

WARM UP

Multiply the following.

a) $(x-5)(x+8)$

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

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

d) $(x-12)(x+3)$

e) $(x+8)(x+5)$

f) $(x-6)(x-4)$

Keep the constants of these binomials in mind as we begin factoring trinomials.

$$(x + \#)(x + \#)$$

$$ax^2 + bx + c$$

Make sure these
#’s multiply to be
the value of c

FACTORING TRINOMIALS

FACTORING SIMPLE TRINOMIALS

$x^2 - 18x - 40$ ← A trinomial breaks down to two binomials

Powers Match

When you factor a trinomial down to two binomials,
the degree of each binomial must match.

$$x^6 - 4x^3 - 12$$

$$x^{6n} - 4x^{3n} - 12$$

The signs used in the polynomial are also extremely important and tell you quite a bit about the binomial factors.

$$x^2 - 7x + 12$$

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

$$x^2 - 2x - 15$$

As you can see, if the sign of the constant is positive, then the constant in each factor of the trinomial has the same sign.

If the sign of the constant is different, then the constant in each function have different signs.

When you factor a trinomial, ideally you would like to find the first term of each binomial factor. That is easy if the leading coefficient is 1. Not so easy when the leading coefficient is a number other than 1 but we will get to that later. Once the first terms are established, look at the sign of the last term.

$$x^2 - 18x - 40$$
$$(x \quad)(x \quad)$$

$$x^2 + 7x + 12$$
$$(x \quad)(x \quad)$$

You can fill in the signs early if the leading coefficient is 1, otherwise you will need to hold off.

For the problem on the left, ask yourself: "What two numbers multiply to be -40 and add to be -18?"

For the problem on the right, ask yourself: "What two numbers with the same sign multiply to be 12 and add to be positive 7?"

Those numbers are used as the constants of the binomials.

Factor the following.

1) $x^2 - 5x - 24$

2) $x^2 + 12x + 32$

3) $x^{10} - 3x^5 - 88$

TRINOMIALS WITH A LEADING COEFFICIENT OTHER THAN 1.

There are two ways to factor a polynomial with a leading coefficient other than one. The first is called the guess and check method.

Factor the following.

4) $3x^2 + 19x - 14$

5) $4x^2 - 17x - 15$

6) $6x^2 + 23x + 20$

As you can see, the guess and check method works best if the leading coefficient is a prime number or the constant in the trinomial has very few factors. The more factors the leading coefficient and constant have, the greater the need for an algebraic method to factor polynomials.

THE ALGEBRAIC METHOD TO FACTORING TRINOMIALS

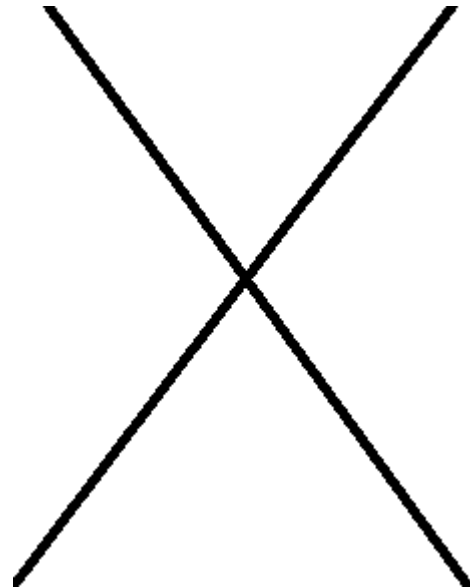
Factor the following

$$4x^2 - 17x - 15$$

On the sides of the x are two numbers that are factors of $a \cdot c \rightarrow$ and whose sum is equal to b .

Once the values that satisfy all conditions are found, rewrite the polynomial replacing the b term with the two factors found above.

Start at the top of the x with the product of a and c .



The value of b goes at the bottom of the x .

There are now 4 terms in the polynomial so **Factor by Grouping**.

