

Solving Quadratic Equations with a Box and Diamond

Definitions:

A **Quadratic Equation** is a two-variable equation with an x^2 in it.

Factors are the constituent parts of a quadratic written in $(x + a)(x + b)$ -form.

Roots are the x-intercepts of a parabola.

Formulas:

$$y = ax^2 + bx + c \text{ or}$$

$$f(x) = ax^2 + bx + c$$

a is the number of x^2 's.

b is the number of x 's.

c is the y-intercept.

Example #1:

$$2x^2 + 11x + 14 = 0$$

$2x$	$2x^2$	$4x$
7	$7x$	14

$28x^2$	
$4x$	$7x$
	$14x$

Step 1 Setup
Step 2 acx^2 product
Step 3 diamond factors
Step 4 factors

$$(2x+7)(x+2)$$

Example #2:

$$6x^2 + 5x - 17 = -13$$

$$+13 \quad +13$$

$$6x^2 + 5x - 4 = 0$$

$2x$	$6x^2$	$8x$
-1	$-3x$	-4

$-24x^2$	
$8x$	$-3x$
	$5x$

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

Example #3:

$$8x^2 + 2x + 9 = 24$$

$$-24 \quad -24$$

$$8x^2 + 2x - 15 = 0$$

$4x$	$8x^2$	$12x$
-5	$-10x$	-15

$-120x^2$	
$12x$	$-10x$
	$2x$

$$(4x-5)(2x+3)$$

Example #4:

$$10x^2 - 12x - 30 = -14$$

$$+14 \quad +14$$

$$10x^2 - 12x - 16 = 0$$

$$\div 2 \quad \div 2$$

$$5x^2 - 6x - 8 = 0$$

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

$-40x^2$	
$-10x$	$4x$
	$-6x$

$$(x-2)(5x+4)$$

Once I have an a-value other than one, we would just think of 'x²' then, it gets much more complicated to factor. The diamond and rectangle are a powerful tool. The ax^2 always goes to that top-left box and the opposite corner, the bottom-right gets the c-value. The bx goes to the bottom of the diamond and the top of the diamond gets the product of the ax^2 and the c.

Example brought in the first sneaky problem for our box-and-diamond method. I need to have an '=0' in order to use the zero-product-property. That '-13' has to go and the opposite operation is to add 13 to both sides making the '-17' into a '-4' and the right side equal to zero.

Example 3 also needed the right side made into a zero, by subtraction this time. Once accomplished we set up our box and diamond. Our diamond showed us that we needed two side numbers that could multiply to '-120x²' but also add to '2x.' Only 12 and 10 can do it and even then, the twelve has to be positive and the ten negative.

Example four seems tough but it got some simplifying by making the 14 add to both sides and then we noticed 10, -12, -16, and 0 all divide by two, making an easier target. We factored for the side numbers '4x' and '-10x' and used them in the box to show our two factors which we placed in parentheses.