mastery level – 85%												

Student Resources	Teacher Resources
9.1 Exponential Functions 9.2 Composite and Inverse Functions 9.3 Logarithmic Functions 9.4 Properties of Logarithms 9.5 Exponential and Logarithmic Equations	Algebra for College Students – Sixth Edition; Blitzer, Robert; Pearson Prentice Hall; ©2009; ISBN #13:978-0-13-601974-9

Identity Equity and Readiness			
Gender Equity		Technology Skill	
Racial/Ethnic Equity		Research/Information	
Disability Equity		Workplace/Job Prep	

<b>Content Area: Mathematics</b>	<b>Course: Algebra III</b>	<b>Strand: Algebraic Relationships 10</b>
<b>Learner Objectives: Students will use algebraic, graphical, and numerical methods to analyze, compare, and translate conic sections.</b>		

- Concepts:**
- A. Utilize equivalent forms
  - B. Analyze change
  - C. Describe and use mathematical manipulation

Students Should Know	Students Should Be Able to
<ul style="list-style-type: none"> <li>• Distance formula</li> <li>• Midpoint formula</li> <li>• Axis of symmetry</li> <li>• Vertex of parabola</li> <li>• Center of circle</li> <li>• Radius of circle</li> </ul>	<ul style="list-style-type: none"> <li>• Produce a graph of a given conic section and identify all major characteristics</li> <li>• Identify the type of conic section given the general form of an equation</li> <li>• Manipulate the general form of an equation to derive the standard form</li> </ul>

### Instructional Support

Student Essential Vocabulary					
Conic Section	Circle	Ellipse	Hyperbola	Parabola	Asymptote Line
Foci	Directrix	Transverse Axis	Major Axis	Minor Axis	Vertices

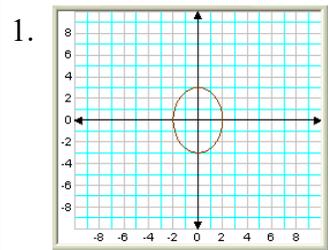
Sample Learning Activities		Sample Assessments																	
<p><b>Learning Activity #1 :</b></p> <p>Identify whether each equation, when graphed, will be a parabola, circle, ellipse, or hyperbola.</p> <ol style="list-style-type: none"> <li><math>(x - 7)^2 + (y - 2)^2 = 4</math></li> <li><math>x = -y^2 + 6y</math></li> <li><math>9x^2 - 4y^2 = 36</math></li> <li><math>y^2 = x^2 + 16</math></li> </ol> <p>Solution:</p> <ol style="list-style-type: none"> <li>circle</li> <li>parabola</li> <li>hyperbola</li> <li>hyperbola</li> </ol>		<p><b>Assessment #1:</b></p> <p>Identify whether each equation, when graphed, will be a parabola, circle, ellipse, or hyperbola.</p> <ol style="list-style-type: none"> <li><math>y = x^2 + 4</math></li> <li><math>\frac{x^2}{16} + \frac{y^2}{4} = 1</math></li> <li><math>3x^2 = 27 - 3y^2</math></li> <li><math>x - 7 - 8y = y^2</math></li> </ol> <p>Solution:</p> <ol style="list-style-type: none"> <li>parabola</li> <li>ellipse</li> <li>circle</li> <li>parabola</li> </ol>																	
<table border="1"> <thead> <tr> <th colspan="2">Activity's Alignment</th> </tr> </thead> <tbody> <tr> <td>CONTENT</td> <td>MA4 Patterns and relationships</td> </tr> <tr> <td>PROCESS</td> <td>3.1 Identify and define problems</td> </tr> <tr> <td>DOK</td> <td>1</td> </tr> </tbody> </table>		Activity's Alignment		CONTENT	MA4 Patterns and relationships	PROCESS	3.1 Identify and define problems	DOK	1	<table border="1"> <thead> <tr> <th colspan="2">Assessment's Alignment</th> </tr> </thead> <tbody> <tr> <td>CONTENT</td> <td>MA4 Patterns and relationships</td> </tr> <tr> <td>PROCESS</td> <td>3.1 Identify and define problems</td> </tr> <tr> <td>DOK</td> <td>1</td> </tr> </tbody> </table>		Assessment's Alignment		CONTENT	MA4 Patterns and relationships	PROCESS	3.1 Identify and define problems	DOK	1
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DOK	1																		

