6 - completing the square.docx

Wednesday, January 22, 2020 9:15 AM

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4.5 COMPLETING THE SQUARE Name: _____ Blk: _____

- Old Skill: Expand the following expressions:

a. $3(x+1)^2-4$

expand.
$3(x+1)(x+1)-4$
$3(x^2+2x+1)-4$
$3x^2+6x+3-4$
$3x^2+6x-1$

c. $-(x+2)^2-1$

$-x^2-4x-5$

b. $3(x-2)^2+5$

$3x^2-12x+17$

d. $-(x-2)^2+7$

$-x^2+4x+3$

You can change vertex form → general form by expanding!

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

- Old Skill: Solve the following equations by completing the square!

a. $x^2+6x+5=0$

make a perfect square trinomial $a^2+2ab+b^2$: $\left(\frac{6}{2}\right)^2$

$x^2+6x=-5$
$x^2+6x+9=-5+9$
$\sqrt{(x+3)^2}=\sqrt{4}$
$x+3=\pm 2$
$x=-3\pm 2$
$x=-1,-5$

b. $2x^2+x-5=0$

$\frac{2}{2}\quad\frac{2}{2}\quad\frac{-5}{2}$

$x=\frac{-1\pm\sqrt{41}}{4}$

You can change general form → vertex form by completing the square!

- $y = ax^2 + bx + c$ is known as the general form of a quadratic function.
- We can change an equation from general form to vertex form by completing the square

- Example 1: Change $y = x^2 + 8x + 12$ into vertex form.

$y = (x^2 + 8x) + 12$	Look at the first 2 terms
$y = (x^2 + 8x + 16 - 16) + 12$ ('pop out')	$\pm$ the 'magic number' that makes a perfect square in trinomial form
$y = (x^2 + 8x + 16) - 16 + 12$	
$y = (x+4)^2 - 16 + 12$	Rewrite as a perfect square binomial
$y = (x+4)^2 - 4$	Clean it up

$y = a(x-p)^2 + q$

$\left(\frac{8}{2}\right)^2$

- Example 2: What if $a > 1$?

  Change $y = 3x^2 - 12x + 7$ into vertex form.

$y = (3x^2 - 12x) + 7$	Look at the first 2 terms
$y = 3(x^2 - 4x) + 7$	Factor out a from the first 2 terms
$y = 3(x^2 - 4x + 4 - 4) + 7$ ('pop out')	Add the 'magic number' that makes a perfect square in trinomial form
$y = 3(x^2 - 4x + 4) - 12 + 7$	Subtract the 'magic number' **times** a
$y = 3(x-2)^2 - 12 + 7$	Rewrite as a perfect square binomial
$y = 3(x-2)^2 - 5$	Clean it up

$\left(\frac{4}{2}\right)^2$

- Example 3: What if $a < 1$?

  Change $y = -4x^2 + 9x - 2$ into vertex form.

$y = -4x^2 + 9x - 2$	Look at the first 2 terms
$y = -4\left(x^2 - \frac{9}{4}x\right) - 2$	Factor out a from the first 2 terms ***WATCH YOUR SIGNS!!***
$y = -4\left(x^2 - \frac{9}{4}x + \frac{81}{64} - \frac{81}{64}\right) - 2$ $y = -4\left(x^2 - \frac{9}{4}x + \frac{81}{64}\right) + \frac{81}{16} - 2$	Add the 'magic number' that makes a perfect square in trinomial form Subtract the 'magic number' **times** a ***WATCH YOUR SIGNS!!***
$y = -4\left(x^2 - \frac{9}{8}\right)^2 + \frac{81}{16} - \frac{32}{16}$	Rewrite as a perfect square binomial
$y = -4\left(x^2 - \frac{9}{8}\right)^2 + \frac{49}{16}$	Clean it up

- Example 4: What if $0 < |a| < 1$?

  Change $y = \frac{1}{5}x^2 + 2x - 1$ into vertex form.

$y = \frac{1}{5}x^2 + 2x - 1$	Look at the first 2 terms
$y = \frac{1}{5}(x^2 + 10x) - 1$	Factor out a from the first 2 terms ***FACTOR OUT, NOT MULTIPLY***
$y = \frac{1}{5}(x^2 + 10x + 25 - 25) - 1$ $y = \frac{1}{5}(x^2 + 10x + 25) - 5 - 1$	Add the 'magic number' that makes a perfect square in trinomial form Subtract the 'magic number' **times** a
$y = \frac{1}{5}(x + 5)^2 - 5 - 1$	Rewrite as a perfect square binomial
$y = \frac{1}{5}(x + 5)^2 - 6$	Clean it up

Assignment: p. 315 #3-5, 7, 8, 10, 11