Polly, Want Some Division?
ID: 11606

Time Required
15–20 minutes

Activity Overview
In this activity, students will determine quotients and remainders when performing polynomial division using CAS commands. The Remainder Theorem is introduced and applied to identify roots or zeros and to determine function values. Graphs are incorporated to visually illustrate outcomes of polynomial division.

Topic: Polynomial Division
- *Remainder*
- *Quotient*
- *Remainder Theorem*
- *Evaluating functions*
- *Roots/Zeros and Factors of Functions*

Teacher Preparation and Notes
- *This activity was designed for use with TI-89 Titanium.*
- *Problems 1 and 2 may be done in class, and Problem 3 could either be done in class or assigned as homework.*
- ***To download the student worksheet, go to education.ti.com/exchange and enter "11606" in the keyword search box.***

Associated Materials
- *PolyDivision_Student.doc*

Suggested Related Activities
To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.
- *The Remainder Theorem Using TI-Nspire CAS (TI-Nspire CAS technology) — 9254*
- *Multiplication & Division of Functions (TI-Nspire technology) — 10218*
- *Polynomial Division (TI-89 Titanium) — 5505*

Problem 1 – Introduction

Students are introduced to dividing polynomials using their graphing calculators. Students can enter the division problem directly on the HOME screen. Remind students to enter parenthesis around each polynomial. If the divisor is a factor of the dividend, then the result from the division will be a polynomial. If the result is fraction, then the divisor is not a factor. This case will be addressed in Problem 2.

Next, students factor the dividend using the **Factor** command. They are asked about the result of this dividend being divided by $x - 1$, a factor.

Problem 2 – Remainders

This section of the activity introduces problems in which the divisor does not divide evenly into the dividend. The Remainder Theorem is introduced and explained.

Again, division is performed on the HOME screen. When students try to divide the polynomials as before, the result will be a fraction. This means that the divisor is not a factor of the dividend. To find the quotient and the remainder, students can use the **Expand** command (**F2 Algebra > 3:expand()**). The result will be a polynomial with a fractional term. The numerator of the fractional term is the remainder of division.

Students are asked to use the Remainder Theorem to interpret the meaning of their results as they relate to function values and roots or zeros.

### Problem 3 – Retained Impressions

This section provides an opportunity for additional practice with division involving a remainder and interpretation of the meaning of the remainder.

Exercise 10 provides another experience for division that does not involve a remainder. Students are again asked to interpret the results of their calculations as they relate to the Remainder Theorem.

The graphs of the dividend and quotient are also explored in this problem to provide additional practice with interpreting the effect of dividing a polynomial by a linear factor.

It may be helpful to have students add the linear factor to the given graph to aid in the illustration of the effect of this factor on the graph.
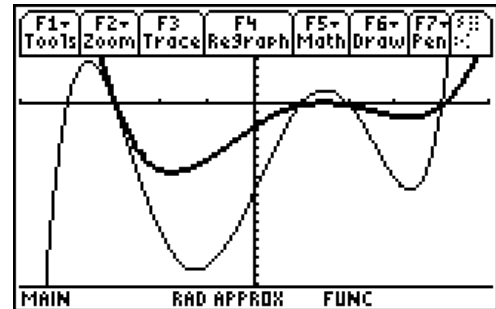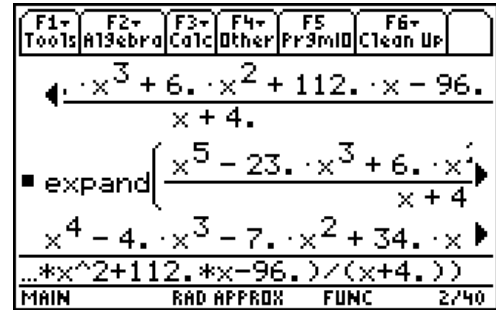
Student Solutions

1. a. dividend

   b. quotient

   c. divisor

2. a. $x^4 + 3x^2 - 10x - 24$

   b. 0

3. $(x - 3)(x + 2)(x + 4)$. Division by $x - 1$ will remove the factor $x - 1$ from the dividend.

4. a. $x^2 + 4x + 9$

   b. 30

5. 30

6. disagree

7. a. $6x^2 + 13x + 43$

   b. 112

8. 112

9. disagree

10. a. $x^4 - 4x^3 - 7x^2 + 34x - 24$

    b. 0

11. 0

12. agree

13. Dividing by a factor results in the removal of zeros or roots from the graph when comparing the graph of the original function to that of the quotient.