**Learning Activity #2:**

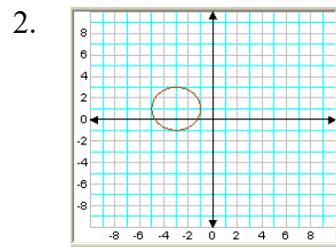
Graph each equation and identify all major characteristics.

1.  $9x^2 + 4y^2 = 36$
2.  $x^2 + y^2 + 6x - 2y + 6 = 0$
3.  $y = x^2 + 10x + 20$

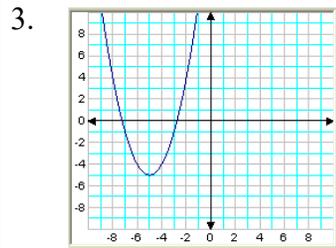
Solution:



center:  $(0, 0)$   
 major axis vertical with vertices  $(0, 3)$  and  $(0, -3)$   
 minor axis horizontal with vertices  $(2, 0)$  and  $(-2, 0)$   
 foci:  $(0, \sqrt{5})$  and  $(0, -\sqrt{5})$



center:  $(-3, 1)$   
 radius: 2



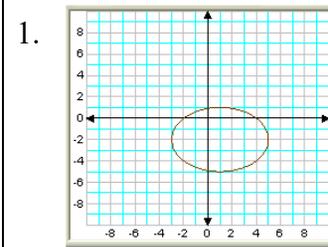
focus:  $(-5, -4\frac{3}{4})$

**Assessment #2:**

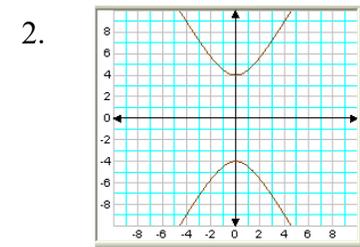
Graph each equation and identify all major characteristics.

1.  $\frac{(x-1)^2}{16} + \frac{(y+2)^2}{9} = 1$
2.  $\frac{y^2}{16} - \frac{x^2}{4} = 1$
3.  $x = -4(y-2)^2 + 2$

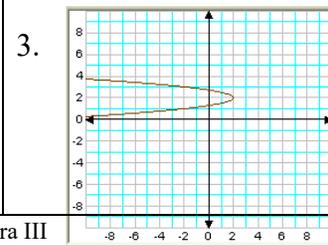
Solution:



center:  $(1, -2)$   
 major axis vertical with vertices  $(1, 1)$  and  $(1, -5)$   
 minor axis horizontal with vertices  $(5, -2)$  and  $(-3, -2)$   
 foci:  $(1 + \sqrt{7}, -2)$  and  $(1 - \sqrt{7}, -2)$



center:  $(0, 0)$   
 transverse axis along the y-axis  
 vertices:  $(0, 4)$  and  $(0, -4)$   
 asymptotes:  $y = \pm 2x$



vertex:  $(2, 2)$   
 axis of symmetry:  $y = 2$   
 opens left  
 intercepts:  $(-14, 0)$ ,

vertex:  $(-5, -5)$   
 axis of symmetry:  $x = -5$   
 opens up

directrix:  $y = -5\frac{1}{4}$   
 intercepts:  $(0, 20)$ ,  
 $(-5 + \sqrt{5}, 0)$ ,  $(-5 - \sqrt{5}, 0)$

$\left(0, \frac{4 + \sqrt{2}}{2}\right), \left(0, \frac{4 - \sqrt{2}}{2}\right)$   
 focus:  $\left(1\frac{15}{16}, 2\right)$  directrix:  $x = 2\frac{1}{16}$

