- MA.912.A.4.2
  Add, subtract, and multiply polynomials.
- MA.912.A.4.3
  Factor polynomial expressions.
- MA.912.A.4.4
  Divide polynomials by monomials and polynomials with various techniques, including synthetic division.

Factoring Quadratic Polynomials

Polynomials that are written in the format $ax^2 + bx + c$ can be factored into two binomials. The following six-step method may help, especially if you have had difficulty with factoring in the past.

Example 1

Format	$ax^2 + bx + c$	
Step 1	$6x^2 + 17x + 5$ x	← Write the problem. Factor out common factors, if there are any. Identify *a*, *b*, and *c*. *a* = 6, *b* = 17, and *c* = 5
Step 2	$ac = 6 \bullet 5$ $= 30$	← Multiply *a* and *c*.
Step 3	$6x^2 + 2x + 15x + 5$	← Rewrite the problem using factors of *ac*. The factors you choose must combine (add or subtract) to *equal the middle term*. **Note:** 2*x* + 15*x* = 17*x*, which is the *same* as the *original* middle term.
Step 4	$(6x^2 + 2x) + (15x + 5)$	← Group the first two terms and the last two terms.
Step 5	$2x(3x + 1) + 5(3x + 1)$	← Factor out the greatest common factor for each term. You will always be left with a matching pair of factors. Notice the factors of (3*x* + 1). If you do **not** have a matching pair, double-check your work at this point!
Step 6	$(3x + 1)(2x + 5)$	← Write down the common factor (3*x* + 1). Then write the "leftovers" in parentheses. You have succeeded!

The next example shows how to handle minus signs. Watch carefully!

Example 2

Format $ax^2 + bx + c$

Step 1 $4x^2 - 5x + 1$ ← Write the problem. Factor out common factors, if there are any. Identify *a*, *b*, and *c*.

a = 4, *b* = -5, and *c* = 1

Step 2 $ac = 4 \bullet 1 = 4$ ← Multiply *a* and *c*.

Step 3 $4x^2 - 4x - x + 1 =$
$4x^2 + -4x + -x + 1 =$ ← Rewrite the problem using factors of *ac*. The factors you choose must combine (add or subtract) to *equal the middle term*.

Step 4 $(4x^2 + -4x) + (-x + 1) =$ ← Group the first two terms and the last two terms. *If the second term in step 3 is followed by a minus sign, this* ***requires*** *a sign change to each term in the second group.*

Step 5 $4x(x - 1) + -1(x - 1) =$ ← Factor out the greatest common factor for each term. You must always have a common factor, even if it is only a 1. You will always be left with a matching pair of factors. Notice the factors of (x – 1). If you do **not** have a matching pair, double-check your work at this point!

Step 6 $(x - 1)(4x - 1)$ ← Write down the common factor (x – 1). Then write the "leftovers" in parentheses. You have succeeded!

Now, you try one!

Example 3

Format $ax^2 + bx + c$

Step 1 $4x^2 + 4x - 3$ ← Write the problem. Factor out common factors, if there are any. Identify *a*, *b*, and *c*.
a = ____ , *b* = ____ , and *c* = ____

Step 2 ac = _______
= _______ ← Multiply *a* and *c*.

Step 3 ________________ ← Rewrite the problem using factors of *ac*. The factors you choose must combine (add or subtract) to *equal the middle term*.

Step 4 ________________ ← Group the first two terms and the last two terms. *If the second term in step 3 is followed by a minus sign, this* ***requires*** *a sign change to each term in the second group.*

Step 5 ________________ ← Factor out the greatest common factor for each term. You must always have a common factor, even if it is only a 1. You will always be left with a matching pair of factors. Notice the factors of $(2x + 3)$. If you do **not** have a matching pair, double-check your work at this point!

Step 6 ________________ ← Write down the common factor. Then write the "leftovers" in parentheses.

Use FOIL to check your answer. If your answer is $(2x + 3)(2x - 1)$, you have succeeded!

Now you are ready to practice some problems on your own.