## Lesson 9: Standard Form and Factored Form

* Let’s write quadratic expressions in different forms.

### 9.1: Math Talk: Opposites Attract

Solve each equation mentally.

$40−8=40+n$

$25+-100=25−n$

$3−\frac{1}{2}=3+n$

$72−n=72+6$

### 9.2: Finding Products of Differences

1. Show that $\left(x−1\right)\left(x−1\right)$ 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.
	1. $\left(x+1\right)\left(x−1\right)$
	2. $\left(x−2\right)\left(x+3\right)$
	3. $\left(x−2\right)^{2}$

### 9.3: 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. The expressions on the left are written in standard form and the expressions on the right 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:

$\left(2x+3\right)x$

$\left(x+1\right)\left(x−1\right)$

$3\left(x−2\right)^{2}+1$

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

$\left(x+8\right)\left(-x+5\right)$

1. What are some characteristics of expressions in standard form?
2. $\left(x+1\right)\left(x−1\right)$ and $\left(2x+3\right)x$ in the right 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 $f\left(x\right)=x^{2}+3x+2$. 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 $ax^{2}+bx+c$

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.

The function $f$ can also be defined by the equivalent expression $\left(x+2\right)\left(x+1\right)$. 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 $\left(x+3\right)\left(x+2\right)$. We can do the same to expand an expression with a sum and a difference, such as $\left(x+5\right)\left(x−2\right)$, or to expand an expression with two differences, for example, $\left(x−4\right)\left(x−1\right)$.

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

|  | $x$ | $-4$ |
| --- | --- | --- |
| $x$ | $x^{2}$ | $-4x$ |
| $-1$ | $-x$ | $4$ |





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