

Algebra 1 Notes...

Date: _____

9.5a Factor Quadratic Equations When the Leading Coefficient "a=1"

VOCABULARY:

- **Standard Form of a Quadratic Equation** $Ax^2 + Bx + C = 0$; Where a, b, c are real numbers; and $A \neq 0$
- **Factoring a quadratic trinomial when a=1 into a product of 2 binomial factors**

Algebra: $x^2 + bx + c = (x + \#)(x + \#)$

When A=1, the question to ask yourself ... What 2 numbers add to "b" and their product is "c"?

Example: $x^2 + 5x + 6 = (x+2)(x+3)$ because $2 + 3 = 5$ and $2 \cdot 3 = 6$.

o Note: order of factors does not matter $(x+2)(x+3) \Leftrightarrow (x+3)(x+2)$ are both equal.

Example 1 Factor when b and c are positive

Steps to Factor: $x^2 + 10x + 16 = (x+2)(x+8)$ or $(x+8)(x+2)$

$\begin{matrix} 1 & 16 \\ 2 & 8 \\ 4 & 4 \end{matrix}$

- 1) Identify a, b, and c. $a = 1$ $b = 10$ and $c = 16$
- 2) Write 2 sets of ()'s. One for each factor.
- 3) The first term in both factors is "x". Why? $x \cdot x = x^2 \leftarrow$ that is the 1st term
- 4) What must the **signs** have to be for each factor? both signs are + b/c: b+c are positive
- 5) What are the factors of 16? Put them under the 16.
- 6) Find the 2 factors $\begin{matrix} 2 & 8 \\ b & c \end{matrix} = 10$ AND $\begin{matrix} 2 & 8 \\ c & b \end{matrix} = 16$
- 7) **CHECK** by Mentally multiplying the factors $(x+2)(x+8) = x^2 + 8x + 2x + 16 = x^2 + 10x + 16 \checkmark$

CHECK POINT: Factor and Check by mentally multiplying

<p>2) $x^2 + 9x + 8$</p> <p>$\begin{matrix} 1 & 8 \\ 2 & 4 \end{matrix}$</p> <p>$(x+1)(x+8)$</p> <p>$1+8=9$ $1 \cdot 8=8$ check</p>	<p>3) $x^2 + 12x + 20$</p> <p>$\begin{matrix} 1 & 20 \\ 2 & 10 \\ 4 & 5 \end{matrix}$</p> <p>$(x+2)(x+10)$</p>
<p>4) $x^2 + 9x + 18$</p> <p>$\begin{matrix} 1 & 18 \\ 2 & 9 \\ 3 & 6 \end{matrix}$</p> <p>$(x+3)(x+6)$</p>	<p>5) $x^2 + 13x + 40$</p> <p>$\begin{matrix} 1 & 40 \\ 2 & 20 \\ 4 & 10 \\ 5 & 8 \end{matrix}$</p> <p>$(x+5)(x+8)$</p>

Example 6 Factor when b is negative and c is positive

Steps to Factor: $x^2 - 5x + 6 = (x - 2)(x - 3)$ or $(x - 3)(x - 2)$

$\begin{array}{r} 1 \ 6 \\ 2 \ 3 \end{array}$

- 1) Identify a , b , and c . $a = 1$ $b = -5$ and $c = 6$
- 2) What must the signs have to be for each factor? Both Negative b/c $-B$ and $+C$
- 3) What are the factors of 6? Put them under the 6.
- 4) Find the 2 factors $-2 + -3 = -5$ ✓ AND $-2 \cdot -3 = 6$ ✓
- 5) CHECK by Multiplying the factors

CHECK POINT: Factor and Check by mentally multiplying

<p>7) $x^2 - 10x + 21 = (x - 3)(x - 7)$</p> <p style="margin-left: 50px;"> $\begin{array}{r} 1 \ 21 \\ 3 \ 7 \end{array}$ </p> <p style="margin-left: 100px; color: purple;">remember mentally mult. to check!</p>	<p>8) $x^2 - 10x + 16 = (x - 2)(x - 8)$</p> <p style="margin-left: 50px;"> $\begin{array}{r} 1 \ 16 \\ 2 \ 8 \\ 4 \ 4 \end{array}$ </p>
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Example 9 Factor when c is negative

Steps to Factor: $x^2 + 3x - 10 = (x + 5)(x - 2)$ or $(x - 2)(x + 5)$

$\begin{array}{r} 1 \ 10 \\ 2 \ 5 \end{array}$

- 1) Identify a , b , and c . $a = 1$ $b = 3$ and $c = -10$
- 2) What must the signs have to be for each factor? OPPOSITE SIGNS (+, -) b/c c is Negative
- 3) What are the factors of 10? Put them under the 10.
- 4) Find the 2 factors $-2 + 5 = 3$ ✓ AND $-2 \cdot 5 = -10$ ✓
- 5) CHECK by Multiplying the factors

