Mathematics Curriculum Guide

High School Algebra 1

2017-18

Topic 9: Polynomials & Factoring (Part 2)

Transfer Goals

1) Demonstrate perseverance by making sense of a never-before-seen problem, developing a plan, and evaluating a strategy and solution.
2) Effectively communicate orally, in writing, and using models (e.g., concrete, representational, abstract) for a given purpose and audience.
3) Construct viable arguments and critique the reasoning of others using precise mathematical language.

Timeframe: 4 weeks/19 days
Start Date: March 29, 2018
Assessment Dates: April 28 & May 1, 2018

Standards

A-SSE Seeing Structure in Expressions
Interpret the structure of expressions [~~Linear, exponential, and~~ quadratic]

1. Interpret expressions that represent a quantity in terms of its context. ★
   a. Interpret parts of an expression, such as terms, factors, and coefficients.
   b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1+r)^n$ *as the product of P and a factor not depending on P.* ★
2. Use the structure of an expression to identify ways to rewrite it.

A-APR Arithmetic with Polynomials and Rational Expressions

Perform arithmetic operations on polynomials [Linear and quadratic]

1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

Meaning-Making

Understandings

Students will understand that…

Equivalence*:* A single quantity may be represented by many different expressions.

- *Some trinomials of the form* ax^2+bx+c and some polynomials of a degree greater than 2 can be factored to equivalent forms which are the product of two binomials.

Properties: *All the facts of arithmetic and algebra follow from certain properties.*

- ax^2+bx+c and some polynomials of a degree greater than 2.

Essential Questions

Students will keep considering…

- Can two algebraic expressions that appear to be different be equivalent?
- How are the properties of real numbers related to polynomials?
- How can the structure of a polynomial determine its factored form?

Acquisition

Knowledge

Students will know…

Vocabulary: monomial, binomial, trinomial, polynomial, standard form of a polynomial, degree of a polynomial, coefficient, Distributive Property, square of a binomial, product of a sum and difference

Procedures for:

- Using special rules to simplify the square of a binomial or the product of a sum and difference.
- Factoring trinomials of the form x^2+bx+c and ax^2+bx+c where $a \neq 1$.

Skills

Students will be skilled at and able to do the following…

- Applying the properties of real numbers to factor polynomials.
- Use the Commutative and Associative Properties to manipulate polynomial expressions.
- Use the Distributive Property to multiply polynomials and factor polynomials.

Topic 9: Polynomials & Factoring (Part 2)

Transfer is a student's ability to independently apply understanding in a novel or unfamiliar situation. In mathematics, this requires that students use reasoning and strategy, not merely plug in numbers in a familiar-looking exercise, via a memorized algorithm.

Transfer goals highlight the effective uses of understanding, knowledge, and skills we seek in the long run – that is, what we want students to be able to do when they confront new challenges, both in and outside school, beyond the current lessons and unit. These goals were developed so all students can apply their learning to mathematical or real-world problems while simultaneously engaging in the Standards for Mathematical Practices. In the mathematics classroom, assessment opportunities should reflect student progress towards meeting the transfer goals.

With this in mind, the revised **PUSD transfer goals** are:

1) **Demonstrate perseverance by making sense of a never-before-seen problem, developing a plan, and evaluating a strategy and solution.**
2) **Effectively communicate orally, in writing, and by using models (e.g., concrete, representational, abstract) for a given purpose and audience.**
3) **Construct viable arguments and critique the reasoning of others using precise mathematical language.**

Multiple measures will be used to evaluate student acquisition, meaning-making and transfer. Formative and summative assessments play an important role in determining the extent to which students achieve the desired results in stage one.

