CC Algebra 2 - Regents Review

Unit #10: Polynomial Functions (Video 1/2)

Video by Mr. Williamson
Newfield Senior High School

Based on Kirk Weiler's emathinstruction lessons

Unit 10 Video Overview

In Video 1:

- Video Overview
- Unit 10 Lesson Overview
- CCLS Associated with Unit 10 (3 slides)
- Power Functions vs. Polynomial Functions
- Graphs of Polynomial Functions
- Writing Equations of Polynomial Functions
- Polynomial Long Division
- The Remainder Theorem

In Video 2:

- Basics of Rational Functions
- Finding the Inverse of a Rational Function
- Simplifying Rational Expressions
- Multiplying Rational Expressions
- Dividing Rational Expressions
- Adding and Subtracting Rational Expressions
- Solving Rational Equations
- Solving Rational Inequalities
- Summary

Unit 10: Lesson Overview

- 10.1 Power Functions
- 10.2 Graphs and Zeroes of Polynomial Functions
- 10.3 Creating Polynomial Equations
- 10.4 Polynomial Identities
- 10.5 Introduction to Rational Functions
- 10.6 Simplifying Rational Expressions
- 10.7 Multiplying and Dividing Rational Expressions
- 10.8 Combining Rational Expressions Using Addition and Subtraction
- 10.9 Complex Fractions
- 10.10 Polynomial Long Division
- 10.11 The Remainder Theorem
- 10.12 Solving Rational Equations
- 10.13 Solving Rational Inequalities
- 10.14 Reasoning About Radical and Rational Equations

CCLS Associated with Unit 10 (Slide 1/3)

- F.IF.4 – For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.* Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.
- F.IF.7 – Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
- F.BF.3 – Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.* Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions

CCLS Associated with Unit 10 (Slide 2/3)

- A.REI.1 – Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. Tasks are limited to simple rational or radical equations.
- A.REI.2 – Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
- A.CED.1 – Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. Tasks are limited to exponential equations with rational or real exponents or rational functions.

CCLS Associated with Unit 10 (Slide 3/3)

- A.APR.2 – now and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.
- A.APR.3 – Identify zeroes of polynomials when suitable factorizations are available, and use the zeroes to construct a rough graph of the function defined by the polynomial. Tasks include quadratic, cubic, and quartic polynomials and polynomials for which factors are not provided.
- A.APR.4 – Prove polynomial identities and use them to describe numerical relationships.
- A.APR.6 – Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.

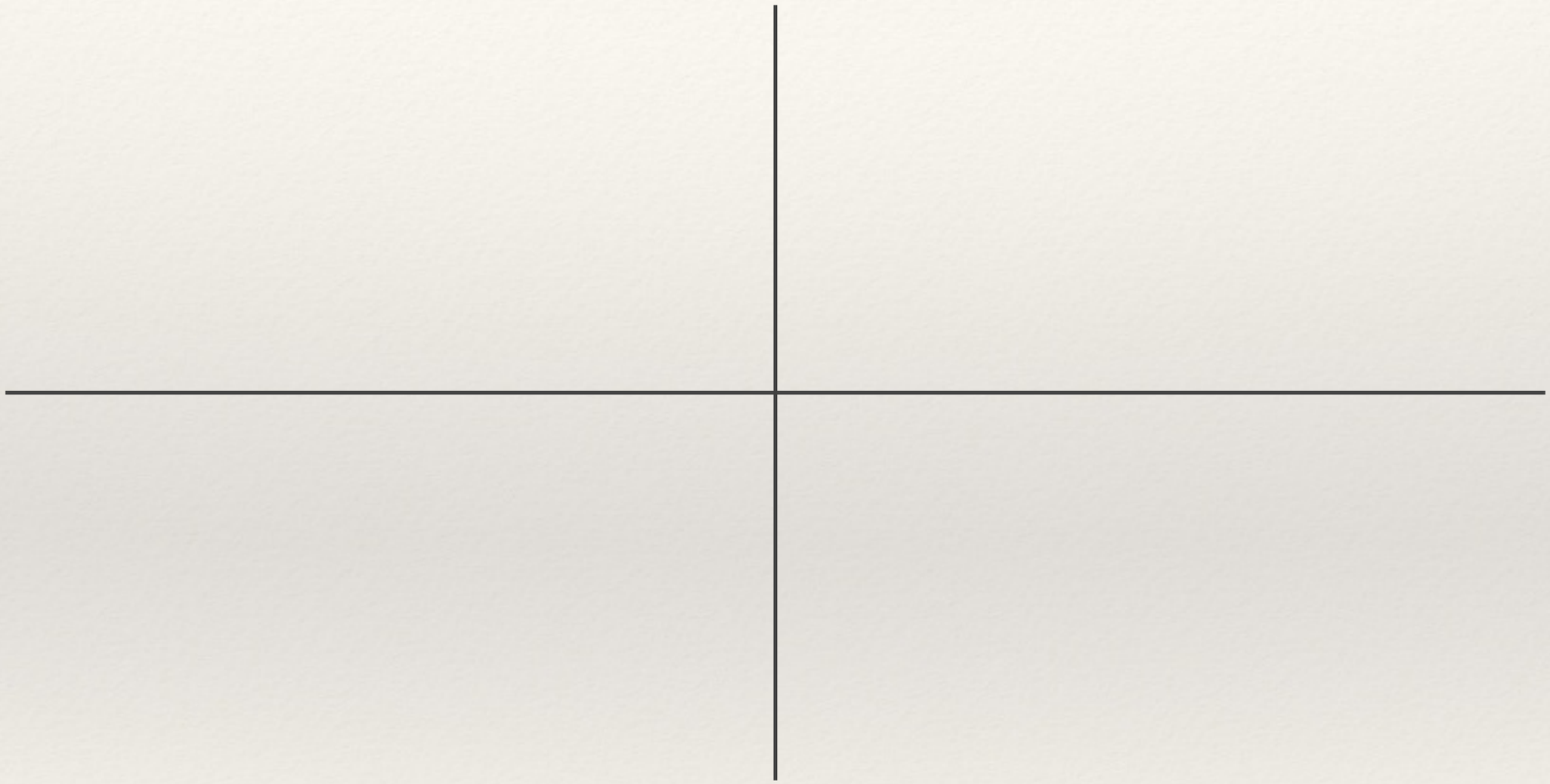
Power Functions vs. Polynomial Functions

