



# Standard Form and Factored Form

Let's write quadratic expressions in different forms.

## 9.1 Math Talk: Opposites Attract

Solve each equation for  $n$ , mentally.

- $40 - 8 = 40 + n$

- $25 + -100 = 25 - n$

- $3 - \frac{1}{2} = 3 + n$

- $72 - n = 72 + 6$

## Finding Products of Differences

1. Show that  $(x - 1)(x - 1)$  and  $x^2 - 2x + 1$  are equivalent expressions by drawing a diagram or applying the distributive property. Show your reasoning.
2. For each expression, write an equivalent expression. Show your reasoning.
  - a.  $(x + 1)(x - 1)$
  - b.  $(x - 2)(x + 3)$
  - c.  $(x - 2)^2$

## What Is the Standard Form? What Is the Factored Form?

The quadratic expression  $x^2 + 4x + 3$  is written in **standard form**.

Here are some other quadratic expressions. In one column, the expressions are written in standard form and in the other column the expressions are not.

Written in standard form:

$$x^2 - 1$$

$$x^2 + 9x$$

$$\frac{1}{2}x^2$$

$$4x^2 - 2x + 5$$

$$-3x^2 - x + 6$$

$$1 - x^2$$

Not written in standard form:

$$(2x + 3)x$$

$$(x + 1)(x - 1)$$

$$3(x - 2)^2 + 1$$

$$-4(x^2 + x) + 7$$

$$(x + 8)(-x + 5)$$

1. What are some characteristics of expressions in standard form?
2.  $(x + 1)(x - 1)$  and  $(2x + 3)x$  in the other column are quadratic expressions written in **factored form**. Why do you think that form is called factored form?



### Are you ready for more?

What quadratic expression can be described as being both standard form and factored form? Explain how you know.

## Lesson 9 Summary

A quadratic function can often be represented by many equivalent expressions. For example, a quadratic function,  $f$ , might be defined by  $f(x) = x^2 + 3x + 2$ . The quadratic expression  $x^2 + 3x + 2$  is called the **standard form**, the sum of a multiple of  $x^2$  and a linear expression ( $3x + 2$  in this case).

In general, standard form is written as

$$ax^2 + bx + c$$

We refer to  $a$  as the coefficient of the squared term  $x^2$ ,  $b$  as the coefficient of the linear term  $x$ , and  $c$  as the constant term.

Function  $f$  can also be defined by the equivalent expression  $(x + 2)(x + 1)$ . When the quadratic expression is a product of two factors where each one is a linear expression, this is called the **factored form**.

An expression in factored form can be rewritten in standard form by expanding it, which means multiplying out the factors. In a previous lesson we saw how to use a diagram and to apply the distributive property to multiply two linear expressions, such as  $(x + 3)(x + 2)$ . We can do the same to expand an expression with a sum and a difference, such as  $(x + 5)(x - 2)$ , or to expand an expression with two differences, for example,  $(x - 4)(x - 1)$ .

To represent  $(x - 4)(x - 1)$  with a diagram, we can think of subtraction as adding the opposite:

	$x$	$-4$
$x$	$x^2$	$-4x$
$-1$	$-x$	$4$

$$\begin{aligned}(x - 4)(x - 1) &= (x + -4)(x + -1) \\ &= x(x + -1) + -4(x + -1) \\ &= x^2 + -1x + -4x + (-4)(-1) \\ &= x^2 + -5x + 4 \\ &= x^2 - 5x + 4\end{aligned}$$