Grade: Math II Lesson Title: Operations on Polynomials

Unit 2: Quadratic Functions - Representations Essential Question:

Targeted Content Standard(s):		Student Friendly Learning Targets	
 A.SSE.1 Interpret expressions that represent a quantity in terms of its context. a)Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example, interpret P(1+r)n as the product of P and a factor not depending on P.</i>* A.SSE.2 Use the structure of an expression to identify ways to rewrite it. <i>For example, see x⁴-y⁴ as (x²)²-(y²)², thus recognizing it as a difference of squares that can be</i> factored as (x² - y²)(x² + y²). APR.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. 		 I can Add, subtract, and multiply polynomials Interpret expressions View complicated expressions by its parts Identify ways to rewrite quadratic expressions 	
Targeted Mathematical Practic	e(s):	1	
1 Make sense of problems and persevere in solving them 2 Reason abstractly and quantitatively 3 Construct viable arguments and critique the reasoning of others 4 Model with mathematics 5 Use appropriate tools strategically 6 Attend to precision 7 Look for and make use of structure 8 Look for an express regularity in repeated reasoning Supporting Content Standard(s): (optional) A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.			
Explanation of Rigor: (Fill in those	that are appropriate.)		
Conceptual: Students will interpret complicated expressions by viewing one or more of their parts.	Procedural: Students will add, subtract, and multiply polynomials, identify wa rewrite quadratic expressions, ar factor and complete the square of quadratic functions.	Application: ays to nd on	
Vocabulary:			
PolynomialTrinomiaMonomialDegree oBinomialImage: Second	I Standard for f a polynomial polynomial L coefficient	rm of a Combine like terms Leading Distributive property (distribution)	

- **Time Frame:** 8 9 Days
- How do the arithmetic operations on numbers extend to polynomials?

Evidence of Learning (Assessment):				
Pre-Assessment: no pre-assessment for this unit				
Formative Assessment(s): Operations o	n Polynomials, Tiling	the Floor		
Summative Assessment: This lesson wil	l be assessed at the e	end of the unit		
Self-Assessment:				
Lesson Procedures:				
Segment 1				
Approximate Time Frame:	Lesson Format: Whole Group Small Group		Resources:	
	Independent			
Focus: Introducing polynomials with an emphasis on important vocabulary	 Modeled Guided Collaborative Assessment 		Modalities Represented: Concrete/Manipulative Picture/Graph Table/Chart Symbolic Oral/Written Language Real-Life Situation	
Math Practice Look For(s):	L	Differentiation for Remediation:		
MP#2: Reason abstractly and quantitat	ively. Students will	Differentiation for English Language Learners:		
extend the properties of real numbers t	o polynomial	Pre-teach vocabulary		
expressions.		Differentiation for Enrichment:		
Potential Pitfall(s)		Independent Practice (Homework):		
		Practice problems involving combining like terms and identifying different degree polynomials using appropriate vocabulary		
Steps:		Teacher Notes/Reflections:		
- Present students with a variety of polynomial				
expressions (including expressions with different				
numbers of terms, different degrees and different leading coefficients). Without discussing lesson				
vocabulary, ask students to individually group the				
expressions in any manner they	see fit.			
 Once students have sorted their group them together and ask st 	r expressions, udents to explain			
their choices in sorting the poly	nomial			
expressions. Some may have so	ort them based on			

	the number of terms while others sort them by	
	degree and others sort them based on the leading	
	coefficient. Hold class discussion on the different	
	assortments which leads to the discovery of the	
	need for the lesson's vocabulary.	
-	Define polynomial, monomial, binomial, trinomial	
	(tie to the vocabulary term "non-linear")	
-	Discuss prefixes mono, bi, and poly and connect to	
	prior knowledge	
-	Define degree and discuss briefly how to	
	determine degree of a polynomial	
-	Show students how to manipulate a polynomial	
	into standard form	
	 For example, 	
	$y + 5y^3 - 7y^6 - 2y^2 + 10$	
-	Define leading coefficient	
-	Use given polynomials modeling real-world	
	situations to estimate values between two points	
	and have students talk with their partners about	
	each problem	
	• For example:	
	Companies overseas produce many of the	
	electronic devices that we use every day.	
	The number P (in thousands) of devices	
	produced by a particular company	
	between 2006 and 2012 can be modeled	
	by the following equation where t is the	
	number of years since 2006:	
	$P=3t^2-2t+10$	
	How many electronic devices were	
	produced in 2008?	
	If the company continues to produce at	
	this rate, now many devices will they	
	produce in 2020?	

