6-3: Dividing Polynomials

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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 divide polynomials using polyomial long division. 2. Studnets will be able to divide polynomials using synthetic division. 3. Students will be able to divide a polynomial by a factor ($x - a$) to find the value of the polynomial evaluated at a (application of the Remainder Theorem).
Summary	EXTENDED TO TWO DAYS! EDIT THIS LESSON!

IMPLEMENTATION

Learning Context	Students learned about factoring polynomial functions in the previous lesson.
Teaching Strategies	Direct instruction, interactive web applet
Time Allotment	1 class periods. 1.5 Hrs. per class.
Sample Student Products	
Author's Comments & Reflections	

PROCEDURE

Anticipatory Set	
Modeling	**Polynomial Long Division** Follows the same format of the long division you learned back in grade school.

$$\begin{array}{r} 4 \;\; \text{R2} \\ 7\,\overline{)30} \\ -28 \\ \hline 2 \end{array}$$

Divide $(x^2 - 3x - 40)$ by $(x + 5)$

$$\begin{array}{r} x \; - \; 8 \\ x + 5 \,\overline{)x^2 - 3x - 40} \\ -(x^2 + 5x) \quad (\textit{How many times does } x \textit{ go into } x^2?) \\ \hline -8x - 40 \\ -(-8x - 40) \quad (\textit{How many times does } x \textit{ go into } -8x?) \\ \hline 0 \end{array}$$

$(x^2 - 3x - 40) \div (x + 5) = (x - 8)$

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Note: We look to the variables first in polynomial long division (the x in the divisor and dividend). The rest of the linear factor comes along for the ride (the 5).

Divide $(x^2 - 7x + 10)$ by $(x + 3)$

$$
\begin{array}{r}
x \quad - 10 \qquad\quad \text{R } 40 \\
x + 3 \enclose{longdiv}{x^2 - 7x + 10} \\
-(x^2 + 3x) \qquad\qquad \\
\hline
-10x + 10 \\
-(-10x - 30) \\
\hline
40
\end{array}
$$

$(x^2 - 7x + 10) \div (x + 3) = (x - 10) \text{ R } 40$

$$= (x - 10) + \frac{40}{(x + 3)}$$

Using Synthetic Division

Divide $(x^3 + 3x^2 - x - 3)$ by $(x - 1)$

First, take the $-$ of the a term of the divisor. $-(-1) = 1$

$$
\begin{array}{r|rrrr}
1 & 1 & 3 & -1 & -3 \quad \textit{(from coefficients of polynomial)} \\
  &   & 1 & 4 & 3 \quad \textit{(multiplied box number by previous bottom line)} \\
\hline
  & 1 & 4 & 3 & 0 \quad \textit{(sum; bottom right is the remainder)}
\end{array}
$$

$(x^3 + 3x^2 - x - 3) \div (x - 1) = (x^2 + 4x + 3)$

What if we were to factor this out?

$x^2 + 4x + 3 = (x + 3)(x + 1)$

Remainder Theorem

If a polynomial $P(x)$ of degreee $n \geq 1$ is divided by $(x - a)$, where a is a constant, then the remainder is $P(a)$.

Guided Practice

Worksheet

Students will complete a worksheet pg 78 in class to practice yesterday's lessons of factor in preparation for pg 77 dividing polynomials with the support of the classroom.

Independent Practice

Homework

Complete worksheets 77 and 78 and workbook Practice 6-3 Problems 2, 3, 6-14 (even), 15-24

Closure

Follow-Up

<u>**Warm-Up 1**</u>

<u>**Warm-Up 2**</u>

Factor:

$$8x^3 + 125$$

Answer:

$$8x^3 + 125 = (a + b)(a^2 - ab + b^2) = (2x + 5)((2x)^2 - (2x)(5) + (5)^2)$$
$$= (2x + 5)(4x^2 - 10x + 25)$$

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 3.0: Students are adept at operations on polynomials, including long division.

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