

College Algebra Corequisite Instructor Guide

Module 2: Polynomial and Rational Expressions

Table of Contents

Table of Contents	1
Learning Outcomes	2
Summary of Module	2
Module Resources	4
Cheat Sheet	4
Worksheets/Handouts	4
Activity One: The Polynomial Path Challenge	5
Evidence-Based Teaching Practice	5
Background	5
Instructions	6
Discussion Prompts	7
Reflection	8
Online Variation	8
Assignments	9
Polynomial Applications Discussion	9
Polynomial Models Writing Task	9

Learning Outcomes

[Detailed Course Learning Outcome Spreadsheet is linked here.](#)

Topic	Student Learning Goals
Polynomial Basics	• Recognize polynomial functions, noting their degree and leading coefficient • Add, subtract, and multiply polynomials using different methods, including the FOIL method for two-term polynomials • Work with polynomials that have more than one variable, understanding how to combine and simplify them
Factoring Polynomials	• Factor polynomial expressions using the Greatest Common Factor (GCF) and by grouping to simplify expressions. • Factor trinomials and perfect square trinomials into binomials. • Break down expressions like differences of squares and cubic equations into their simpler factors. • Use specific methods to factor expressions that contain fractional or negative exponents.
Rational Expressions	• Figure out which values make a rational expression impossible to calculate (like dividing by zero) • Simplify rational expressions • Practice how to multiply, divide, add, and subtract rational expressions

Summary of Module

Background You'll Need

The assumed prerequisite skills:

- Learn how to find the smallest shared denominator for two fractions and adjust them to have the same denominator.
- Find the largest factor that common terms in an algebraic expression share.

Polynomial Basics

In this section, students explore polynomial functions through real-world applications like an expanding oil spill, learning to identify polynomial types and key components such as terms, degrees, and coefficients. They progress through fundamental operations, starting with adding and subtracting polynomials by combining like terms, then advancing to multiplication using both the distributive method and FOIL technique. The module then introduces special polynomial forms - perfect square trinomials and difference of squares - helping students recognize patterns and shortcuts, before concluding with applications to polynomials containing multiple variables, where students apply these same operational principles to more complex expressions.

Factoring Polynomials

In this section, students explore the fundamental concept of factoring polynomials, starting with identifying and factoring out the Greatest Common Factor (GCF) from expressions. They then progress through increasingly complex factoring techniques, including factoring trinomials with leading coefficients of both 1 and other values, learning to recognize and factor special polynomial forms like perfect square trinomials and difference of squares, and mastering the factoring of sum and difference of cubes. The module concludes with applications to expressions containing fractional and negative exponents, with students practicing each concept through problems that help them build proficiency in breaking down polynomial expressions into their simplest factored forms.

Rational Expressions

In this section, students explore rational expressions, which are formed by dividing one polynomial by another. Starting with a real-world application involving a pastry shop's costs, students learn to identify undefined values where denominators equal zero and practice simplifying rational expressions through factoring and canceling common terms. They then progress through fundamental operations with rational expressions, learning to add and subtract by finding least common denominators, multiply by combining factored terms, and divide by using reciprocals. The module concludes with complex rational expressions, where students learn to simplify expressions containing fractions within fractions by combining terms in numerators and denominators before applying division techniques.

Module Resources

Cheat Sheet



Polynomial and Rational Expressions: Cheat Sheet

Worksheets/Handouts



[The Polynomial Path Challenge: Building Blueprint](#)



[The Polynomial Path Challenge Navigation Guide](#)



[The Polynomial Path Challenge: Building Blueprint Answer Key](#)



[Polynomial Applications Discussion](#)



[Polynomial Models Writing Task](#)

Activity One: The Polynomial Path Challenge

Evidence-Based Teaching Practice



Time on Task

Educators maximize the amount of learning time students spend actively engaged in practice through a structured progression of polynomial problems that keep students consistently working and building on their understanding.



Higher Order Thinking

Educators engage students in activities specifically designed to cultivate level-appropriate critical thinking and analytical reasoning by requiring them to analyze polynomial expressions and determine appropriate factoring strategies.



Collaboration

Educators design group projects that require students to work together to help them master both core content and critical skills related to collaboration and teamwork by having students collectively analyze and solve polynomial factoring challenges.

Background

Students have learned about polynomial operations and factoring techniques, including identifying polynomial types, working with GCF, factoring by grouping, recognizing special patterns, and simplifying rational expressions. This activity transforms polynomial factoring into an engaging escape room experience where students work in teams to analyze expressions and determine appropriate factoring methods to navigate through a mathematical maze. You will need to print the handouts ahead of time or require students to complete it as a Google Doc and share it with you.

