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:

Not written in standard form:

$$x^{2}-1$$

$$x^{2} + 9x$$

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

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

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

$$(2x+3)x$$

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

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

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

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

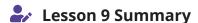
1. What are some characteristics of expressions in standard form?

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?

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Are you ready for more?

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



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
х	x^2	-4 <i>x</i>
-1	-x	4

$$(x - 4) (x - 1)$$

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

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

$$= x^{2} + -1x + -4x + (-4)(-1)$$

$$= x^{2} + -5x + 4$$

$$= x^{2} - 5x + 4$$

