9.5 Notes **Completing the Square - when a doesn't equal 1**

What do we need to add to these expressions to complete the square (create a perfect square)?

1. $2x^2+16x+\_\_\_\_ = \_\_\_(x+\_\_\_\_)^2$

2. $3x^2-6x+\_\_\_\_ = \_\_\_\_(x-\_\_\_)^2$

3. $2x^2+10x+\_\_\_\_ = \_\_\_\_(x+\_\_\_)^2$

4. $2x^2-20x+\_\_\_\_ = \_\_\_(x-\_\_\_)^2$

How did you find the c value in ax^2+bx+c when there is a number in front of a?

Ex. 1: Solve by completing the square.

$2x^2-12x+16=0$

1) Isolate the ax^2+bx on one side.

2) Factor out the a from ax^2+bx

3) Determine what you need to add in the parenthesis to the right side to complete the square. **To keep the equation balanced, you need to add the same amount to each side, but be careful!!!**

4) Write the left side as a squared binomial.

5) Solve the quadratic by taking the square root of both sides and continue to solve.

Ex. 2: Solve by completing the square.

$4x^2 + 16x - 8 = 0$

You Try! Solve by completing the square.

$5x^2 + 10x - 15 = 0$

Ex. 3: Write in Vertex Form by Completing the Square.

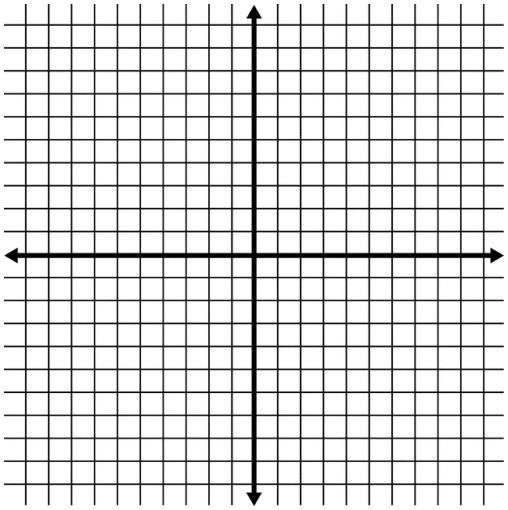
Vertex Form: _____

$y = 2x^2 - 8x + 11$

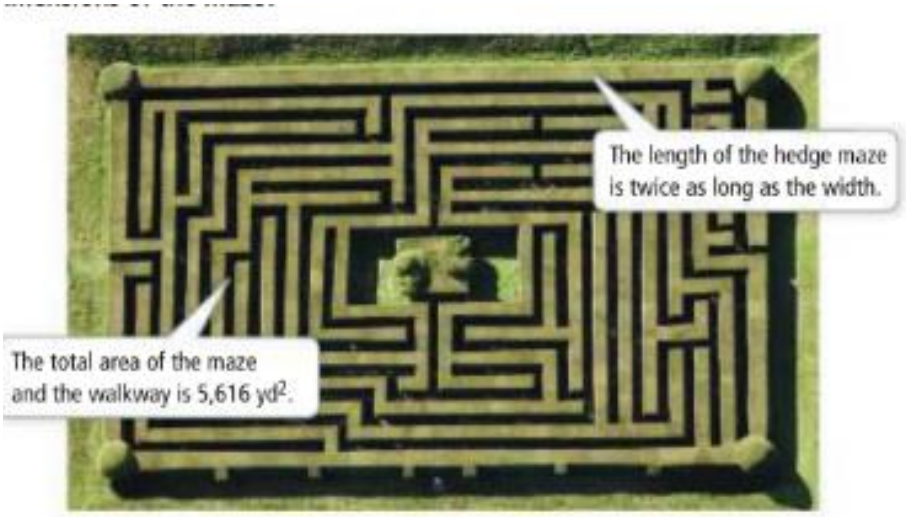
1) Isolate the $(ax^2 + bx)$
2) Factor out the a from $ax^2 + bx$
3) Complete the square in the parenthesis. **Subtract outside the parenthesis to keep the equation balanced. Again, remember to multiply what you are subtracting by a.**
4) Simplify the parenthesis to a squared binomial

Ex. 4: Write in vertex form and graph.

$y = 2x^2 - 4x + 5$



Ex.5: A heddge maze has a 2 yard wide walkway around it. What are the dimensions of the maze with the walkway, if the length of the hedge maze is twice as long as the width?



$x = -56$ $x = 50$

9.5 Notes **Completing the Square - when a doesn't equal 1**

What do we need to add to these expressions to complete the square (create a perfect square)?