Formative Assessment	Summative Assessment
Aligning Assessment to Stage One	
• What constitutes evidence of understanding for this lesson? • Through what other evidence during the lesson (e.g. response to questions, observations, journals, etc.) will students demonstrate achievement of the desired results? • How will students reflect upon, self-assess, and set goals for their future learning?	• What evidence must be collected and assessed, given the desired results defined in stage one? • What is evidence of understanding (as opposed to recall)? • Through what task(s) will students demonstrate the desired understandings?
Opportunities	
• Discussions and student presentations • Checking for understanding (using response boards) • Ticket out the door, Cornell note summary, and error analysis • *Performance Tasks* within a Unit • Teacher-created assessments/quizzes	• Unit assessments • Teacher-created quizzes and/or mid-unit assessments • *Illustrative Mathematics* tasks (https://www.illustrativemathematics.org/) • Performance tasks

Topic 9: Polynomials & Factoring (Part 2)

Transfer Goals
1) Demonstrate perseverance by making sense of a never-before-seen problem, developing a plan, and evaluating a strategy and solution. 2) Effectively communicate orally, in writing, and using models (e.g., concrete, representational, abstract) for a given purpose and audience. 3) Construct viable arguments and critique the reasoning of others using precise mathematical language.

Essential Questions:
- Can two algebraic expressions that appear to be different be equivalent?
- How are the properties of real numbers related to polynomials?
- How can the structure of a polynomial determine its factored form?

Standards: A-SSE 1a, A-SSE 1B, A-SSE 2, A-APR 1

Timeframe: 4 weeks/19 days
Start Date: March 29, 2018
Assessment Dates: April 28 & May 1, 2018

Time	Lesson/ Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Resources
2 Days	**Lesson 8-2: Multiplying and Factoring** (pp. 492-496) SMP 1,2,3,4 **A-APR 1**	**Focus Question(s):** • How do you factor a monomial from a polynomial? • How are the multiplication of polynomials and the factoring of polynomials related? **Inquiry Question:** p. 492 Solve It!	• Factoring a polynomial reverses the multiplication process. • The first step when factoring a monomial from a polynomial is finding the greatest common factor of the terms of the polynomial.	**Vocabulary**: factor, greatest common factor **Students will know…** • That factoring the greatest common factor from a polynomial is the inverse of using the Distributive Property when multiplying a monomial by a polynomial. • How to complete the X-box.	• Factor a monomial from a polynomial using the Greatest Common Factor.	**Notes:** • Include examples where the GCF is a variable. [See problems 2& 3 on Pg. 493]. **Problems to Emphasize:** • p. 495 #15-20 **Thinking Maps:** Use Flow Maps to give the steps for multiplying a monomial and a trinomial. **CC Problems:** #8, 35, 36, 40, 41 **STEM:** #43

Time	Lesson/ Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Additional Resources
4 Days	**Lesson 8-5: Factoring $x^2 + bx + c$** (pp. 512-517) SMP 1,3,4,7,8 **A-SSE 1a** Day 1: Factoring x^2+bx+c w/o GCF Day 2: Factoring x^2+bx+c w/ GCF Day 3: Area and review problems Day 4: Teacher Generated Quiz #1	**Focus Question(s):** • How can you use the structure of $x^2 + bx + c$ to determine its factored form? **Inquiry Question:** p. 512 Solve It!	• Some trinomials of the form $x^2 + bx + c$ can be factored into equivalent forms that are the product of two binomials. • The signs and factors of the coefficients of the trinomial indicate how the trinomial can be factored.	**Vocabulary**: factoring, factored form, greatest common factor **Students will know…** • The methods for factoring trinomials of the form $x^2 + bx + c$.	• Factor trinomials of the form $x^2 + bx + c$.	**Note:** • Include an area of a rectangle problem where the area is given and one of the sides is missing. **Problems to emphasize:** • pp. 515-516: #9, 10-13, 20-23, 41, 42 • 8-5 Standardized Test prep problems 6 and 8 **Thinking Maps:** Use a Double-Bubble Map to compare factoring a trinomial with one variable and a trinomial with two variables. **CC Problems:** #9, 41, 42, 43, 47, 48 **STEM:** #30
5 Days	**Lesson 8-6: Factoring $ax^2 + bx + c$** (pp. 518-522) SMP 1,2,3,4 **A-SSE 1a** Day 1: Factoring ax^2+bx+c w/o GCF Day 2: Factoring ax^2+bx+c w/o GCF Day 3: Factoring ax^2+bx+c w/ GCF Day 4: Review Day 5: Teacher Generated Quiz #2	**Focus Question(s):** • How can you use the structure of $ax^2 + bx + c$ to determine its factored form? • How do you determine how to rewrite the middle term of a trinomial that has a leading coefficient? **Inquiry Question:** p. 518 Solve It!	• Some trinomials of the form $x^2 + bx + c$ can be factored into equivalent forms that are the product of two binomials. • Sometimes the greatest common monomial factor of the polynomial should be factored out before the remaining polynomial is factored.	**Vocabulary**: factoring, factored form **Students will know…** • The methods for factoring trinomials of the form $ax^2 + bx + c$.	• Factor trinomials of the form $ax^2 + bx + c$.	**Notes:** • On day 2 of lesson, include examples of trinomials with two variables. **Problems to emphasize:** • p 520-521: # 5, 7, 28-33, 35, 37 **Thinking Maps:** Use Flow Maps to give the steps for using the distributive property with binomials. **CC Problems:** #5, 6, 7, 28-322, 34, 35, 37, 47, 51 **STEM:** #36