Instructions

Time Estimate: 60-75 minutes

1. Conversation starter

What strategies do you use to determine how to factor a polynomial?

2. Review

You may wish to briefly review key factoring techniques including GCF, grouping, special patterns (difference of squares, perfect square trinomials), and factoring trinomials.

3. Split the class into groups of 3-4 students

Students will need paper for calculations and a copy of the building blueprint to mark their path.

4. Distribute Materials

Give each team a copy of the Building Blueprint and Navigation Guide handouts.

5. Explain the Challenge

Teams must find their way through the building by factoring or simplifying expressions in each room. The result determines which adjacent room they can enter next.

6. Guide Navigation

Show students how to mark their path by numbering rooms sequentially as they progress through the building.

7. Monitor progress

Circulate among teams to verify calculations and provide hints when needed.

8. Class Discussion

Facilitate a class discussion about the groupings and any surprising results or challenges faced.

Discussion Prompts

- **What patterns did you notice in how different polynomials could be factored? How did recognizing these patterns help you navigate through the building?**

Goal: This discussion aims to develop students' pattern recognition skills and metacognitive awareness of factoring strategies. By reflecting on the patterns they encountered, students can build a more systematic approach to identifying factoring techniques. The discussion should help students connect visual patterns in polynomial expressions to specific factoring methods and understand how these patterns relate to the polynomial's structure.

- **Why is it important to check for a Greatest Common Factor (GCF) before attempting other factoring techniques?**

Misconception: Many students bypass checking for a GCF because they:

- Assume GCF only applies to simple monomials
- Think finding a GCF is an extra step rather than a simplifying first step
- Don't realize that finding the GCF first makes subsequent factoring easier
- Believe that jumping straight to more complex factoring techniques is more efficient. This discussion helps students understand that identifying and factoring out the GCF first often simplifies the remaining factoring process significantly.

- **When factoring a polynomial completely, why might you need to apply multiple factoring techniques? Can you give an example from today's activity?**

Goal: This discussion helps students understand the iterative nature of polynomial factoring and the importance of continuing to factor until no further factoring is possible. Students should recognize that complex polynomials often require a combination of techniques applied in a strategic order.

- **How did you determine whether to factor by grouping versus looking for special patterns?**

Sample answer: This discussion helps students understand the iterative nature of polynomial factoring and the importance of continuing to factor until no further factoring is possible. Students should recognize that complex polynomials often require a combination of techniques applied in a strategic order.

Reflection

After the activity, we recommend that students complete exit cards. Have each student write on a piece of paper one key concept they learned from the activity and one concept they have questions about. Below are some suggestions for students:

- Which factoring technique did you find most challenging in today's activity, and why?
- How would you explain to a classmate your strategy for identifying special polynomial patterns?
- What was one error your team caught and corrected during the activity?
- Which room required the most discussion among your team members and what made it challenging?
- What strategy did you develop for checking if your factored expression was correct?
- If you were to create a new room for this activity, what type of polynomial would you include and why?
- What questions do you still have about identifying when to use different factoring techniques?

Online Variation

To adapt this activity for online learning, use breakout rooms for teams and create a digital version of the building blueprint using Google Slides or Jamboard. Teams can document their path in a shared Google Doc while using collaborative whiteboard tools for calculations. Move between breakout rooms regularly to provide guidance and verify progress. The entire class can be brought back into one room for students to compare results and discuss the activity. Discussion prompts are provided.

Assignments

Polynomial Applications Discussion

In this discussion, students will explore real-world applications of polynomials across diverse fields such as engineering, economics, medicine, and computer graphics. Students will select an application that interests them, identify the polynomials involved including their degree and variables, and explain how polynomial operations are used to model or solve problems in their chosen context. Students will create posts describing their applications with specific polynomial expressions and engage with classmates by responding to at least two other posts, making connections between applications and discussing similarities in how polynomial operations are applied in different scenarios.

[Polynomial Applications Discussion](#)

We ask that you make your own copy to edit and adjust to fit the needs of your classroom

Polynomial Models Writing Task

In this assignment, students will create and analyze polynomial models based on a rectangular garden scenario with a dividing fence. Students will develop polynomial expressions for the garden's area and the cost of fencing, analyze these expressions through factoring, determine maximum area dimensions, simplify rational expressions, and solve polynomial inequalities related to budget constraints. This practical application reinforces how polynomial operations and rational expressions can model real-world situations involving areas, dimensions, and cost optimization. Students will also discuss how their model would be affected by modifications and explore other real-world applications of polynomial modeling.

[Polynomial Models Writing Task](#)

We ask that you make your own copy to edit and adjust to fit the needs of your classroom