Grade Level	Content Area	Course Title *(9-12 Samples Only)*	Unit Title
11th grade	Mathematics	Algebra 3	Factoring Quadratics

Length of Unit	Time of Year Taught	Expected Prior Knowledge
Five days	First Semester of 11th grade	Mastery of the following standards and PO's: MHS-S1C1-01, MHS-S3C3-01, 08, 09, 10. Course credit in Algebra 1-2. Units within Algebra 3: Algebraic Equations, Solving Equations, Rewriting Formulas, Exponents

Unit Description

Algebra 3 is delivered as an independent, self-paced, computer-based course. Students use ANYWHERE LEARNING SYSTEM *(A+LS™)* for lesson instruction and activities. Although this course and unit is intended to be taken as an independent, self-paced program, teacher involvement is built into the lesson sequence. This allows the math instructor to check student understanding and perform formative assessments to ensure the student is able to master the standards on the summative assessment at the end of the unit.

<u>The following topics are covered in this unit:</u>

Students learn to *manipulate polynomials to put in standard form* $\pm ax^2 \pm c$, $\pm ax^2 \pm bx$, and $\pm ax^2 \pm bx \pm c$, then *factor the quadratic expressions*: The lesson introduces the traditional guess-and-check method, in which the student is expected to choose the best-fitting solution from all the possible choices (i.e., the factors of *a* and *c*). The FOIL method is reintroduced, reviewed and described as a method for factoring quadratics.

After completing this unit, the student will be able to:

- use real number properties to manipulate polynomial expressions and equations to put in standard form
- identify a quadratic expression and each term
- determine the numbers for the two binomials
- use the FOIL method
  - the product of the First terms
  - the product of the Outside terms
  - the product of the Inside terms
  - the product of the Last terms
- factor quadratic polynomials

Strand(s), Concept(s), and PO(s) *List and define the required Strand(s), Concepts(s), and PO(s) for each lesson included in this sample.*	MHS-S1C2-02- Number and Operations Strand 1: Understand and apply numbers, ways of representing numbers, and the relationships among numbers and different number systems. Concept 2: Numerical Operations Understand and apply numerical operations and their relationship to one another. PO 02. Summarize the properties of and connections between real number operations; justify manipulations of expressions

	using the properties of real number operations. MHS-S3C3-12- Patterns, Algebra, and Functions Strand 3: Identify patterns and apply pattern recognition to reason mathematically while integrating content from each of the other strands Concept 3: Algebraic Representations Represent and analyze mathematical situations and structures using algebraic representations. PO 12. Factor quadratic polynomials in the form of $ax^2 + bx + c$ where *a, b,* and *c* are integers.
Summative Assessment *Describe a cumulative and comprehensive activity that allows students to demonstrate mastery of stated POs. A copy of the summative assessment must be included in the application package.*	The summative assessment is at the end of the unit. This assessment is multiple choice and fill in the blank. It measures the mastery of MHS-S1C2-02 and MHS-S3C3-12. The student will need to manipulate polynomial expressions in order to put equations into standard form, identify the quadratic expression and binomials, and remember the steps to the FOIL method.
Assessment Scoring *Explain how each assessment is scored, to include points per question, total points possible, criteria, and grading scale. Describe rubric, if applicable, to include components being evaluated and the scoring criteria for each. A copy of the answer key and/or scoring rubric must be included in the application package.*	The unit test is 10 questions. Each question is worth 10 points. A passing score of 70% must be achieved on the unit test to be considered "successfully completed." A score of less than 70% on the unit test will result in the student having to retake the test. Grade Breakdown: 90 – 100% = A 80 – 89% = B 70 – 79% = C < 70% = no credit
Materials/Resources Needed *(Include all items for the entire unit.)*	Computer with access to ANYWHERE LEARNING SYSTEM (A+LS™)– – Lesson 37 Factoring Quadratics Pencil/Paper for note-taking and as scratch paper for making calculations Math Instructor for lesson activity clarification, further explanations, demonstration of problems, test proctoring.

