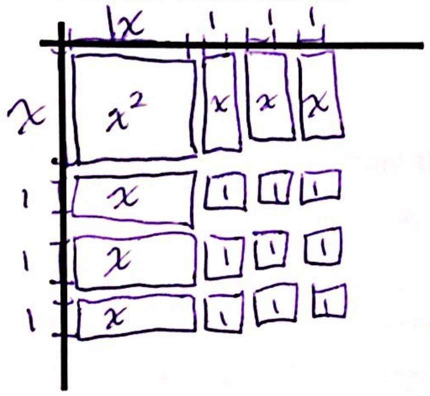
Completing the Square!

The Road from Standard to Vertex

Name: Key

1) Consider the Quadratic Equation: $y = x^2 + 6x + 9$. It is in Standard form.

Use the digital tiles to represent this quadratic. Try to arrange them so they fit in a perfect square shape. Sketch the result below.



What is the length of your square?

x+3

What is the width of your square?

x+3

Rewrite the quadratic equation as a product of the length and width.

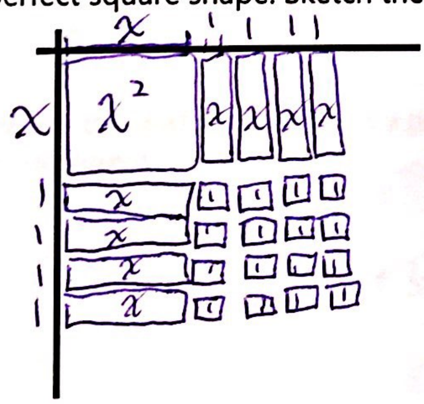
$y = (x+3)(x+3)$ Ex.) $5 \cdot 5 = 5^2 = 25$

$y = (x+3)^2$

It is now in Vertex! form. What transformation does this tell you?

Shift left 3. Vertex @ (-3,0)

2) Use the digital tiles to represent the quadratic $y = x^2 + 8x + 16$. Try to arrange them so they fit in a perfect square shape. Sketch the result below.



What is the length of your square?

x+4

What is the width of your square?

x+4

Rewrite the quadratic equation as a product of the length and width.

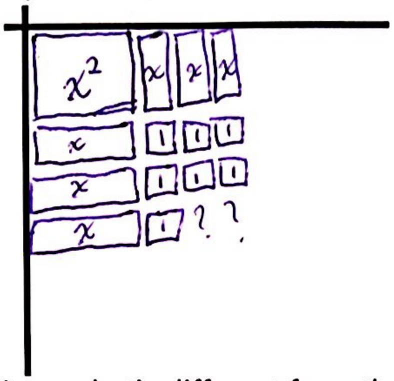
$y = (x+4)(x+4)$

$y = (x+4)^2$

What transformation does this tell you?

Shift left 4. Vertex @ (-4,0)

3) Use the digital tiles to represent the quadratic $y = x^2 + 6x + 7$. Try to arrange them so they fit in a perfect square shape. Sketch the result below.



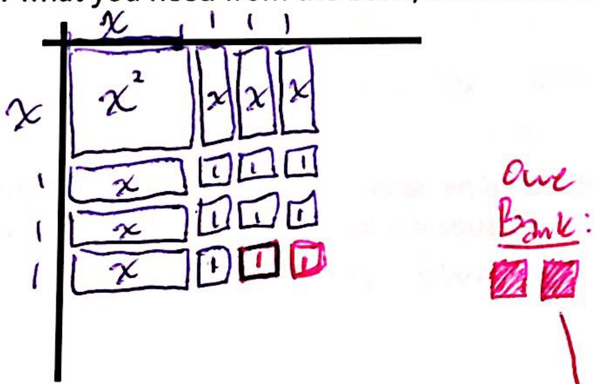
Why is this quadratic different from the previous two?

It doesn't make a square!
We don't have enough yellow "1" tiles

What more would we need if we were going to make a perfect square shape?

We need two more yellow "1" tiles

Borrow what you need from the bank, and sketch the result below.



What is the length of your square?

x+3

What is the width of your square?

x+3

Rewrite the quadratic equation as a product of the length and width. Remember to note what you owe to the bank!

$y = (x+3)(x+3) - 2$ owe two

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

What transformations does this tell you?

Shift left 3, down 2

Vertex @ (-3, -2)

Practice:

Use the digital tiles to turn each of these *standard form* quadratics into their *vertex forms*.

1) $y = x^2 + 4x + 3$

$y = (x+2)(x+2) - 1$

$y = (x+2)^2 - 1$

2) $y = x^2 + 10x + 20$

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

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

3) $y = x^2 + 8x + 9$

$y = (x+4)(x+4) - 7$

$y = (x+4)^2 - 7$

4) $y = x^2 + 2x + 2$

$y = (x+1)(x+1) + 1$

$y = (x+1)^2 + 1$

Too many yellows. Put it away in savings

Conclusion:

In the practice problems above, how many ~~blue~~ green "x" tiles went on the top and how many went on the side?

half of the blue tiles went on top and half went on the side.

Since the number of ~~blue~~ green "x" tiles is given by the b in $y = ax^2 + bx + c$, what must we do to b to determine the length and width of the square?

divide b by two $\frac{1}{2}$ of b.

In the practice problems above, how did the total number of yellow "1" tiles relate to the length or width?

If the length was $x+3$, the # of yellow tiles was 3^2. Whatever the length is, square it.

Use the information gathered from this conclusion to turn the following quadratic into vertex form.

$y = x^2 + 14x + 40$

① green x tiles. half on top. half on sides

② $x+7$ is the length, so $7^2 = 49$ is how many yellow tiles needed. We need 9 more. Owe the bank 9. $(49-40=9)$

$y = (x+7)(x+7) - 9$

$y = (x+7)^2 - 9$

Shift left 7, down 9. Vertex @ $(-7,-9)$