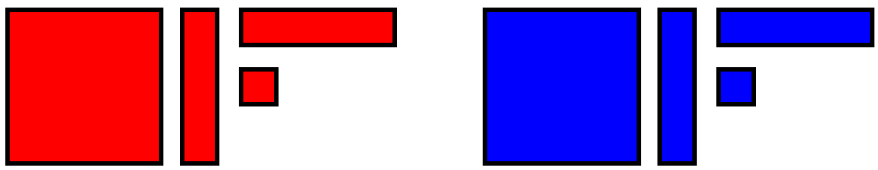
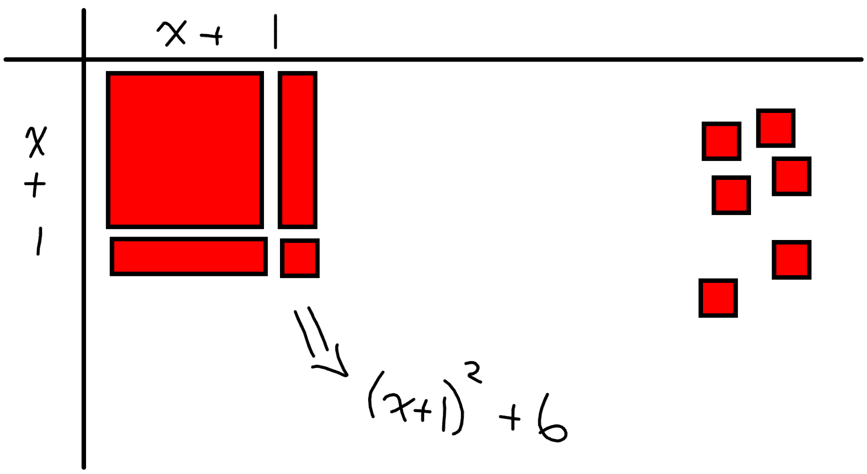
5.1 Completing the Square

The process of completing the square allows you to change a quadratic equation from standard form to vertex form.

standard form		vertex form
$y = x^2 + 4x + 3$	$\xleftarrow{\text{expand}}$ $\xrightarrow[\text{square}]{\text{complete the}}$	$y = (x + 2)^2 - 1$



Ex. 1 Use tiles to complete the square for $y = x^2 + 2x + 7$.

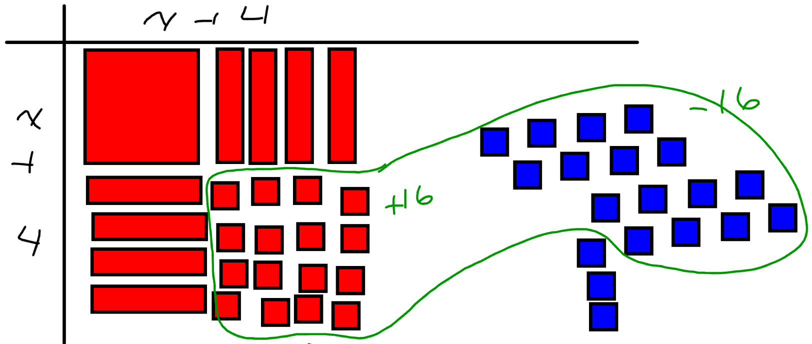


STEPS

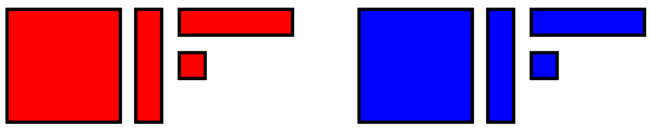
- place the x^2 terms in the upper left to make a square
- place the x terms evenly to the right and below the x^2 terms
- place the "ones" off to the side
- add "ones" to make a square...use the zero principle to place the same # of opposite "ones" off to the side
- write the expression in vertex form

Ex. 2 Rewrite each equation in vertex form using tiles to complete the square.

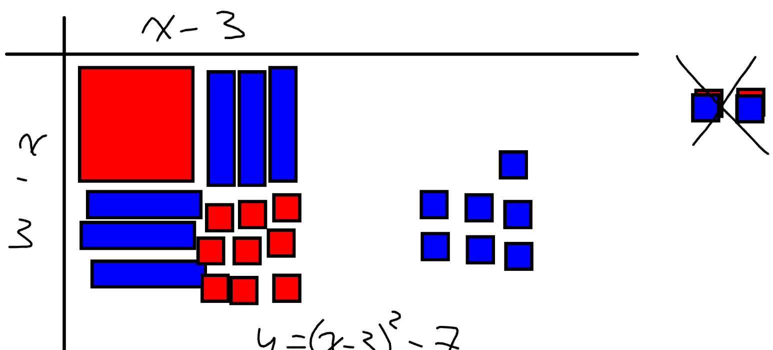
a) $y = x^2 + 8x - 3$



$y = (x+4)^2 - 19$



b) $y = x^2 - 6x + 2$



$y = (x-3)^2 - 7$

What do you notice?

Example	Standard Form	Square	
	# of x-terms	# of x-terms on each side of x^2	# of ones added
$y = x^2 + 2x + 7$	2	1	1
$y = x^2 + 8x - 3$	8	4	16
$y = x^2 - 6x + 2$	-6	-3	9

What kind of trinomial are you creating?

Perfect square trinomial

Can you do that without tiles?

WE SURE CAN!

We can use a chart instead of algebra tiles.

- The x^2 and x-terms will go in the chart.
- The constant term will stay apart.

Ex. 3 Rewrite $y = x^2 + 8x - 3$ in vertex form by algebraically completing the square.

Chart

	x	4
x	x^2	$4x$
4	$4x$	16

$\boxed{-3 - 16}$

$y = (x+4)^2 - 19$

Algebraically

$$y = x^2 + 8x - 3$$

What do we need to add to $x^2 + 8x$ to make it a perfect square trinomial?

$$y = (x^2 + 8x + \underline{16}) - \underline{16} - 3$$

$4 \quad 4^2$

Factor the trinomial and simplify the constant terms.

$$y = (x + \underline{4})^2 - \underline{19}$$

Ex. 4 Rewrite each of the following in vertex form by completing the square with ~~tiles~~, then algebraically.

a grid

a) $y = x^2 - 10x - 4$

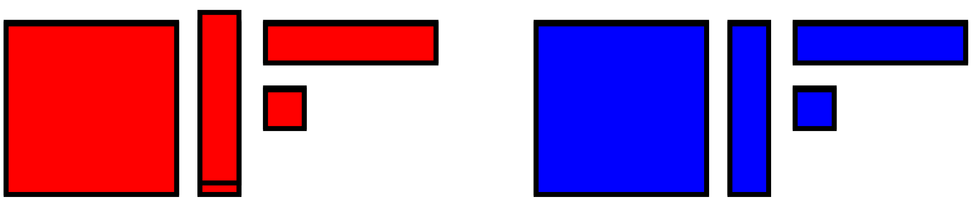
	x	-5
x	x^2	$-5x$
-5	$-5x$	25

$-4-25$

$$y=(x^2-10x+25)-25-4$$

$$\frac{10}{2}=5 \qquad 5^2$$

$$y=(x-5)^2-29$$



b) $y = x^2 + 12x - 5$

$$y=(x^2+12x+36)-36-5$$

$$y=(x+6)^2-41$$

CHECK!

FBUHL

Use tiles (or tile diagrams)

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