

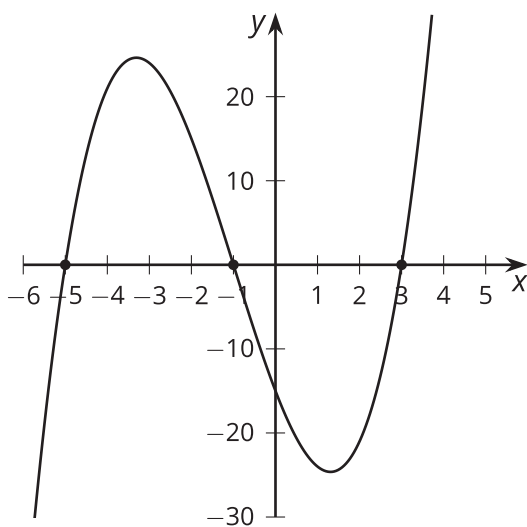
# Connecting Factors and Zeros

Let's investigate polynomials written in factored form.

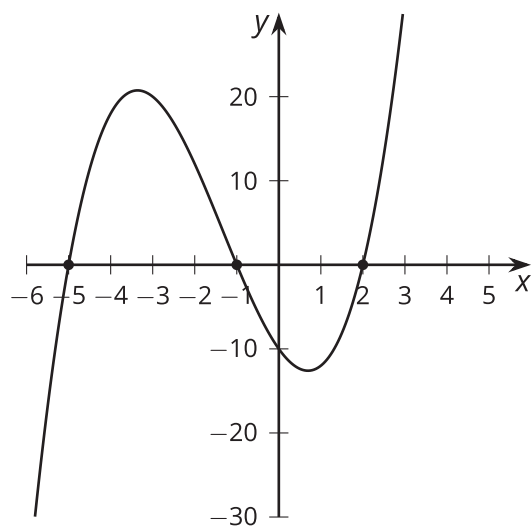
## 5.1 Notice and Wonder: Factored Form

What do you notice? What do you wonder?

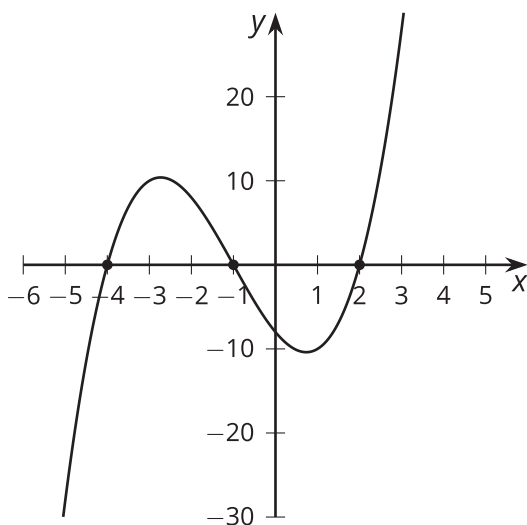
$$f(x) = (x + 5)(x + 1)(x - 3)$$



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



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



## 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.

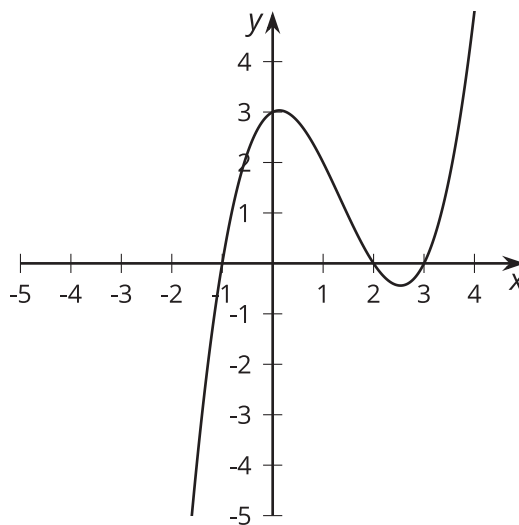
1. For each match that you find, explain to your partner how you know it's a match.
2. For each match that your partner finds, listen carefully to their explanation. If you disagree, discuss your thinking and work to reach an agreement.

### 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.