**Activity's Alignment**

CONTENT	MA2 Geometric and spatial sense
PROCESS	1.6 Discover/evaluate relationships
DOK	2
INSTRUCTIONAL STRATEGIES	Nonlinguistic representation

**Assessment's Alignment**

CONTENT	MA2 Geometric and spatial sense
PROCESS	1.6 Discover/evaluate relationships
DOK	2
LEVEL OF EXPECTATION	Mastery level – 75%

**Student Resources**

- 10.1 Distance and Midpoint Formulas: Circles
- 10.2 The Ellipse
- 10.3 The Hyperbola
- 10.4 The Parabola: Identifying Conic Sections
- 10.5 Systems of Nonlinear Equations in Two Variables

**Teacher Resources**

Algebra for College Students – Sixth Edition; Blitzer, Robert; Pearson Prentice Hall; ©2009; ISBN #13:978-0-13-601974-9

**Identity Equity and Readiness**

Gender Equity		Technology Skill	
Racial/Ethnic Equity		Research/Information	
Disability Equity		Workplace/Job Prep	

<b>Content Area: Mathematics</b>	<b>Course: Algebra III</b>	<b>Strand: Algebraic Relationships 11</b>
<b>Learner Objectives: Students will use algebraic, graphical and numerical methods to analyze, compare, translate and solve polynomial and rational equations.</b>		

- Concepts:**
- A. Describe the effects of parameter changes
  - B. Utilize equivalent forms
  - C. Represent mathematical situation

Students Should Know	Students Should Be Able to
<ul style="list-style-type: none"> <li>● Asymptote</li> <li>● Synthetic division</li> <li>● Intercepts</li> <li>● Domain</li> <li>● Range</li> <li>● Degree of a polynomial</li> </ul>	<ul style="list-style-type: none"> <li>● Investigate and sketch the graphs of polynomial and rational functions using the characteristics of               <ul style="list-style-type: none"> <li>○ domain and range</li> <li>○ maximum and minimum points</li> <li>○ asymptotes and end behavior</li> <li>○ zeros</li> <li>○ multiplicity of zeros</li> <li>○ intercepts</li> <li>○ symmetry</li> </ul> </li> </ul>

### Instructional Support

Student Essential Vocabulary					
Odd Function	Even Function	Multiplicity	Descartes' Rule of Signs	Zeros/Roots/Solutions	End Behavior
Leading Coefficient Test	Rational Zero Theorem	Asymptote			

Sample Learning Activities	Sample Assessments
<p><b>Learning Activity #1 :</b></p> <p>For each equation, determine the following:</p> <ol style="list-style-type: none"> <li>y-intercept,</li> <li>zeros with multiplicity</li> <li>maximum and minimum points</li> <li>end behavior.</li> </ol> <ol style="list-style-type: none"> <li><math>f(x) = 3(x + 5)(x + 2)^3</math></li> <li><math>f(x) = 2x^3 - 6x^5</math></li> </ol> <p>Solution:</p> <ol style="list-style-type: none"> <li> <ol style="list-style-type: none"> <li>(0, 120)</li> <li><math>x = -5</math>, multiplicity 1 <math>x = -2</math>, multiplicity 3</li> <li>maximum points: none minimum point: <math>(-4\frac{1}{4}, -25\frac{161}{256})</math></li> <li>rises to the left rises to the right</li> </ol> </li> <li> <ol style="list-style-type: none"> <li>(0, 0)</li> <li><math>x = 0</math>, multiplicity 3 <math>x = \frac{\sqrt{3}}{3}</math>, multiplicity 1 <math>x = -\frac{\sqrt{3}}{3}</math>, multiplicity 1</li> <li>maximum points: <math>(\frac{\sqrt{5}}{5}, \frac{4\sqrt{5}}{125})</math></li> </ol> </li> </ol>	<p><b>Assessment #1:</b></p> <p>For each equation, determine the following:</p> <ol style="list-style-type: none"> <li>y-intercept,</li> <li>zeros with multiplicity</li> <li>maximum and minimum points</li> <li>end behavior.</li> </ol> <ol style="list-style-type: none"> <li><math>y = x^3 - 2x^2 + x</math></li> </ol> <p>Solution:</p> <ol style="list-style-type: none"> <li> <ol style="list-style-type: none"> <li>(0, 0)</li> <li><math>x = 0</math>, multiplicity 1 <math>x = 1</math>, multiplicity 2</li> <li>maximum point: <math>(\frac{1}{3}, \frac{4}{27})</math> minimum point: (1, 0)</li> <li>falls to the left rises to the right</li> </ol> </li> </ol>