Power Function:

Polynomial Function:

The end behavior of a polynomial function follows the same end behavior as its corresponding power function.

Graphs of Polynomial Functions



Writing Equations of Polynomial Functions

Write the equation of the cubic function that has zeroes located at –5, –1, and 3 and also contains the point (2, –42). Write your equation in standard form and sketch the graph of the function.

Polynomial Long Division

Divide the following polynomial using long division and write your answers in quotient-remainder form.

$$\frac{x^4 - 3x^2 + 6x + 41}{x - 5}$$

The Remainder Theorem

The Remainder Theorem states that when a polynomial function f(x) is divided by the binomial $x - a$, then remainder of the division will be f(a).

Apply the Remainder Theorem to determine the remainder of the following rational expression.

$$\frac{2x^3 - 4x^2 - 12x + 10}{x + 2}$$

End of Video 1

- In the second review video, I will go over:
  - Basics of Rational Functions
  - Finding the Inverse of a Rational Function
  - Simplifying Rational Expressions
  - Multiplying Rational Expressions
  - Dividing Rational Expressions
  - Adding and Subtracting Rational Expressions
  - Solving Rational Equations
  - Solving Rational Inequalities
  - Summary

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Unit #10: Polynomial Functions (Video 2/2)

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Review from Video 1

- Just a quick recall of what we reviewed in the first video:
  - Power Functions vs. Polynomial Functions
  - Graphs of Polynomial Functions
  - Writing Equations of Polynomial Functions
  - Polynomial Long Division
  - The Remainder Theorem

Review Material in This Video

- In this video review, I will go over:
  - Basics of Rational Functions
  - Finding the Inverse of a Rational Function
  - Simplifying Rational Expressions
  - Multiplying Rational Expressions
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Basics of Rational Functions

Graph:

Domain:

Range:

Find the domain of the following rational expressions.

$$\frac{8x}{5x^2+2x}$$

$$\frac{x^3-8}{2x^2-5x-3}$$

Find the x and y-intercepts of the following rational function.

$$f(x)=\frac{3x-12}{x+4}$$

Finding the Inverse of a Rational Function

Find the inverse of each of the following rational functions. Write your answers using proper inverse function notation.

$$h(x)=\frac{2x+3}{5x}$$

$$g(x)=\frac{2}{x+4}$$

Simplifying Rational Expressions

Completely factor the numerator and the denominator. Then cancel any factors that appear in the numerator and the denominator.

Completely reduce the following rational expressions.

$$\frac{x^2-3x}{4x-12}$$

$$\frac{3m-2m^2}{2m^2-m-3}$$

Multiplying Rational Expressions

Multiply the following rational expressions.

$$\frac{x^3+8}{4-x^2}\cdot\frac{6x^2-12x}{3x^3-6x^2+12x}$$

Dividing Rational Expressions

Divide the following rational expressions.

$$\frac{x^2-5x+6}{x^2+3x+2} \div \frac{3x-9}{x+1}$$

$$\frac{\frac{6}{x-2}+\frac{4}{x+3}}{\frac{2}{x^2+x-6}}$$

Adding and Subtracting Rational Expressions

Add or subtract the following rational expressions by first finding a common denominator.

$$\frac{2x}{x^2-1}+\frac{5x}{x^2+x}$$

$$\frac{y}{y-3}-\frac{18}{y^2-9}$$

Solving Rational Equations

Solve the following rational equation for all values of x.

$$\frac{x+1}{x+5}+\frac{18}{x^2+8x+15}=\frac{9}{x+3}$$

Solving Rational Inequalities

Solve the following rational inequality. Represent your answer both algebraically and on a number line.

$$\frac{x+1}{x+2}-\frac{1}{2}>\frac{6}{x+2}$$

Summary of Most Important Information

- Students should be able to:
  - Identify key aspects of a power function, polynomial function, or rational function, such as intercepts, asymptotes, zeroes, and end behavior.
  - Write the equation of a polynomial function given its roots and one point on the function.
  - Apply polynomial long division to divide two polynomials.
  - Apply the Remainder Theorem.
  - Find the domain and range of a polynomial or rational function.
  - Find the inverse of a rational function.
  - Completely simplify a rational expression.
  - Add, subtract, multiply, or divide rational expressions.
  - Solve rational equations and inequalities.