Unit 2: Quadratic Functions - Representations
Essential Question:

Lesson Format: Whole Group Small Group Independent Modeled Guided Collaborative Assessment	Differentiation for Differentiation for Differentiation for	Resources: Algebra tiles (if desired) Modalities Represented: Concrete/Manipulative Picture/Graph Table/Chart Symbolic Oral/Written Language Real-Life Situation Remediation: English Language Learners: Enrichment:	
Potential Pitfall(s):		Independent Practice (Homework):	
Students may make mistakes when a -1 needs to be distributed to a polynomial or make sign errors. Students may struggle with connecting knowledge of finding area to polynomials. Students may distribute the exponent when a binomial is squared instead of expanding first.		Practice problems for all combinations of polynomials to reinforce correct procedures when using the distributive property.	
	Lesson Format:	Lesson Format: Whole Group Small Group Independent Modeled Guided Collaborative Assessment Differentiation for Practice problems for needs to be nerrors. cnowledge of then a binomial is	

Stens:		Teacher Notes/Reflections:
-	Give students an example of combining like terms (no x^2 terms)	
	• For example $2x + 5 + 3x - 10 + 4 + 17 - 11x$	
_	Ask students to recall the appropriate method for simplifying this	
	evoression	
_	Then use the same expression from above, but add some x^2 terms	
	\sim Ask students to give suggestions for simplifying this	
	evonession	
	The goal is to have students arrive at the	
	conclusion that the same rules of addition and	
	subtraction apply to polynomials of degree 2	
_	Provide students several examples to work on with a partner	
	including addition and subtraction	
	 Include an example like this one paying close attention to 	
	how the subtraction affects the second polynomials:	
	$(-4h^2 - 2h + 8) - (4h^3 + 3h^2 - 5)$	
_	Multiplying a monomial by a polynomial	
-	\sim (Brief distributive property review) Give students an	
	example of a constant multiplied by a polynomial of	
	degree 1	
	 Follow up with a monomial multiplied by a polynomial of 	
	degree 2	
	 Continue providing examples as needed, including 	
	opportunities for students to use distribution and	
	combining of like-terms	
	• For example:	
	$3b(-6b^2+b+9) - b^3(b^2-7b^2+5)$	
-	Multiplying two binomials using the distributive property	
	 Using distributive property as a foundation, demonstrate 	
	the procedure for multiplying two binomials	
	 Emphasize the distributive property and snow multiple 	
	ways to approach the procedure	
	 Provide several examples for students to practice with a partner including ones similar to these. 	
	partner including ones similar to these. $(x \pm 2)(x \pm 4)$	
	(x - 3)(x - 4)	
	(x - 1)(x + 6)	
	$(x + 2)^2$	
-	Apply the concepts and procedures of multiplying two binomials to	
	a real-world situation	
	 For example, 	
	 An artist needs to frame a picture using a matte. 	
	Using the dimensions in the diagram below, write	
	an expression that represents the area of the	
	picture and matte.	
	20 in	

Segment 3			
Approximate Time Frame: 100-120 minutes	Lesson Format: Whole Group Small Group Independent		Resources:
Focus: Multiplying two polynomials with degree > 1.	 Modeled Guided Collaborative Assessment 		Modalities Represented: Concrete/Manipulative Picture/Graph Table/Chart Symbolic Oral/Written Language Real-Life Situation
Math Practice Look For(s):		Differentiation for Remediation:	
MP#2: Reason abstractly and quantitatively. Students will extend the properties of real numbers to polynomial expressions.		Differentiation for English Language Learners: Differentiation for Enrichment:	
Potential Pitfall(s): Students may attempt to "do these problems in their heads" instead of thoroughly writing out each step in the distribution procedure, which would cause students to lose terms. Students may neglect negative coefficients when multiplying two		Independent Practice (Homework):	
 terms and when combining like terms. Steps: Review multiplying two binomials and use this as a bridge to multiplying polynomials with larger degree As a large group, work through one example like this one below: (m² + 2m - 1)(2m² - 7m + 4) Be sure to use the term distribution to connect with previous learning Create a set of practice problems for students to work on with a partner Have students share their work in some way (on the board, paper pass, etc.) to generate discussion about proper procedures and common errors when multiplying polynomials Take a Chance on Polynomials Activity Pre-cut the poly-cards and enrichment set of polycards Pre-cut the dice out of cardstock (not regular paper) and then assemble them If you choose, you can use regular 6-sided dice and assign the numbers to the necessary operations 		Teacher Notes/R	eflections:

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Essential Question:

•	How do the arithmetic operations on numbers extend to polynomia	als?
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 Divide your class into groups of 2 students and give each group one activity packet If desired, the number of cards and trials can be reduced 				
Approximate Time Frame: Lesson Format:			Resources:	
45-50 minutes	Small Group		Operations of Polynomials Assessment	
Focus: Assessing student understanding of the operations on polynomials as they relate to operations on real numbers.	 Modeled Guided Collaborative Assessment 		Modalities Represented: Concrete/Manipulative Picture/Graph Table/Chart Symbolic Oral/Written Language Real-Life Situation	
Math Practice Look For(s):		Differentiation for Remediation:		
MP#2: Reason abstractly and quantitatively. Students will extend the properties of real numbers to polynomial expressions.		Differentiation for English Language Learners: Differentiation for Enrichment:		
Potential Pitfall(s):		Independent Practice (Homework):		
Steps: - Use assessment "Operations on Polynomials"		Teacher Notes/Refl	ections:	