Dividing Polynomials

Key Points:

- Polynomial long division can be used to divide a polynomial $f(x)$ by any polynomial $d(x)$ with equal or lower degree.

- The ***Division Algorithm*** is defined as follows:

  $$f(x) = d(x)q(x) + r(x), \text{ where } q(x) \neq 0.$$

  The Division Algorithm tells us that a polynomial dividend $f(x)$ can be written as the product of the divisor $d(x)$ and the quotient $q(x)$ added to the remainder.

- Synthetic division is a shortcut that can be used to divide a polynomial by a binomial in the form $x - k$.

Dividing Polynomials Video

- Using Long Division to Divide Polynomials
- Using Synthetic Division to Divide Polynomials

Practice Exercises

Follow the directions for each exercise below:

1. Use long division to find the quotient and remainder: $\frac{x^3-2x^2+4x+4}{x-2}$

2. Use long division to find the quotient and remainder: $\frac{3x^4-4x^2+4x+8}{x+1}$

3. Use synthetic division to find the quotient. If the divisor is a factor, then write the factored form: $\frac{x^3-2x^2+5x-1}{x+3}$

4. Use synthetic division to find the quotient. If the divisor is a factor, then write the factored form: $\frac{x^3+4x+10}{x-3}$

5. Use synthetic division to find the quotient. If the divisor is a factor, then write the factored form: $\frac{2x^3+6x^2-11x-12}{x+4}$

6. Use synthetic division to find the quotient. If the divisor is a factor, then write the factored form: $\frac{3x^4+3x^3+2x+2}{x+1}$

Answers:

1. $x^2 + 4$ with remainder 12

2. $3x^3 - 3x^2 - x + 5$ with remainder 3

3. $x^2 - 5x + 20 - \frac{61}{x+3}$

4. $x^2 + 3x + 13 + \frac{49}{x-3}$

5. $2x^2 - 2x - 3$, so factored form is $(x + 4)(2x^2 - 2x - 3)$

6. $3x^3 + 2$, so factored form is $(x + 1)(3x^3 + 2)$