Math-3A

Lesson 2-3

Factoring Quadratics with Lead Coefficient Not = 1,

Complex Conjugates

Factor the quadratic expressions.

$$3x^3 + 15x^2 - 42x$$

$$5x^3 - 25x^2 - 20x$$

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

$$\boxed{2x^2 + 7x + 3}$$

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

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

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

$$\boxed{2x^2+7x+3}$$

Left times left is left

Right times right is right

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

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

$6x$

x

$$6x+x=7x$$

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

$$1+6=7$$

$$6=1*6$$

$$2*3=6$$

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 <u>13x</u> into <u>10x + 3x</u>

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

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

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?

$$40=8*5$$

This tells us to break <u>13x</u> into <u>8x + 5x</u>

$$4x^2+13x+10$$

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

Factored form:

$$4x^2+13x+10$$

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

These are all of the terms in "the box"

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

Since $4x^2$ can be factored 2 ways, look for the common factors of the 1st row.

'x' is the common factor of $4x^3$ and 5x

Look for the common factors of the 1st column

'4x' is the common factor of $4x^3$ and 8x

4x*(2) = 8x

x*(5) = 5x

Final check: 2*5 = 10?

$$3 * 8 = 24$$

$$3x^2 + 14x + 8$$

$$2 + 12 = 14$$

Other factors of 24 that add up to 14?

$$24 = 2 * 12$$

This tells us to break <u>14x</u> into <u>2x + 12x</u>

$$3x^2 + 14x + 8$$

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

These are all of the terms in "the box"

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

What is the bottom-left term in the box?

x*(2) = 2x

What is the top-right term in the box?

3x*(4) = 12x

Final check: 2*4 = 8?

Factored form:

$$3x^2 + 14x + 8$$

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

Factor

5*4= ____

$$5x^2 + 12x + 4$$

____*____= ____

____+____= 12

11*(-9) = ____

$$11x^2 + 2x - 9$$

____*____= ____

____+____= 2

Factor

9*10 = ____

$$9x^2 - 13x - 10$$

____*____= ____

____+____= -13

12*5 = ____

$$12x^2 - 16x + 5$$

____*____= ____

____+____= -16

Factor

____ * ____ = ____

$$6x^2 - 5x - 6$$

____ * ____ = ____

____ + ____ = ____

____ * ____ = ____

$$8x^2 - 2x - 3$$

____ * ____ = ____

____ + ____ = ____

Factor

____ * ____ = ____

$$7x^2 - 12x - 4$$

____ * ____ = ____

____ + ____ = ____

____ * ____ = ____

$$6x^2 - 29x + 9$$

____ * ____ = ____

____ + ____ = ____