Lesson 3 - Factoring Trinomials

Algebra and Number
Demonstrate an understanding of common factors and trinomial factoring, concretely, pictorially and symbolically.

Lesson 3

A rectangle can have an area that is a trinomial. By finding the dimensions of the rectangle, you are reversing the process of multiplying two binomials. This process is called *factoring*.

You can factor a trinomial of the form $x^2 + bx + c$ and the form $ax^2 + bx + c$ by studying patterns.

Observe patterns that result from multiplying two binomials.

Factor Trinomials of the Form $ax^2 + bx + c$, $a = 1$

Multiply $x + 2$ and $x + 3$

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

$= x^2 + 2x + 3x + (2)(3)$

$= x^2 + 5x + 6$

Note that $3 + 2 = 5$ and $(2)(3) = 6$

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Example 1
Factor, if possible. $x^2 + 5x + 4$

$x^2 + bx + c$

b = 2 numbers that add to give you b

c = 2 numbers that multiply to give you c.

multiply to get $\underline{\underline{4}}$.

$2 \times 2 \Rightarrow 2 + 2 = 4$

$\boxed{4 \times 1 \Rightarrow 4 + 1 = 5}$

$\boxed{(x + 4)(x + 1)}$

Check

$(x + 4)(x + 1)$

$x^2 + 1x + 4x + 4$

$x^2 + 5x + 4$ ✓

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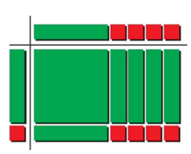
Example 1
Factor, if possible. $x^2 + 5x + 4$

Solution

Method 1: Use Algebra Tiles

Arrange one x^2-tile, five x-tiles, and four 1-tiles into a rectangle.
Then, add tiles to show the dimensions.



The dimensions of the rectangle are $x + 4$ and $x + 1$. Therefore, the factors are $x + 4$ and $x + 1$.

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Method 2: Symbolic
Factor $x^2 + 5x + 4$.

The first term in each factor must be x.
(x) (x)

To find the last terms in each factor, think of two numbers that multiply to equal the coefficient of the last term and add to equal the coefficient of the middle term

____ x _____ = 4 ____ + _____ = 5

The two numbers are 4 and 1.

The factors will be (x + 1) (x + 4)

Check by multiplying:

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Example 2
Factor if possible.

a) $x^2 - 29x + 28$

multiplies: 28
add −29

−28 & −1

$(x-28)(x-1)$

b) $x^2 + 3xy - 18y^2$

multiply −18
add +3

−1 18
−2 9
−3 6

$(x-3y)(x+6y)$

$x^2 + 6xy - 3xy - 18y^2$
$x^2 + 3xy - 18y^2$

c) $x^2 + 4x + 6$

multiply 6
add 4

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Example 2
Factor if possible.

Solution
a) $x^2 - 29x + 28$

(x) (x)

____ x _____ = 28 ____ + _____ = -29

Therefore, the factors are $x - 1$ and $x - 28$.

b) $x^2 + 3xy - 18y^2$

(x y) (x y)

____ x _____ = 18 ____ + _____ = 3

Therefore, the factors are $x + 6y$ and $x - 3y$.

c) $x^2 + 4x + 6$

(x) (x)

____ x _____ = 6 ____ + _____ = 4

No two integers have a product of 6 and sum of 4. Therefore, you cannot factor $x^2 + 4x + 6$ over the integers.

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