

Chapter 5 Section 4 Factoring Trinomials

Trinomial: three terms

Form: $ax^2 + bx + c$

Quadratic term: ax^2

Linear term: bx

Constant term: c

Factoring by groups.

Factor: $2x^2 + 11x + 12$

Step 1: multiply ac

$$2 \cdot 12 = 24$$

Step 2: Find two factors of 24 whose sum is b or 11

List the factors of 24

$$1 \cdot 24$$

$$2 \cdot 12$$

$$3 \cdot 8 \quad \text{product is 24 and the sum is 11.}$$

Step 3: Rewrite the middle term using the two factors found in step 2

$$2x^2 + 3x + 8x + 12$$

Step 4: Group the first 2 and last 2 terms

$$(2x^2 + 3x) + (8x + 12)$$

Step 5: Factor and factor

$$x(2x + 3) + 4(2x + 3)$$

$$(x + 4)(2x + 3)$$

Step 6: Check

Multiply the two binomials and should get the original polynomial

$$\begin{array}{c}
 2x^2 + 11x + 12 \\
 \swarrow \quad \searrow \quad \swarrow \quad \searrow \\
 \quad \quad 24x^2 \\
 \swarrow \quad \searrow \\
 2x^2 + 8x + 3x + 12 \\
 \underbrace{\hspace{2cm}} \quad \underbrace{\hspace{2cm}} \\
 2x(x + 4) + 3(x + 4) \\
 \swarrow \quad \searrow \quad \swarrow \quad \searrow \\
 \underline{\underline{(x + 4)(2x + 3)}}
 \end{array}$$

Multiply the x^2 term with the constant term

Split $24x^2$ into two terms that add to $11x$

Bring down $2x^2$ and 12

Group the 1st 2 terms and 2nd 2 terms - GCF!

The grouping should be the same - that's the first binomial. The other binomial comes from the other two terms

Way 2: Steps 1, 2 same

Factor: $2x^2 + 11x + 12$

Step 1: multiply ac
 $2 \cdot 12 = 24$

Step 2: Find two factors of 24 whose sum is b or 11

List the factors of 24

$$1 \cdot 24$$

$$2 \cdot 12$$

$$3 \cdot 8 \quad \text{product is 24 and the sum is 11.}$$

Step 3:

Using the two numbers found in step 2, divide each by the coefficient of the quadratic term

$$\frac{3}{2} \text{ and } \frac{8}{2} \quad \frac{8}{2} = 4$$

with the fraction, the 2 is the linear term and 3 is the constant term in one of the factored terms

$$(2x + 3)(x + 4)$$

Way 3: Using a table – Area model
Steps 1, 2 same

Factor: $2x^2 + 11x + 12$

Step 1: multiply ac

$$2 \cdot 12 = 24$$

Step 2: Find two factors of 24 whose sum is b or 11

List the factors of 24

$$1 \cdot 24$$

$$2 \cdot 12$$

$$3 \cdot 8 \quad \text{product is 24 and the sum is 11.}$$

Step 3:

Set up a box with information in step 2 and the quadratic term and constant term

	$2x^2$	$8x$
	$3x$	12

Step 4:

Factor the horizontal and vertical and put the common factor on the left side and on top

	x	4
2x	$2x^2$	$8x$
3	$3x$	12

Step 5:

Write the factors: top and side

$$(x + 4)(2x + 3)$$

Factor: $5x^2 + 14x + 8$

This is the form $ax^2 + bx + c$ where $a = 5$, $b = 14$, $c = 8$

Step 1: multiply ac

$$5 \cdot 8 = 40$$

Step 2: Find two factors of 40 whose sum is b or 14

List the factors of 40

$$1 \cdot 40$$

$$2 \cdot 20$$

$$4 \cdot 10 \quad \text{product is 40 and the sum is 14.}$$

Decide which way to factor:
group, area model

Grouping

Step 3: Rewrite the middle term using the two factors found in step 2

$$5x^2 + 4x + 10x + 8$$

Step 4: Group the first 2 and last 2 terms

$$(5x^2 + 4x) + (10x + 8)$$

Step 5: Factor and factor

$$x(5x + 4) + 2(5x + 4)$$

$$(5x + 4)(x + 2)$$

Step 6: Check

Multiply the two binomials and should get the original polynomial

Try using the area model.

Factoring with two variables

Example 4: page 354

$$x^2 - 4xy - 21y^2$$

Example 5: page 355

$$8x^3 - 40x^2 - 48x$$

Factor using substitution

$$x^6 - 8x^3 + 15 \text{ or } (x^3)^2 - 8x^3 + 15$$