minimum point:  $\left(-\frac{\sqrt{5}}{5}, -\frac{4\sqrt{5}}{125}\right)$   
 d) rises to the left  
 falls to the right

Activity's Alignment	
CONTENT	MA4 Patterns and relationships
PROCESS	1.6 Discover/evaluate relationships
DOK	2
INSTRUCTIONAL STRATEGIES	Homework and practice

Assessment's Alignment	
CONTENT	MA4 Patterns and relationships
PROCESS	1.6 Discover/evaluate relationships
DOK	2
LEVEL OF EXPECTATION	Mastery level – 80%

**Learning Activity #2:**

For each equation, find the following:

- a) domain and range
- b) intercepts
- c) symmetry
- d) asymptotes.

1.  $h(x) = \frac{x}{x(x+4)}$

2.  $g(x) = \frac{x-4}{x^2-x-6}$

Solution:

1. a) domain:  $(-\infty, -4) \cup (-4, 0) \cup (0, \infty)$   
 range:  $(-\infty, 0) \cup (0, \infty)$   
 b) intercepts: none  
 c) symmetry: none with respect to x-axis, y-axis, or origin  
 d) asymptotes:  $y = 0$  &  $x = -4$
2. a) domain:  $(-\infty, -2) \cup (-2, 3) \cup (3, \infty)$   
 range:  $(-\infty, 0) \cup (0.476, \infty)$   
 b) intercepts:  $(0, \frac{2}{3})$

**Assessment #2:**

For each equation, find the following:

- a) domain and range
- b) intercepts
- c) symmetry
- d) asymptotes.

1.  $f(x) = \frac{2}{x^2-4}$

Solution:

1. a) domain:  $(-\infty, -2) \cup (-2, 2) \cup (2, \infty)$   
 range:  $(-\infty, -\frac{1}{2}) \cup (0, \infty)$   
 b) intercepts:  $(0, -\frac{1}{2})$   
 c) symmetry: with respect to y-axis  
 d) asymptotes:  $y = 0$  &  $x = \pm 2$

- c) symmetry: none with respect to  $x$ -axis,  $y$ -axis, or origin  
 d) asymptotes:  $y = 0$ ,  $x = -2$  &  $x = 3$

Activity's Alignment	
CONTENT	MA4 Patterns and relationships
PROCESS	1.6 Discover/evaluate relationships
DOK	2
INSTRUCTIONAL STRATEGIES	Homework and practice

Assessment's Alignment	
CONTENT	MA4 Patterns and relationships
PROCESS	1.6 Discover/evaluate relationships
DOK	2
LEVEL OF EXPECTATION	Mastery level – 80%

Student Resources	Teacher Resources
11.1 Polynomial Functions and Their Graphs 11.2 Zeros of Polynomial Functions 11.3 Rational Functions and Their Graphs	Algebra for College Students – Sixth Edition; Blitzer, Robert; Pearson Prentice Hall; ©2009; ISBN #13:978-0-13-601974-9

Identity Equity and Readiness			
Gender Equity		Technology Skill	
Racial/Ethnic Equity		Research/Information	
Disability Equity		Workplace/Job Prep	