3.1 Factoring

Tuesday, November 19, 2019 12:21 PM

3.1 FACTORING POLYNOMIAL EXPRESSIONS Name: ____________________ Blk: _________

$ax^2 + bx + c \quad a = 1$

Remember that time in Math 10?

- "Expand" $(x + 4)(x - 3)$

  $= x^2 + x - 12$

- "Factor" $x^2 - 8x + 15$

  $(x - 5)(x - 3)$

- "Expand" $(2x + 1)(3x - 5)$

  $= 6x^2 - 7x - 5$

- "Factor" $a^2 + 8a + 15$

  $(x + 5)(x + 3)$

- "Perfect Square" trinomial

  $a^2 + 2ab + b^2$

- "Difference of Squares"

  $a^2 - b^2$

RECALL:

To factor a trinomial in the form $ax^2 + bx + c$, identify two integers that have a sum $(+)$ of b and a product $(\times)$ of c.

$a = 1$

Example: Factor $x^2 + 7x + 10$

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

OR

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

$2 + 5 = 7$

$2 \times 5 = 10$

<u>Example 1:</u> Determining whether a Trinomial is Factorable in the form $ax^2 + bx + c$.

To determine if a trinomial is factorable in the form $ax^2 + bx + c$

1) Determine the product of ac
2) Determine the factors of ac which can also add to b (the coefficient of x.
3) If there is a pair that satisfies both, the trinomial is factorable

Determine if each trinomial is factorable using integers

a. $2x^2 + 11x + 5$

b. $2x^2 - 3x - 7$

<u>Example 2:</u> Factoring by Decomposition when $a \neq 1 \;\; in \;\; ax^2 + bx + c$.

Step1: Find two numbers that multiply to equal ac and add to equal b. ($add\ to\ the\ middle, multiply\ to\ the\ product\ of\ first\ and\ last$)
Step2: Re-Write the expression but split or *decompose* the *b* term using the two numbers from step 2.
Step3: Now the expression has FOUR terms, so we can factor by grouping the first two terms and the last two terms.
Step4: When fully factored, the remaining two brackets <u>need to be identical!</u> These are now a common factor, and can be factored out, and what is left becomes the components of the second bracket.

a. $-8c^2 - 12c - 4$

$1 \times 2 = 2$
$1 + 2 = 3$

$ac = 2$
$b = 3$

$-4(2c^2 + 3c + 1)$

$-4(\underbrace{2c^2 + 2c}\underbrace{+1c + 1})$

$2c(c+1) + 1(c+1)$

$\boxed{-4(2c+1)(c+1)}$

b. $-6x^2 - 20x + 16$

$ac = -24$
$12 \times (-2) = -24$
$12 + (-2) = 10$

$-2(3x^2 + 10x - 8)$

$(\underbrace{3x^2 + 12x}\underbrace{-2x - 8})$

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

$\boxed{-2(3x-2)(x+4)}$

c. $4x^2 + 16x + 15$

ac
$(4)(15) = 60$
$6 \times 10 = 60$
$6 + 10 = 16$

$\underbrace{4x^2 + 6x}\underbrace{+10x + 15}$

$2x(2x+3) + 5(2x+3)$

$\boxed{(2x+3)(2x+5)}$

Example 3: Factor using "systematic trial"

Step1: Identify pairs of possible binomial factors for your first term and last term. The first terms in your binomial will have the product of ax^2 and the second terms will have a product of the constant ($c\ term$).
Step2: Cross multiply then add to see which combination of first and last terms produce the middle term.
Step3: Group terms across from each other to form your binomial.

a. $4d^2 - 4d - 15$

$4d$ -3
d 5
$(4d)(5)+(-3)(d)$

$2d$ -3
$2d$ 5

$4d$ -5
d 3

$2d$ -5
$2d$ 3

$6d - 10d = 4d$

$\boxed{(2d-5)(2d+3)}$

b. $5x^2 + 14x - 3$

$5x$ -1
x 3

$15x - x = 14x$ ✓

$\boxed{(5x-1)(x+3)}$

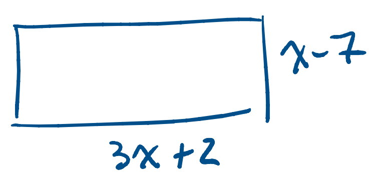
Example 4: Using Factoring to Solve a Problem

The area of a rectangle is represented by the trinomial $\overbrace{3x^2 - 19x - 14}^{A}$.

a) Factor the trinomial to determine the possible dimensions of the rectangle.

$3x^2 - 19x - 14$
$3x^2 - 21x + 2x - 14$
$3x(x-7) + 2(x-7)$
$(x-7)(3x+2)$

$ac = -42$
$2 \times -21 = -42$
$2 + -21 = -19$



b) Use the factored form of the trinomial. Determine possible dimensions of the rectangle when x = 9 cm.

$x = 9$ sub into our dimensions!

$x - 7 \Rightarrow 9 - 7 = \boxed{2}$
$3x + 2 \rightarrow 3(9) + 2 = \boxed{29}$

$\boxed{29\text{cm by } 2\text{cm}}$

p. 181 - #4-7, #8-11 (every other letter)