Time	Lesson/ Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Additional Resources
1 Day	**Performance Task: Planning a Garden Plot** Introduction-Textbook p. 485 Pulling it all together-Textbook p.534					**Note:** Have students work collaboratively to reflect on *Completing the Performance Task* and *On your Own*
2 Days	**Lesson 8-7: Factoring Special Cases** (pp. 523-528) SMP 1,2,3,4 **A-SSE 1a**	**Focus Question(s):** • How do you recognize the special cases for factoring polynomials? • How can you use the structure of $a^2+2ab+b^2$ or $a^2-2ab+b^2$ to determine its factored form? • How can you use the structure of a^2-b^2 to determine its factored form? **Inquiry Question:** p. 523 Solve It!	• Some trinomials, such as squares of binomials or differences of two squares, can be factored by reversing the rules for multiplying special-case binomials.	**Vocabulary**: square of a binomial, product of a sum and difference **Students will know…** • That the factored form of $a^2+2ab+b^2$ is $(a+b)^2$. • That the factored form of $a^2-2ab+b^2$ is $(a-b)^2$. • That the factored form of a^2-b^2 is $(a+b)(a-b)$.	• Factor perfect-square trinomials. • Factor differences of two squares. • Factor completely.	**Note:** • Include an area of a square problem where the area is given and one of the sides is missing. • Include problems where students factor a GCF prior to using the difference of squares. • Include problems where students factor a GCF prior to factoring perfect-square trinomials. **Problems to emphasize:** • pp. 526-527: #5, 6, 23, 24-28 **Thinking Maps:** Use Tree Map to give details for "special cases." **CC Problems:** #8, 40, 41, 42, 43, 49, 50, 57
2 Days	**Lesson 8-8: Factoring by Grouping** (pp. 529-533) SMP 1,2,3,4,7 **A-SSE 1a**	**Focus Question(s):** • How do you factor polynomials by grouping? • When factoring a polynomial by grouping, how do you determine whether to group the terms in two's or three's? **Inquiry Question:** p. 529 Solve It!	• Some polynomials of a degree greater than 2 can be factored.	**Vocabulary**: factoring by grouping **Students will know…** • To look for difference of two squares, a perfect square, or a pair of binomial factors when grouping the polynomial in terms of two or three.	• Factor higher-degree polynomials by grouping.	**Problems to emphasize:** • pp. 531-532: 5-8, 35, 39 • Think about a plan in the Practice and Problem Solving Workbook **Thinking Maps:** Use a Flow Map to show how to factor by grouping. **CC Problems:** #5,6,7, 8, 35, 36, 37, 38, 39 **STEM:** #30

Time	Lesson/ Activity	Focus Questions for Lessons	Understandings	Knowledge	Skills	Additional Resources
1 Day	**Unit 9 Review** (Use Textbook Resources and/or Teacher Created Items)					**Note:** Include the following problems on review: • Application of a system of linear equations • Multiplying powers • Area of shaded region • Multiplying polynomials • Adding polynomials • Subtracting polynomials
2 Days	**Topic 9 Assessment** (Created and provided by PUSD)					