

Section 3.3: Dividing Polynomials

Key Topics: polynomial factor, division algorithm, synthetic division, remainder theorem, factor theorem

Polynomial Factor

A polynomial $D(x)$ is a **factor** of a polynomial $F(x)$ if there is a polynomial $Q(x)$ such that $F(x) =$ _____.

THE DIVISION ALGORITHM

If a polynomial $F(x)$ is divided by a polynomial $D(x)$, and $D(x)$ is not the zero polynomial, then there are unique polynomials $Q(x)$ and $R(x)$ such that

$$\frac{F(x)}{D(x)} = Q(x) + \frac{R(x)}{D(x)}$$

or

$$F(x) = D(x) \cdot Q(x) + R(x).$$

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 _____ _____ _____ _____

Either $R(x)$ is the *zero polynomial* or the degree of $R(x)$ is less than the degree of $D(x)$.

Compare/contrast long division and synthetic division by dividing $x^3 + 6x^2 - x - 32$ by $x + 5$.

THE REMAINDER THEOREM

If a polynomial $F(x)$ is divided by $x - a$, then the remainder R is given by

_____.

THE FACTOR THEOREM

A polynomial $F(x)$ has $(x - a)$ as a factor if and only if _____.

Given that 5 is a zero of the function $f(x) = 4x^3 - 11x^2 - 54x + 45$, solve the polynomial equation $4x^3 - 11x^2 - 54x + 45 = 0$.