

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	$+2$
\times	x^2	$+2x$
$+6$	$+6x$	$+12$

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

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

	x	-3
\times	x^2	$-3x$
$+7$	$+7x$	-21

$$x^2 + 4x - 21$$

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

	x	-4
\times	x^2	$-4x$
-5	$-5x$	$+20$

$$x^2 - 9x + 20$$

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

Factoring: break up into multiplication

(some things are not factorable)

Example 1:

For Algebraic Expressions/Eqns:

ALWAYS factor out the
Greatest Common Factor (GCF) first!

What do the terms have in common?

Factor out the common monomial.

a) $4x^2 + 20$

GCF = 4

$4(x^2 + 5)$

b) $17x^2 + 10x$

GCF = x

$x(17x + 10)$

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

GCF = $-5v$

$-5v(v - 10)$

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

GCF = $3x$

$3x(4x^2 + x + 1)$

Example 2: 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

$$ax^2 + bx + c = (px + m)(qx + n)$$

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

$(2y+1)(y+6)$

***SIGNS**

If the sign of c is positive,
 then the sign of the factor values are the same,
 and they match the sign of b .

If the sign of c is negative,
 then the sign of the factor values are different,
 and the sign of the larger factor value matches
 the sign of b .

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

a) $x^2 - 5x + 6$ $a=1$
 $b=-5$
 $c=6$

• No GCF

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

$-1 \quad -6$

$-2 \quad -3$

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

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

b) $3x^2 + 7x - 6$ $a=3$
 $b=7$
 $c=-6$

• no GCF

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

$-1 \quad 18$

$-2 \quad 9$

$-3 \quad 6$

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

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

c) $2x^2 - x - 6$ $a=2$
 $b=-1$
 $c=-6$

• no GCF

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

$1 \quad -12$

$2 \quad -6$

$3 \quad -4$

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

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

d) $x^2 + 5x - 6$ $a=1$
 $b=5$
 $c=-6$

• no GCF

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

$-1 \quad 6$

$-2 \quad 3$

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

$(x-1)(x+6)$

Example 3: "Special Patterns"

★ Difference of Squares

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

a) $x^2 - 9$

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

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

b) $25x^2 - 144$

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

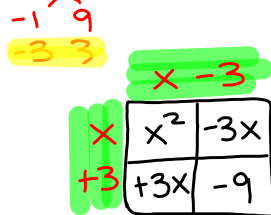
$$(5x+12)(5x-12)$$

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



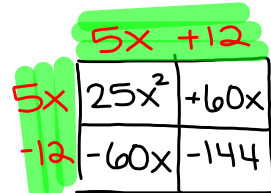
$$(x+3)(x-3)$$

b) $25x^2 - 144$

$25x^2 + 0x - 144$
 $a=25$
 $b=0$
 $c=144$
 •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.



$$(5x+12)(5x-12)$$

Example 4 - "Combination"

a) $5x^2 - 20$

• GCF = 5

$5(x^2 - 4)$

$x^2 - 4$

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

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

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

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

$2(7x-6)(x+1)$