✕-Games, X-Patterns, ✕-Factors, Diamonds

This activity can be used from the beginning of the school year to get students more familiar and comfortable with patterns. It provides very good practice to review material you want to make sure students remember or to preview something they will see later on. It should be a short (time) activity that stimulates student engagement. ✕-Games show patterns for multiplying, then extend the patterns to factoring and looking for specific factors.

Getting started:

Begin by drawing an ✕ on the board. Refer to the openings as top, bottom, right, and left.

Write numbers in the right and left and ask students to guess what goes in top and bottom. To teach the game, place the sum of right and left in the top opening. The bottom will be the product of right and left. Although it is not critical whether the product is placed in the top or bottom of the ✕, it is important to maintain consistency throughout the year. However, you need not tell the students these rules. In the beginning you want them to feel free to guess and not to feel like they are expected to know the right answers. Try to find a positive way to respond to each wrong answer.

Provide examples and give hints, as needed, until students come up with the right answers. Write those answers in the appropriate places. Some students will begin to see the pattern very quickly.

Once the students seem to have discovered the pattern, have a student explain it to the class. Then start varying the given information by filling in top and right, bottom and left, top and bottom, etc. Also, now that students know the pattern, you can also start using negatives, decimals, fractions, variable expressions, or any other expressions that you want to review or preview in a non-threatening, fun way.

As a variation, you may also decide to change the way the top and bottom numbers are determined. For example, top might be the result of squaring the number in the left and adding the right number, while bottom might be found by doubling the number in the left and adding the right number. This would demonstrate contrast between squaring and doubling.

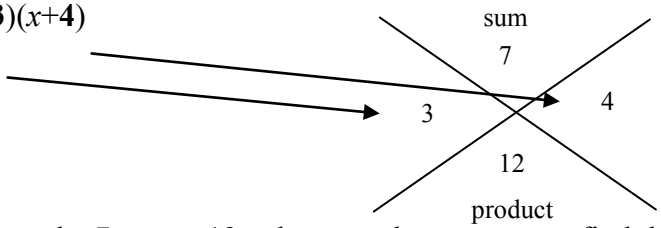
Example:

There is a special pattern for multiplying and/or factoring trinomials.

For example, to multiply $(x+3)(x+4)$ put the 3 in the right (or left) and the 4 in the left (or right).

Then fill in the top and bottom. The top will be the sum and bottom will be the product.

The product would be pulled from the ✕ as $(x+\mathbf{3})(x+\mathbf{4})$



The product is $\boldsymbol{x^2 + 7x + 12}$.

To factor $\boldsymbol{x^2 + 7x + 12}$, do the reverse. That is, put the 7 at top, 12 at bottom, then find the two numbers whose sum is 7 and whose product is 12. You get $(x+\mathbf{3})(x+\mathbf{4})$.

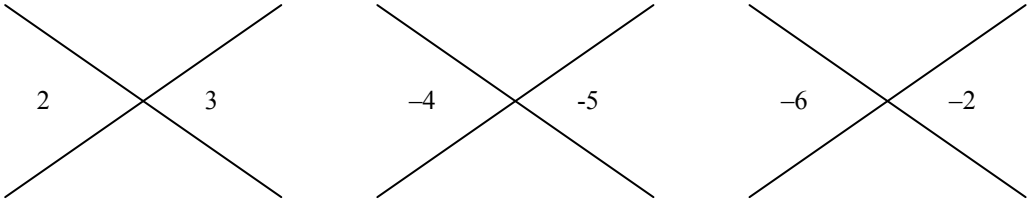
Again, the ✕-Games can be used for other math practice. Practice using the ✕ concept with fractions, integers, radicals, absolute value, opposites, factorials, squares, cubes, double and add , and vocabulary.

