Algebra II – Chapter 4
Solving by Factoring Intervention

METHOD 1: GREATEST COMMON FACTOR

When to use this method: Try to use this method before using other methods. This will typically be the method to use if we only have two terms.

How to use this method: Find any numbers that all terms are disable by and factor them out front. Do the same with the powers of the variables.

Example:

$15x^2 + 35x = 0$

$5x(3x + 7) = 0$ **Both 15 and 35 are divisible by 5. Both terms have an x.**

$5x = 0 \quad 3x + 7 = 0$ **Set each part equal to 0.**

$x = 0 \quad x = -7/3$ **Solve.**

Check:

$15(0)^2 + 35(0) = 0 + 0 = 0$ ✔

$15(-7/3)^2 + 35(-7/3) = 245/3 – 245/3 = 0$ ✔

Practice:

1) $x^3 + 3x^2 = 0$

2) $12x^2 + 33x = 0$

3) $45x^4 – 25x^3 = 0$

4) $12x^2 - 8x = 0$

METHOD 2: DIFFERENCE OF TWO SQUARES

When to use this method: Use this method when we have only 2 terms, there is subtraction between them, and both terms are perfect squares.

How to use this method: Take the square root of both terms, and then use those square roots to write your factored solution using the set up below.

$a - b = 0$

$(\sqrt{a} + \sqrt{b})(\sqrt{a} - \sqrt{b}) = 0$

Example:

$9x^2 - 25 = 0$

$(3x + 5)(3x - 5) = 0$ $\quad \sqrt{9x^2} = 3x$ **and** $\sqrt{25} = 5$

$3x + 5 = 0 \quad 3x - 5 = 0$ **Set each part equal to 0.**

$x = -5/3 \quad x = 5/3$ **Solve.**

Check:

$9(-5/3)^2 - 25 = 25 - 25 = 0$ ✔

$9(5/3)^2 - 25 = 25 - 25 = 0$ ✔

Practice:

1) $x^2 - 81 = 0$

2) $49x^2 - 36 = 0$

3) $4x^2 - 100 = 0$

4) $16x^2 - 64 = 0$

METHOD 3: FACTOR SUM

When to use this method: Use this method when we have 3 terms in the form: $ax^2 + bx + c = 0$

How to use this method: Create a factor/sum chart to find the two "key numbers" to help us factor.

FACTOR ac	**SUM** b
What two numbers multiply to be ac? Let these numbers be: n, m	And add to be b?

CASE 1: a = 1

$ax^2 + bx + c = 0$

$(x + n)(x + m) = 0$ **Write in factored form using the "key numbers."**

$x + n = 0 \quad x + m = 0$ **Set each part equal to 0.**

$x = -n \quad x = -m$ **Solve.**

Example:

$x^2 + 8x + 12 = 0$

$a = 1$

$b = 8$

$c = 12$

FACTOR ac = 12	**SUM** b = 8
1, 12	11 ✗
3, 4	7 ✗
2, 6	8 ✔

$(x + 2)(x + 6)$ **Write in factored form using "key numbers."**

$x + 2 = 0 \quad x + 6 = 0$ **Set each part equal to 0.**

$x = -2 \quad x = -6$ **Solve.**

Check:

$(-2)^2 + 8(-2) + 12 = 4 - 16 + 12 = 0$ ✔

$(-6)^2 + 8(-6) + 12 = 36 - 48 + 12 = 0$ ✔

Practice:

1) $x^2 - 11x + 30 = 0$

2) $x^2 + 11x + 24 = 0$

3) $x^2 - 2x - 15 = 0$

4) $x^2 + 7x - 18 = 0$

METHOD 3: FACTOR SUM (CONTINUED)

FACTOR ac	**SUM** b
What two numbers multiply to be ac? Let these numbers be: n, m	And add to be b?