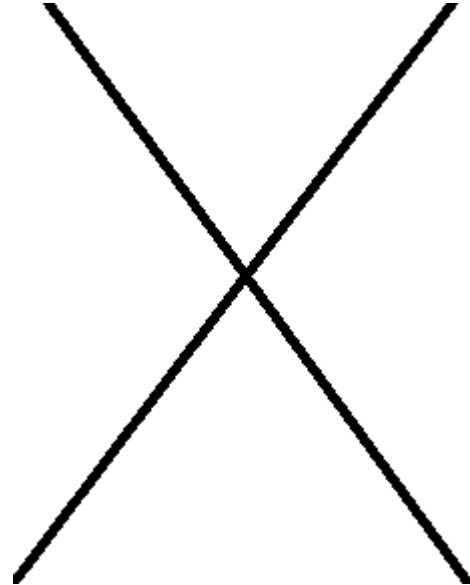
Now lets try with:

$$6x^2 + 23x + 20$$

On the sides of the x are two numbers that are factors of $a \cdot c \rightarrow$ and whose sum is equal to b .

Once the values that satisfy all conditions are found, rewrite the polynomial replacing the b term with the two factors found above.

Start at the top of the x with the product of a and c .



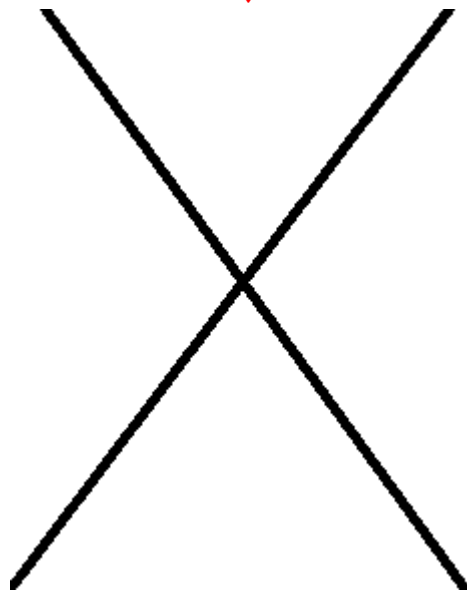
The value of b goes at the bottom of the x.

$$12x^2 + 25x + 12$$

On the sides of the x are two numbers that are factors of $a \cdot c \rightarrow$ and whose sum is equal to b .

Once the values that satisfy all conditions are found, rewrite the polynomial replacing the b term with the two factors found above.

Start at the top of the x with the product of a and c .



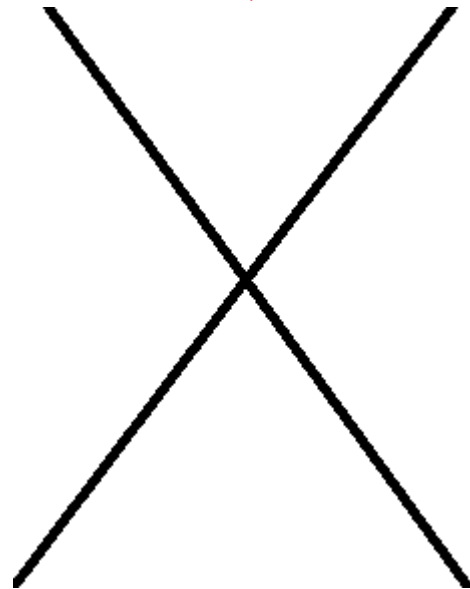
The value of b goes at the bottom of the x.

$$4x^2 - 8x - 60$$

On the sides of the x are two numbers that are factors of $a \cdot c \rightarrow$ and whose sum is equal to b .

Once the values that satisfy all conditions are found, rewrite the polynomial replacing the b term with the two factors found above.

Start at the top of the x with the product of a and c .



The value of b goes at the bottom of the x.

PERFECT SQUARE TRINOMIALS

$$9x^2 + 24x + 16$$

Notice the first and last terms of the trinomial are **PERFECT SQUARES**.

This is a clue that there is a very good chance this is a perfect square trinomial. Your next step is to take the square root of the first and last term.

$$9x^2 + 24x + 16$$

$$\sqrt{9x^2}$$

$$\sqrt{16}$$

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

Try these

1) $x^2 - 10x + 25$

2) $16x^2 + 56x + 49$

3) $36x^2 - 60x + 25$