4.7 Using Algebra Tiles to Complete the Square

TEKS a.5, 2A.2.A, 2A.5.E

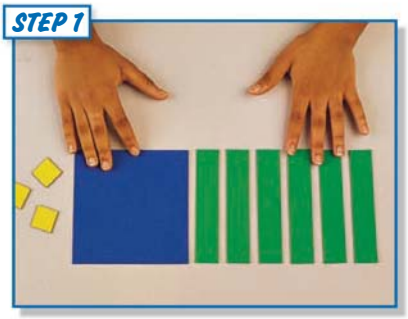
MATERIALS • algebra tiles

QUESTION How can you use algebra tiles to complete the square for a quadratic expression?

If you are given an expression of the form $x^2 + bx$, you can add a constant c to the expression so that the result $x^2 + bx + c$ is a perfect square trinomial. This process is called *completing the square*.

EXPLORE Complete the square for the expression $x^2 + 6x$

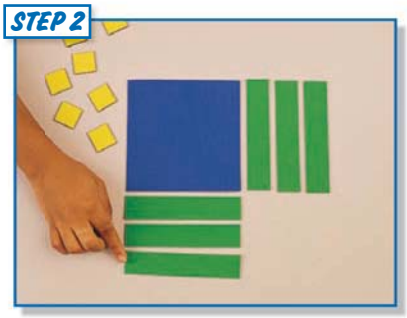
STEP 1



Model the expression

Use algebra tiles to model the expression $x^2 + 6x$. You will need to use one x^2-tile and six x-tiles for this expression.

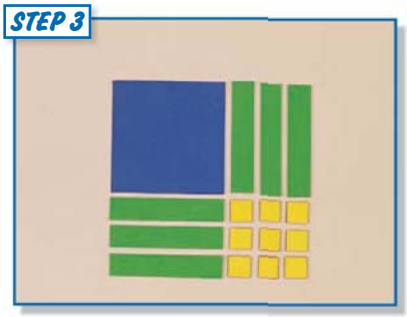
STEP 2



Make a square

Arrange the tiles in a square. You want the length and width of the square to be equal. Your arrangement will be incomplete in one of the corners.

STEP 3



Complete the square

Find the number of 1-tiles needed to complete the square. By adding nine 1-tiles, you can see that $x^2 + 6x + 9$ is equal to $(x + 3)^2$.

DRAW CONCLUSIONS Use your observations to complete these exercises

1. Copy and complete the table at the right by following the steps above.
2. Look for patterns in the last column of your table. Consider the general statement $x^2 + bx + c = (x + d)^2$.
   - **a.** How is d related to b in each case?
   - **b.** How is c related to d in each case?
   - **c.** How can you obtain the numbers in the table's second column directly from the coefficients of x in the expressions from the first column?

Completing the Square

Expression	Number of 1-tiles needed to complete the square	Expression written as a square
$x^2 + 2x +$?	?	?
$x^2 + 4x +$?	?	?
$x^2 + 6x +$?	9	$x^2 + 6x + 9 = (x + 3)^2$
$x^2 + 8x +$?	?	?
$x^2 + 10x +$?	?	?