CASE 2: $a \neq 1$

$ax^2 + bx + c = 0$

$ax^2 + mx + nx + c = 0$ — **Rewrite "b" term using the "key numbers." Then factor by grouping, set each part equal to 0, and solve.**

Example: $2x^2 + 9x + 4 = 0$

$a = 2$

$b = 9$

$c = 4$

FACTOR ac = 2(4) = 8	**SUM** b = 9
2, 4	6 ✗
1, 8	9 ✔

$2x^2 + 1x + 8x + 4$ — **Rewrite "b" term using the "key numbers"**

$x(\mathbf{2x + 1}) + 4(\mathbf{2x + 1})$ — **Factor first two terms and second two terms using greatest common factor. **Terms in parentheses must be the same.**

$(\mathbf{x + 4})(2x + 1)$ — **Group terms in front of parentheses together.**

$x + 4 = 0 \quad 2x + 1 = 0$ — **Set each part equal to 0.**

$x = -4 \quad x = -1/2$ — **Solve.**

Check:

$2(-4)^2 + 9(-4) + 4 = 32 - 36 + 4 = 0$ ✔

$2(-1/2)^2 + 9(-1/2) + 4 = ½ - 9/2 + 4 = 0$ ✔

Practice:

1) $3x^2 + 16x - 12 = 0$

2) $4x^2 - 4x - 3 = 0$

3) $5x^2 + 22x + 8 = 0$

4) $2x^2 + 11x + 15 = 0$

METHOD 4: QUADRATIC FORMULA

When to use this method: This method will work every time you have an equation in the form $ax^2 + bx + c = 0$.

How to use this method: Use the quadratic formula.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Example:

$x^2 - 4x - 6 = 0$

$a = 1$

$b = -4$

$c = -6$

$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-6)}}{2(1)}$ **Plug into the quadratic formula.**

$x = \frac{3 \pm \sqrt{16+24}}{2}$ **Simplify.**

$x = \frac{3 \pm \sqrt{40}}{2}$ **Simplify.**

$x = \frac{3 \pm 2\sqrt{10}}{2}$ **Simplify the square root.**

$x = \frac{3 + 2\sqrt{10}}{2}$ $x = \frac{3 - 2\sqrt{10}}{2}$ **Break into two expressions.**

$x = \frac{3}{2} + \sqrt{10}$ $x = \frac{3}{2} - \sqrt{10}$ **Simplify if possible.**

Practice:

1) $x^2 - x - 4 = 0$

2) $x^2 + 3x - 6 = 0$

3) $4x^2 - 100 = 0$

4) $3x^2 + 4x - 7 = 0$

ANSWERS:

Greatest Common Factor Practice:

1) $x^3 + 3x^2 = 0$
x = 0, x = -3

2) $12x^2 + 33x = 0$
x = 0, x = -11/4

3) $45x^4 - 25x^3 = 0$
x = 0, x = 5/9

4) $12x^2 - 8x = 0$
x = 0, x = 2/3

Perfect Square Practice:

1) $x^2 - 81 = 0$
x = 9, x = -9

2) $49x^2 - 36 = 0$
x = 6/7, x = -6/7

3) $4x^2 - 100 = 0$
x = 5 x = -5

4) $16x^2 - 64 = 0$
x = 2, x = -2

Factor Sum Practice 1:

1) $x^2 - 11x + 30 = 0$
x = 5, x = 6

2) $x^2 + 11x + 24 = 0$
x = -3, x = -8

3) $x^2 - 2x - 15 = 0$
x = -3, x = 5

4) $x^2 + 7x - 18 = 0$
x = -9, x = 2

Factor Sum Practice 2:

1) $3x^2 + 16x - 12 = 0$
x = -6, x = 2/3

2) $4x^2 - 4x - 3 = 0$
x = -1/2, x = 3/2

3) $5x^2 + 22x + 8 = 0$
x = -4, x = -2/5

4) $2x^2 + 11x + 15 = 0$
x = -3, x = -5/2

Quadratic Formula Practice:

1) $x^2 - x - 4 = 0$
$x = \frac{(1 + \sqrt{17})}{2}, x = \frac{(1 - \sqrt{17})}{2}$

2) $x^2 + 3x - 6 = 0$
$x = \frac{(-3 + \sqrt{33})}{2}, x = \frac{(-3 - \sqrt{33})}{2}$

3) $4x^2 - 100 = 0$
x = 5, x = -5

4) $3x^2 + 4x - 7 = 0$
x = -7/3, x = 1