6-2: Polynomials and Linear Factors

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LESSON OVERVIEW

Subject(s)	Mathematics
Topic or Unit of Study	Polynomials and Polynomial Functions
Grade/Level	Grade 10
Objective	1. Students will be able to write a polynomial in standard form when given factors of the polynomial. 2. Students will be able to write a polynomial in factored form when given a polynomial. 3. Students will be able to find relative maximum and minimum of a function. 4. Students will be able to find the zeroes of a function.
Summary	Students will learn how to factor polynomial functions and write polynomials from factors. This lesson also emphasizes that x-intercepts, roots, zeros, solutions, and factors are all the same.

IMPLEMENTATION

Learning Context	Students have learned how to classify polynomials and use XBox factoring to factor quadratics.
Teaching Strategies	Direct instruction, whiteboards (if time permits)
Time Allotment	1 class periods. 1.5 Hrs. per class.
Sample Student Products	
Author's Comments & Reflections	Students may need to review factoring techniques or the concept of factoring polynomials before teaching this lesson.

PROCEDURE

Anticipatory Set	
Modeling	**Writing a Polynomial in Standard Form**

Write the expression $(x + 4)(x - 3)(x + 1)$ as a polynomial in standard form.

$$(x + 4)(x - 3)(x + 1)$$
$$= [(x + 4)(x - 3)](x + 1)$$
$$= (x^2 - 3x + 4x - 12)(x + 1)$$
$$= (x^2 + x - 12)(x + 1)$$
$$= x^3 + x^2 + x^2 + x - 12x - 12$$
$$= x^3 + 2x^2 - 11x - 12$$

Writing a Polynomial in Factored Form

Write $9x^3 + 6x^2 - 3x$ in factored form.

$$9x^3 + 6x^2 - 3x$$
$$= 3x(3x^2 + 2x - 1); \text{ Greatest common factor is } 3x$$

$3(-1) = -3$			$3x$	-1
-1		3	x	$3x^2$ $-x$
	2		$+1$	$3x$ -1

$$= 3x(3x - 1)(x + 1)$$

Relative Maximum: the greatest y-value of the points in a region of a graph.

Relative Minimum: the least y-value among nearby points on a graph.

<u>Factor Theorem</u>

The expression $x - a$ is a linear factor of a polynomial if and only if the value a is a zero of the related polynomial function.

Multiple Zero: a repeated zero of a polynomial function (occurs if a linear factor of a polynomial is repeated).

Multiplicity: the number of times a specific multiple zero occurs.

<u>Equivalent Statements</u>

1. **-4** is a **solution** of $x^2 + 3x - 4 = 0$
2. **-4** is an **x-intercept** of the graph of $y = x^2 + 3x - 4$
3. **-4** is a **zero** of $y = x^2 + 3x + 4$
4. $x + 4$ is a **factor** of $x^2 + 3x - 4$

Guided Practice	Whiteboards
Independent Practice	
Closure	
Follow-Up	Warm-Up

MATERIALS AND RESOURCES

Instructional Materials	
Resources	

STANDARDS & ASSESSMENT

Standards

CA- California K-12 Academic Content Standards

Subject: Mathematics

Grade: Grades Eight Through TwelveThe standards for grades eight through twelve are organized differently from those for kindergarten through grade seven. In this section strands are not used for organizational purposes as they are in the elementary grades because the mathematics studied in grades eight through twelve falls naturally under disci-pline headings: algebra, geometry, and so forth. Many schools teach this material in traditional courses; others teach it in an integrated fashion. To allow local educational agencies and teachers flexibility in teaching the material, the stan-dards for grades eight through twelve do not mandate that a particular discipline be initiated and completed in a single grade. The core content of these subjects must be covered; students are expected to achieve the standards however these subjects are sequenced.

Standards are provided for algebra I, geometry, algebra II, trigonometry, math-ematical analysis, linear algebra, probability and statistics, Advanced Placement probability and statistics, and calculus. Many of the more advanced subjects are not taught in every middle school or high school. Moreover, schools and districts have different ways of combining the subject matter in these various disciplines. For example, many schools combine some trigonometry, mathematical analysis, and linear algebra to form a precalculus course. Some districts prefer offering trigonometry content with algebra II.

Area: Algebra IIThis discipline complements and expands the mathematical content and concepts of algebra I and geometry. Students who master algebra II will gain experience with algebraic solutions of problems in various content areas, including the solution of systems of quadratic equations, logarithmic and exponential functions, the binomial theorem, and the complex number system.

Sub-Strand 10.0: Students graph quadratic functions and determine the maxima, minima, and zeros of the function.

Assessment Plan

Homework is out of 20 points. The teacher will check 5 questions and grade each question (worth 4 points). The 5 questions will be from different sections of the assignment to avoid grading 5 questions that are the same problem-type (example: 5 problems asking to plot a linear equation) which may not adequately represent the student's progress towards the lesson's learning goal/standard.

Assessment/Rubrics

Rubrics:

1. Textbook Homework Rubric