	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Lesson Instruction Is provided through the study portion of the unit lesson in the A+LS course. A math teacher is readily available when the student needs additional help.	Introduction (pgs 1- 8) (10 min) • Describe mastery and course expectations. • Provide an overview of Quadratic expressions and equations including format and related vocabulary. Guided Practice (50 min) • Describe and demonstrate the manipulation of expressions using real number properties. • Describe and demonstrate the factoring of a quadratic expression. • Review and demonstrate the use of FOIL for determining the factors. • Review and demonstrate multiplication rules with positive and negative numbers used when factoring quadratic expression. • Provide practice for factoring quadratic expression when the quadratic term x^2 =1.	Introduction (pgs 8-12) (15 min) • Describe the standard form for quadratics. • Define quadratic expressions as binomials, trinomials or polynomials. • Describe and demonstrate the process used to factor a quadratic when (a) coefficient of quadratic term x^2 is a number other than 1. Guided Practice (15 min) • Practice manipulating expressions in order to put equations into standard form. • Practice factoring quadratics when (a) coefficient of x^2 is a number other than 1. Independent Practice (30 min) • Manipulating into standard form and factoring quadratic polynomials when (a) coefficient of x^2 is 1.	Introduction (pgs. 12-15) (15 min) • Describe and provide examples of polynomial expressions that produce trinomials when (b) is a 0 and/or when (c) is a negative number. • Describe and provide examples of quadratic trinomials when (b) is a 0. • Describe and provide examples of quadratic trinomials when (c) is a negative number. Guided Practice (15 min) • Practice manipulating polynomial expressions that produce trinomials when (b) is a 0 and/or when (c) is a negative number. • Practice factoring quadratic trinomials when (b) is a 0. • Practice factoring quadratic trinomials when (c) is a negative number. Independent Practice (30 min) • Manipulating expressions in order to put equations into standard form and factoring quadratic trinomials.	Review (pgs. 1-15) (15 min) • Review manipulating polynomial expressions in order to put equations into standard form. • Review factoring of quadratic polynomials. Test Toward Mastery (45 Min) • Practice manipulating polynomial expressions in order to put equations into standard form. • Practice factoring quadratic polynomials. • The student takes a practice test which provides feedback for each answer.	Review (Lesson 37) (15min) • Review concepts from A+LS, Lesson 37, Factoring Quadratic Polynomials. Check Mastery (45 min) Teacher provides test and proctors testing.

	Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Student Activities	Introduction (10 min) • Student takes notes for course expectations, format of Quadratic Equations and related vocabulary. Guided Practice (50 min) • Student manipulates equations and expressions using real number properties. • Student practices the factoring of a quadratic expression. • Student reviews and practices the use of FOIL for determining the factors. • Student practices factoring quadratic expressions and reviews rules when multiplying positive and negative numbers. • Student practices factoring quadratic equations when the quadratic term is equal to 1. • Student requests teacher support as needed.	Introduction (15 min) • Student takes notes on manipulating expressions using real number properties. • Student takes notes on quadratic expressions as binomials, trinomials and polynomials. • Student takes notes on the process used to factor a quadratic when (a) coefficient of quadratic term x^2 is a number other than 1. Guided Practice (15min) • Student practices manipulating expressions in order to put equations into standard form. • Student practices factoring quadratics when (a) coefficient of x^2 is a number other than 1. Independent Practice (30 min) • Student manipulates polynomial expressions in order to put equations into standard form and practices factoring quadratic polynomials when (a) coefficient of x^2 is 1. • Student requests teacher support as needed.	Introduction (15 min) • Student takes notes on examples of polynomial expressions that produce trinomials when (b) is a 0 and/or when (c) is a negative number. • Student takes notes on examples of quadratics trinomials when (b) is a 0. • Student takes notes on examples of quadratic trinomials when (c) is a negative number. Guided Practice (15 min) • Student manipulates polynomial expressions that produce trinomials when (b) is a 0. • Student factors quadratic trinomials when (b) is a 0. • Student practices factoring quadratic trinomials when (c) is a negative number. Independent Practice (30 min) • Student manipulates expressions and practices factoring quadratic trinomials Student requests teacher support as needed.	Review (15 min) • Student reviews notes for manipulating polynomial expressions in order to put equations into standard form. • Student reviews notes for factoring of quadratic polynomials. Test Toward Mastery (45 Min) • Student practices manipulating polynomial expressions in order to put the equations into standard form. • Student practices factoring quadratic polynomials. • Student takes a practice test which provides feedback for each chosen answer. • Student compares solutions with those provided, studies notes when errors are noted. • Student requests teacher support as needed.	Review (Lesson 37) (15 min) • Student reviews notes Lesson 37. Factoring Quadratic Polynomials • Student meets with teacher for clarification of understanding. Check Mastery (45 min) • Meet with teacher to access final unit summative assessment.

