Math-2A

Lesson 2-13

Factoring Quadratics with Lead Coefficient Not = 1

When factoring a quadratic expression, what if there is no common factor AND the lead coefficient is NOT equal to 1?

$$ax^2 + bx + c$$

(These come from multiplying binomials that also do not have lead coefficients of 1.)

$$(2x + 1)(x + 3)$$

Use the "box method" to multiply the binomials

$$2x^2 + 7x + 3$$

	x	3
2x	$2x^2$	6x
1	x	3

Notice a nice pattern when you multiply this out ("simplify")

$$(2x+1)(x+3)$$

$$2x^2+7x+3$$

"right plus right" *does not* add up to 7, but notice something.

Left times left is left

Right times right is right

$$(2x+1)(x+3)$$

$6x$ (arc over $2x+1$ to $x+3$)

x (arc under $2x+1$ to $x+3$)

$$6x+x=7x$$

$$2x^2+7x+3$$

$$1+6=7$$

$$6=1*6$$

$$2*3=6$$

Are there any other factors of 6 that add up to 7?

$$2 * 15 = 30$$

$$2x^2 + 13x + 15$$

$$10 + 3 = 13$$

$$30 = 10 * 3$$

Are there any *other* factors of 30 that add up to 13?

This tells us to break 13x into 10x + 3x

$$2x^2 + 13x + 15$$

$$2x^2 + 10x + 3x + 15$$

These are all of the terms in "the box"

	x	5
2x	$2x^2$	10x
3	3x	15

What is the bottom-left term in the box?

x*(3) = 3x

What is the top-right term in the box?

2x*(5) = 10x

Final check: 3*5 = 15?

Factored form:

$$2x^2 + 13x + 15$$

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

$4 * 10 = 40$

$4x^2 + 13x + 10$

$8 + 5 = 13$

Other factors of 40 that add up to 13?

$40 = 8 * 5$

These are all of the terms in "the box"

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

This tells us to break 13x into 8x + 5x

$4x^2 + 13x + 10$

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

$4x^2 + 13x + 10$

Factored form:

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

$3 * 8 = 24$

$3x^2 + 14x + 8$

$2 + 12 = 14$

Other factors of 24 that add up to 14?

$24 = 2 * 12$

This tells us to break 14x into 2x + 12x

$3x^2 + 14x + 8$

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

These are all of the terms in "the box"

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

$3x^2 + 14x + 8$

Factored form:

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

Factor

5*4= 20

11*(-9) = ____

$5x^2 + 12x + 4$

$11x^2 + 2x - 9$

	x	2
5x	$5x^2$	10x
2	2x	4

2 * 10 = 20

____ * ____ = -99

2 + 10 = 12

____ + ____ = 2

(5x + 2)(x + 2)

Factor

9*10 = ____

$9x^2 - 13x - 10$

____*____= -90

____+____= -13

12*5 = ____

$12x^2 - 16x + 5$

____*____= 60

____+____= -16