CHECK POINT: Factor and Check by mentally multiplying

<p>10) $x^2 - 5x - 50 = (x + 5)(x - 10)$</p> <p style="margin-left: 50px;"> $\begin{array}{r} 1 \ 50 \\ 2 \ 25 \\ 5 \ 10 \end{array}$ </p> <p style="margin-left: 100px; border: 1px solid blue; border-radius: 10px; padding: 5px;"> $-10 + 5 = -5$ $-10 \cdot 5 = -50$ </p>	<p>10) $x^2 + 2x - 24 = (x + 6)(x - 4)$</p> <p style="margin-left: 50px;"> $\begin{array}{r} 1 \ 24 \\ 2 \ 12 \\ 3 \ 8 \\ 4 \ 6 \end{array}$ </p>
<p>11) $x^2 + 4x - 21 = (x + 7)(x - 3)$</p> <p style="margin-left: 50px;"> $\begin{array}{r} 1 \ 21 \\ 3 \ 7 \end{array}$ </p>	<p>11) $x^2 - 4x - 32 = (x + 4)(x - 8)$</p> <p style="margin-left: 50px;"> $\begin{array}{r} 1 \ 32 \\ 2 \ 16 \\ 4 \ 8 \end{array}$ </p>

9.5b Solve Quadratic Equations by Factor

Example 1 Steps to Solve Quadratic Equations by Factor:

$x^2 + 7x = 18$ <p style="text-align: center;">-18 -18</p> <hr/> $x^2 + 7x - 18 = 0$	<p>1) Put in standard form</p> $Ax^2 + Bx + C = 0$
$(x + 9)(x - 2) = 0$ <p style="text-align: center;"> $x + 9 = 0$ $x - 2 = 0$ -9 -9 +2 +2 </p> <hr/> $x = -9$ $x = 2$	<p>2) Factor</p>
<p>C: $(-9)^2 + 7(-9) = 18$ C: $2^2 + 7(2) = 18$</p> <p>81 - 63 = 18 4 + 14 = 18</p> <p>18 = 18 ✓ 18 = 18 ✓</p>	<p>3) Set each factor to "0" and solve</p> <p>Notice: there are 2 solutions</p>
	<p>4) Check each solution in the original equation</p>

CHECK POINT: Solve by Factoring and Check

2) $x^2 + x = 12$
 $\begin{array}{r} -12 \quad -12 \\ \hline x^2 + x - 12 = 0 \end{array}$
 1 12
 2 6
 3 4

$(x+4)(x-3) = 0$

$x+4 = 0$

$x = -4$

$x-3 = 0$

$x = 3$

C: $(-4)^2 + (-4) = 12$
 $16 - 4 = 12$
 $12 = 12$

C: $3^2 + 3 = 12$
 $12 = 12 \checkmark$

3) $x^2 - 14x = -40$
 $\begin{array}{r} +40 \quad +40 \\ \hline x^2 - 14x + 40 = 0 \end{array}$
 1 40
 2 20
 4 10
 5 8

$(x-4)(x-10) = 0$

$x-4 = 0$

$x = 4$

$x-10 = 0$

$x = 10$

C: $4^2 - 14(4) = -40$
 $-40 = -40$

C: $10^2 - 14(10) = -40$
 $100 - 140 = -40$
 $-40 = -40 \checkmark$

4) $x^2 + 12x = -36$
 $\begin{array}{r} +36 \quad +36 \\ \hline x^2 + 12x + 36 = 0 \end{array}$
 1 36
 2 18
 3 12
 4 9
 6 6

5) $x^2 + 3x + 10 = 10$
 $\begin{array}{r} -10 \quad -10 \\ \hline x^2 + 3x = 0 \end{array}$

Think!
 JUST FACTOR
 GCF

$x(x+3) = 0$

$x = 0$

$x+3 = 0$

$x = -3$

C: $10 = 10 \checkmark$

C: $(-3)^2 + 3(-3) + 10 = 10$
 $9 - 9 + 10 = 10$
 $10 = 10 \checkmark$

6) $x^2 - 80 = 20$ (CHALLENGE PROBLEM ☺)

What are a, b, c?

$a = 1 \quad b = 0 \quad c = -100$

* So what are signs of FACTORS?

$x^2 - 100 = 0$
 $\begin{array}{r} 1 \quad 100 \\ 2 \quad 50 \\ 4 \quad 25 \\ 5 \quad 20 \\ 10 \quad 10 \end{array}$ ← Think

$- + - = b = 0$

$- \cdot - = c = -100$

$(x + \quad)(x - \quad) = 0$

$(x+10)(x-10) = 0$

$x+10 = 0$

$x = -10$

$x-10 = 0$

$x = 10$

C: $100 - 80 = 20$
 $20 = 20 \checkmark$

C: $100 - 80 = 20$
 $20 = 20 \checkmark$