Patterns for Multiplying Binomials

[Same signs]
$(x + 2)(x + 3)$ =

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

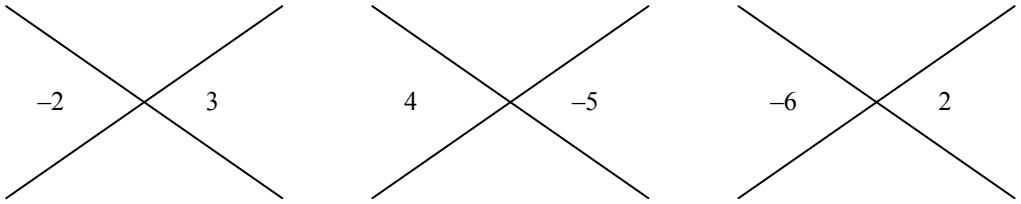
$(x - 6)(x - 2)$ =



[Different signs]
$(x - 2)(x + 3)$ =

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

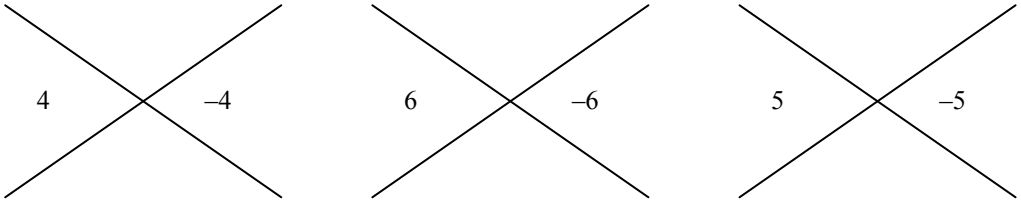
$(x - 6)(x + 2)$ =



[Conjugates]
$(x + 4)(x - 4)$ =

$(x + 6)(x - 6)$ =

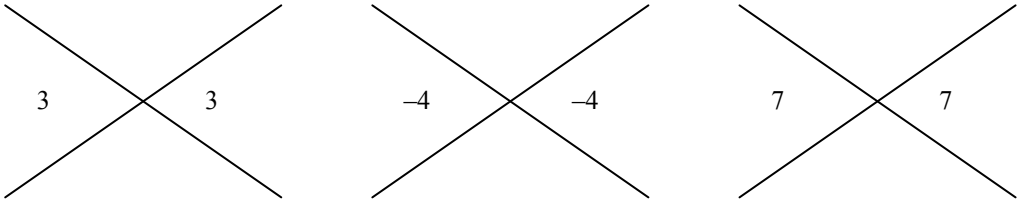
$(x - 5)(x + 5)$ =



[Binomial squared]
$(x + 3)^2$ =

$(x - 4)^2$ =

$(x + 7)^2$ =



You can get through a lot of examples quickly with the X-Factor.
The pattern is adding to get the middle term and multiplying to get the last term, **every time**.

Note: This is not to replace instruction, just to provide quick mental connections. ALWAYS bring them back to the actual multiplication methods utilizing the distributive property.

Now: What if we UNDO the multiplication process (factor)?

NEXT: It is interesting to note that $(x + 2)(x + 3) = x^2 + \underline{2x + 3x} + 6 = x^2 + \underline{5x} + 6$

Notice that, going backwards, $5x$ is split up into $\underline{2x + 3x}$

Does this always work for these kinds of problems?

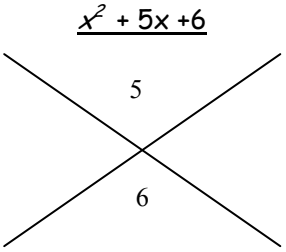
Patterns for Factoring Trinomials

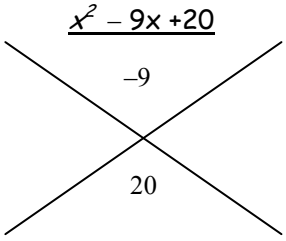
[Same signs]

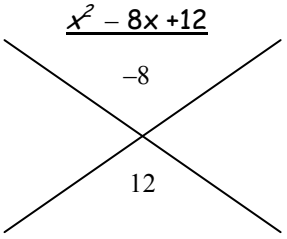
$(x+\_\_)(x+\_\_) =$

$(x-\_\_)(x-\_\_) =$

$(x\_\_\_\_)(x\_\_\_\_) =$





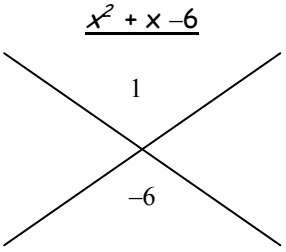


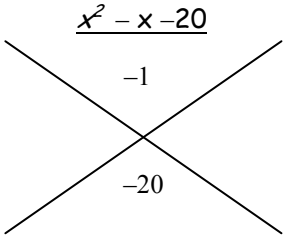
[Different signs]

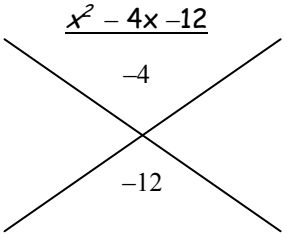
$(x-\_\_)(x+\_\_) =$

$(x+\_\_)(x-\_\_) =$

$(x\ \ \_\_)(x\ \ \_\_) =$





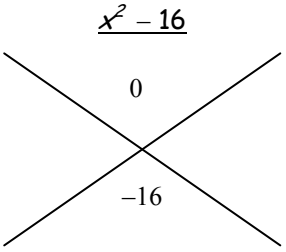


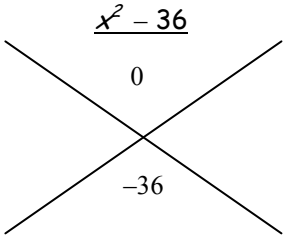
[Conjugates]

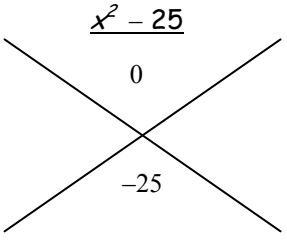
$(x+\_\_)(x-\_\_) =$

$(x-\_\_)(x+\_\_) =$

$(x\ \ \_\_)(x\ \ \_\_) =$





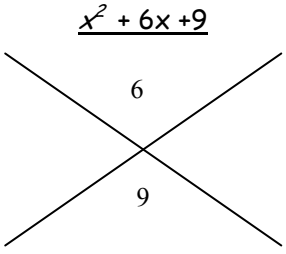


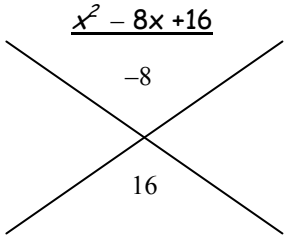
[Binomial squared]

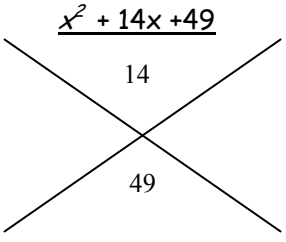
$(x+\_\_)^2 =$

$(x-\_\_)^2 =$

$(x\ \ \_\_)^2 =$







After the pattern is well developed, discuss with students what they could use for the other three numbers if only the top number was provided.

You can get through a lot of examples quickly with the X-Factor.
The pattern is figuring out what to add to get the middle term and also multiply to get the last term.

Note: This is not to replace instruction, just to provide quick mental connections. ALWAYS bring them back to the actual multiplication methods utilizing the distributive property and the inverse of factoring.