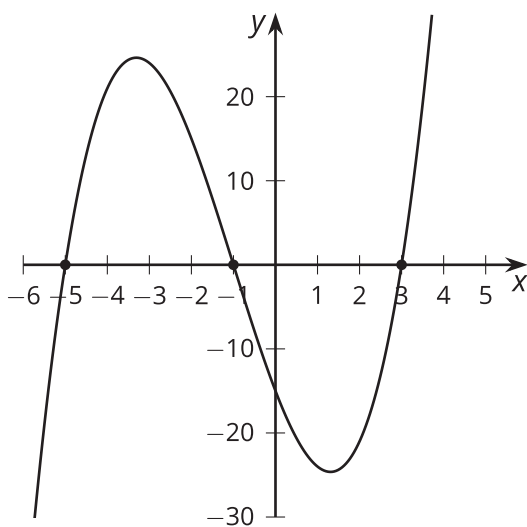# Connecting Factors and Zeros

Let's investigate polynomials written in factored form.
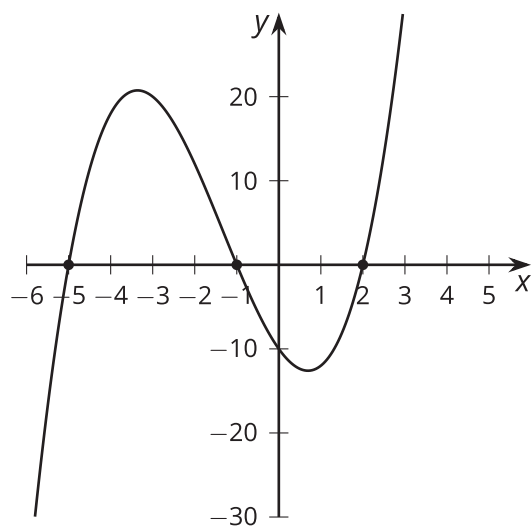
5.1 Notice and Wonder: Factored Form

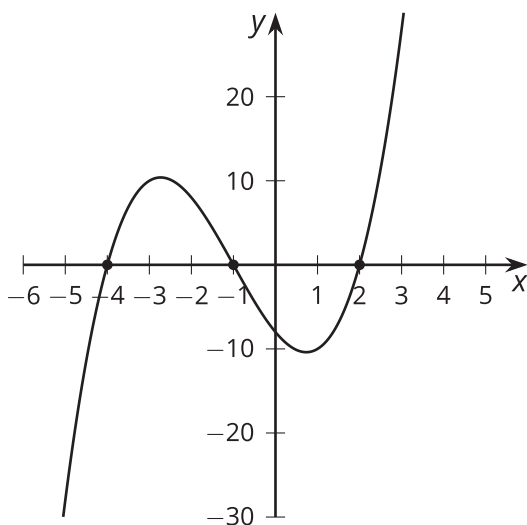What do you notice? What do you wonder?

$f(x) = (x + 5)(x + 1)(x - 3)$

$g(x) = (x + 5)(x + 1)(x - 2)$

$h(x) = (x + 4)(x + 1)(x - 2)$

5.2 What Values of x Make These Equations True?

Find all values of x that make the equation true.

1. $(x + 4)(x + 2)(x - 1) = 0$

2. $(x + 4)(x + 2)(x - 1)(x - 3) = 0$

3. $(x + 4)^2(x + 2)^2 = 0$

4. $-2(x - 4)(x - 2)(x + 1)(x + 3) = 0$

5. $(2x + 8)(7x - 3)(x - 10) = 0$

6. $x^2 + 3x - 4 = 0$

7. $x(3 - x)(x - 1)(x + 0.75) = 0$

8. $(x^2 - 4)(x + 9) = 0$

💡 Are you ready for more?

1. Write an equation that is true when x is equal to -5, 4, or 0 and for no other values of x.

2. Write an equation that is true when x is equal to -5, 4, or 0 and for no other values of x, and where one side of the equation is a 4th-degree polynomial.

5.3 Card Sort: Factors, Intercepts, and Graphs

Your teacher will give you a set of cards. Take turns with your partner to match each equation to either a graph or a description of a graph.
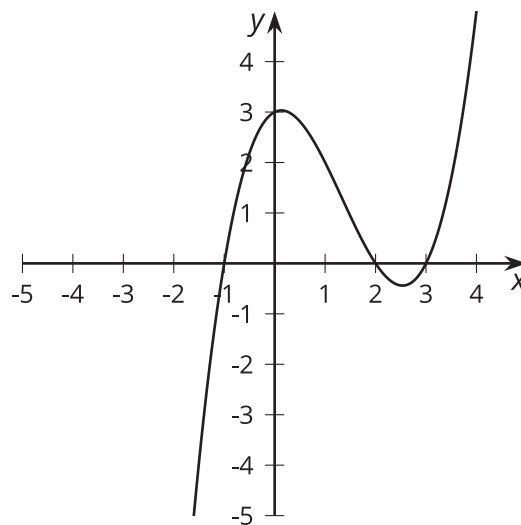
1. For each match that you find, explain to your partner how you know it's a match.

2. For each match that your partner finds, listen carefully to their explanation. If you disagree, discuss your thinking and work to reach an agreement.

👥 Lesson 5 Summary

When a polynomial is written in factored form, we can identify several facts about it.

For example, the factored form of the polynomial shown in the graph is $P(x) = 0.5(x - 3)(x - 2)(x + 1)$.

The graph has x-intercepts at $x = 3$, 2, and -1. Each of these x-values makes one of the factors in the expression $0.5(x - 3)(x - 2)(x + 1)$ equal to 0, and so makes the equation $P(x) = 0$ true. The numbers 3, 2, and -1 are known as the *zeros* of the function.

When a polynomial is not written in factored form, identifying the zeros from the expression for the polynomial can be more challenging. We'll learn how to do that in future lessons.