Quadratics 3b - Factoring
Factorable Quadratic Functions

Standards: A-REI.4b, A-SSE.3a, F-IF.8a

Math Practices: Look for and make use of structure

GLOs: #3 - Complex Thinker

HW#11: Quads 3b #1-2 & 3-13 (odds)

Learning Target: How do you factor a quadratic expression?

Warmup:

Recall multiplying:

$$(x+2)(x+6)$$

	x	+2
x	x^2	+2x
+6	+6x	+12

$x^2+8x+12$

$$(x-3)(x+7)$$

	x	-3
x	x^2	-3x
+7	+7x	-21

$x^2+4x-21$

$$(x-4)(x-5)$$

	x	-4
x	x^2	-4x
-5	-5x	+20

$x^2-9x+20$

Now let's try the reverse of mulitplication: **FACTORING!**

<u>Factoring</u>: break up into multiplication

(some things are not factorable)

<u>Example 1:</u>

For Algebraic Expressions/Eqns:

ALWAYS factor out the

Greatest Common Factor (GCF) <u>first!</u>

What do the terms have in common?
Factor out the common monomial.

a) $4x^2 + 20$

$\boxed{GCF = 4}$

$\boxed{4(x^2 + 5)}$

b) $17x^2 + 10x$

$\boxed{GCF = x}$

$\boxed{x(17x + 10)}$

c) $-5v^2 + 50v$

$\boxed{GCF = -5v}$

$\boxed{-5v(v - 10)}$

d) $12x^3 + 3x^2 + 3x$

$\boxed{GCF = 3x}$

$\boxed{3x(4x^2 + x + 1)}$

<u>Example 2:</u> Trinomials $ax^2 + bx + c$

Looking at our warm-up, we can generalize that something that is in the form $ax^2 + bx + c$ can be factored into something like $(px+m)(qx+n)$, so

$$\boxed{ax^2 + bx + c = (px+m)(qx+n)}$$

A couple ways to factor... We will use "Box Method"

$2y^2 + 13y + 6$

$a=2$
$b=13$
$c=6$

•No GCF

$a \cdot c = 12$ $b=13$

1 12
2 6
3 4

	$2y$	$+1$
y	$2y^2$	$+1y$
$+6$	$+12y$	$+6$

$$\boxed{(2y+1)(y+6)}$$

<u>*SIGNS</u>

If the sign of c is **<u>positive</u>**,
then the sign of the factor values are the **<u>same</u>**,
and they match the sign of ***<u>b</u>***.

If the sign of c is **<u>negative</u>**,
then the sign of the factor values are **<u>different</u>**,
and the sign of the <u>larger</u> factor value matches
the sign of ***<u>b</u>***.

Ex 2: $ax^2 + bx + c$ (continued)

a) $x^2 - 5x + 6$

$a = 1$
$b = -5$
$c = 6$

• No GCF

$a \cdot c = 6 \quad b = -5$

-1 -6
-2 -3

	x	-3
x	x^2	$-3x$
-2	$-2x$	$+6$

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

b) $3x^2 + 7x - 6$

$a = 3$
$b = 7$
$c = -6$

• no GCF

$a \cdot c = -18 \quad b = 7$

-1 18
-2 9
-3 6

	3x	-2
x	$3x^2$	$-2x$
+3	$+9x$	-6

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

c) $2x^2 - x - 6$

$a = 2$
$b = -1$
$c = -6$

• no GCF

$a \cdot c = -12 \quad b = -1$

1 -12
2 -6
3 -4

	2x	+3
x	$2x^2$	$+3x$
-2	$-4x$	-6

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

d) $x^2 + 5x - 6$

$a = 1$
$b = 5$
$c = -6$

• no GCF

$a \cdot c = -6 \quad b = 5$

-1 6
-2 3

	x	-1
x	x^2	$-1x$
+6	$+6x$	-6

$\boxed{(x-1)(x+6)}$

Example 3: "Special Patterns"

☆ **Difference of Squares**

$$a^2 - b^2 = (a+b)(a-b)$$

a) $x^2 - 9$

$(x)^2 - (3)^2$

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

b) $25x^2 - 144$

$(5x)^2 - (12)^2$

$\boxed{(5x+12)(5x-12)}$

* cannot factor x^2+9

not difference

Another way to factor these is to expand then use A-B-C- Box Method.

a) $x^2 - 9$

$x^2 + 0x - 9$ $a=1$, $b=0$, $c=-9$

•no GCF

$a \cdot c = -9$ $b=0$

-1 9

-3 3

	x	-3
x	x^2	$-3x$
$+3$	$+3x$	-9

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

b) $25x^2 - 144$ $a=25$

$25x^2 + 0x - 144$ $b=0$, $c=144$

•no GCF

$a \cdot c = 3600$ $b=0$

-1	3600
-2	1800
-3	1200
-4	900
-5	720
-6	600
-8	450
-9	400
-10	360
-12	300
-15	240
-16	225
-18	200
-20	180
-24	150
-25	144
-30	120
-36	100
-40	90
-45	80
-48	75
-50	72
-60	60

This takes a long time because of the large #, 3600.

	$5x$	$+12$
$5x$	$25x^2$	$+60x$
-12	$-60x$	-144

$\boxed{(5x+12)(5x-12)}$

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Example 4 - "Combination"

a) $5x^2 - 20$

• GCF = 5

$5(x^2 - 4)$

$x^2 - 4$

$(x)^2 - (2)^2$

$(x+2)(x-2)$

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

b) $14x^2 + 2x - 12$

GCF = 2

$2(7x^2 + x - 6)$

$7x^2 + x - 6$ a = 7, b = 1, c = −6

a·c = −42 b = 1

−1	42
−2	21
−3	14
−6	7

	7x	−6
x	$7x^2$	−6x
+1	+7x	−6

$\boxed{2(7x-6)(x+1)}$