Algebra 3 Factoring Quadratics: Summative Assessment

MHS-S1C2-02- Number and Operations
Strand 1:
Understand and apply numbers, ways of representing numbers, and the relationships among numbers and different number systems.
Concept 2: Numerical Operations
Understand and apply numerical operations and their relationship to one another.
PO 02 Summarize the properties of and connections between real number operations; justify manipulations of expressions using the properties of real number operations.

MHS-S3C3-12- Patterns, Algebra, and Functions
Strand 3:
Identify patterns and apply pattern recognition to reason mathematically while integrating content from each of the other strands
Concept 3: Algebraic Representations
Represent and analyze mathematical situations and structures using algebraic representations.
PO 12. Factor quadratic polynomials in the form of $ax^2 + bx + c$ where a, b, and c are integers.

***Test rekeyed from** ANYWHERE LEARNING SYSTEM *(A+LS™)*

Solve the polynomial equation for questions 1 & 2 by putting in standard form, and justify each step with a real number property (e.g. associative, inverse, commutative, distributive, addition).

Question #1 *MHS-S1C2-02*

$$-8x + 2x^2 + 10x - 62 = 22$$

Question #2 MHS-S1C2-02

$$13x^2 + 4x + 7 = 5x^2 + 19$$

Question #3 *MHS-S1C2-02*

Describe the connections between the distributive property, the property of addition, and using the FOIL method.

Determine the factors of the following quadratic polynomial expressions for questions 4 - 6.

Question #4 *MHS-S3C3-12*

$3x^2 – 31x + 36$
A. $(3x + 4)(x – 9)$
B. $(3x + 4)(x + 9)$
C. $(3x – 4)(x – 9)$

Question #5 *MHS-S3C3-12*
$– 5x^2 + 28x – 32$
A. $(– 1)(5x + 8)(x + 4)$
B. $(– 1)(5x – 8)(x – 4)$
C. $(5x – 8)(x + 4)$

Question #6 *MHS-S3C3-12*
$x^2 – 16$
A. $(x + 2)(x – 8)$
B. $(x + 4)(x – 4)$
C. $(x – 7)(x – 9)$

Determine the factors of these quadratic trinomial expressions using the FOIL method and fill in the blanks for questions 7 - 9.

Question #7
$3x^2 – 7x + 4$ _____

Question #8
$3x^2 – 14x + 8$ _____

Question #9
$3x^2 – 5x – 2$ _____

Question #10
List and sequence the steps for factoring a trinomial using the FOIL method where the coefficient of x^2 is 1.

Answer Key

Question #1

$2x^2 - 8x + 10x - 62 = 22$ *commutative property*
$2(x^2 - 4x + 5x - 31) = 22$ *distributive property*
$2(x^2 + x - 31) = 22$ *property of addition*
$x^2 + x - 31 = 11$ *inverse property*
$x^2 + x - 31 - 11 = 0$ *inverse property*
$x^2 + x - 42 = 0$ *property of addition*
$(x + 7)(x - 6) = 0$ *distributive property*

Question #2

$13x^2 - 5x^2 + 4x - 19 + 7 = 0$ *inverse property*
$8x^2 + 4x - 12 = 0$ *property of addition*
$4(2x^2 + x - 3) = 0$ *distributive property*
$4(2x + 3)(x - 1) = 0$ *distributive property*

Question #3

FOIL is the application of the distributive property in two stages. The first element of the first set is distributed to the second set of elements followed by the distribution of the second element. The property of addition is the final step of FOIL and is used when combining like terms.

Questions #4- 9

4. $(3x - 4)(x - 9)$ **5**. $(5x - 8)(x - 4)$ **6**. $(x + 4)(x - 4)$ **7.** $(x - 1)(3x - 4)$ **8**. $(x - 4)(3x -2)$ **9**. $(x - 2)(3x + 1)$

Question #10

List factors of last term in binomial or trinomial
Add pairs of factors and choose the combination that matches the middle term
Write the binomial pairs and verify by using FOIL