1. $2x^2+16x+\underline{32}=\underline{2}(x+\underline{4})^2$

$2(x^2+8x+16)=2(x+4)^2$

$\frac{8}{2}=4 \quad 4^2=16$

$2x^2+16x+32$

2. $3x^2-6x+\underline{3}=\underline{3}(x-\underline{1})^2$

$3(x^2-2x+1)=3(x-1)^2$

$\frac{-2}{2}=-1 \quad (-1)^2=1$

$3x^2-6x+3$

How did you find the c value in ax^2+bx+c when there is a number in front of a?

1) factored out a
2) Divide b by 2 & square it
3) Distribute a back through

Ex. 1: Solve by completing the square.

$2x^2-12x+16=0$

$-16 \quad -16$

$2x^2-12x=-16$

$2(x^2-6x+9)=-16+2(9)$

$\frac{-6}{2}=-3 \quad (-3)^2=9$

$2(x-3)^2=-16+18$

$\frac{2(x-3)^2}{2}=\frac{2}{2}$

$\sqrt{(x-3)^2}=\sqrt{1}$

$x-3=\pm 1$

$+3 \quad +3$

$x=4$ & $x=2$

1) Isolate the ax^2+bx on one side.
2) Factor out the a from ax^2+bx
3) Determine what you need to add in the parenthesis to the ~~right~~ left side to complete the square. **To keep the equation balanced, you need to add the same amount to each side, but be careful!!!**
4) Write the left side as a squared binomial.
5) Solve the quadratic by taking the square root of both sides and continue to solve.

Ex. 2: Solve by completing the square.

$4x^2+16x-8=0$

$+8 \quad +8$

$4x^2+16x = 8$

$4(x^2+4x+\underline{4}) = 8+4(4)$

$(2)^2=4$

$\frac{4}{2}=2$

$4(x+2)^2 = 8+16$

$\frac{4(x+2)^2}{4} = \frac{24}{4}$

$\sqrt{(x+2)^2} = \sqrt{6}$

$x+2 = \pm\sqrt{6}$

$-2 \quad -2$

$x = -2 \pm \sqrt{6}$

You Try! Solve by completing the square.

$5x^2+10x-15=0$

$5x^2+10x = 15$

$5(x^2+2x+\underline{1}) = 15+1(5)$

$\frac{5(x+1)^2}{5} = \frac{20}{5}$

$\sqrt{(x+1)^2} = \sqrt{4}$

$x+1 = \pm 2$

$-1 \quad -1$

$x = 1 \text{ or } x = -3$

Ex. 3: Write in Vertex Form by Completing the Square.

Vertex Form: $y = a(x-h)^2+k$

$y=2x^2-8x+11$

$y = (2x^2+8x\quad)+11$

$y = 2(x^2+4x+\underline{4})+11-2(4)$

$\frac{4}{2}=2 \quad 2^2=4$

$y = 2(x+2)^2+11-8$

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

1) Isolate the (ax^2+bx)
2) Factor out the a from ax^2+bx
3) Complete the square in the parenthesis. **Subtract outside the parenthesis to keep the equation balanced. Again, remember to multiply what you are subtracting by a.**
4) Simplify the parenthesis to a squared binomial

Ex. 4: Write in vertex form and graph.

$y = 2x^2 - 4x + 5$

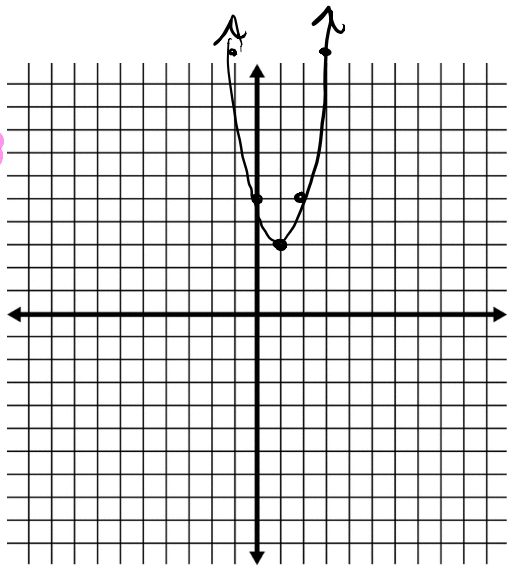
$y = (2x^2 - 4x \quad) + 5$

$y = 2(x^2 - 2x + 1) + 5 - (1 \cdot 2)$

$\frac{-2}{2} = -1 \qquad (-1)^2 = 1$

$y = 2(x-1)^2 + 3$

Vertex: $(1, 3)$



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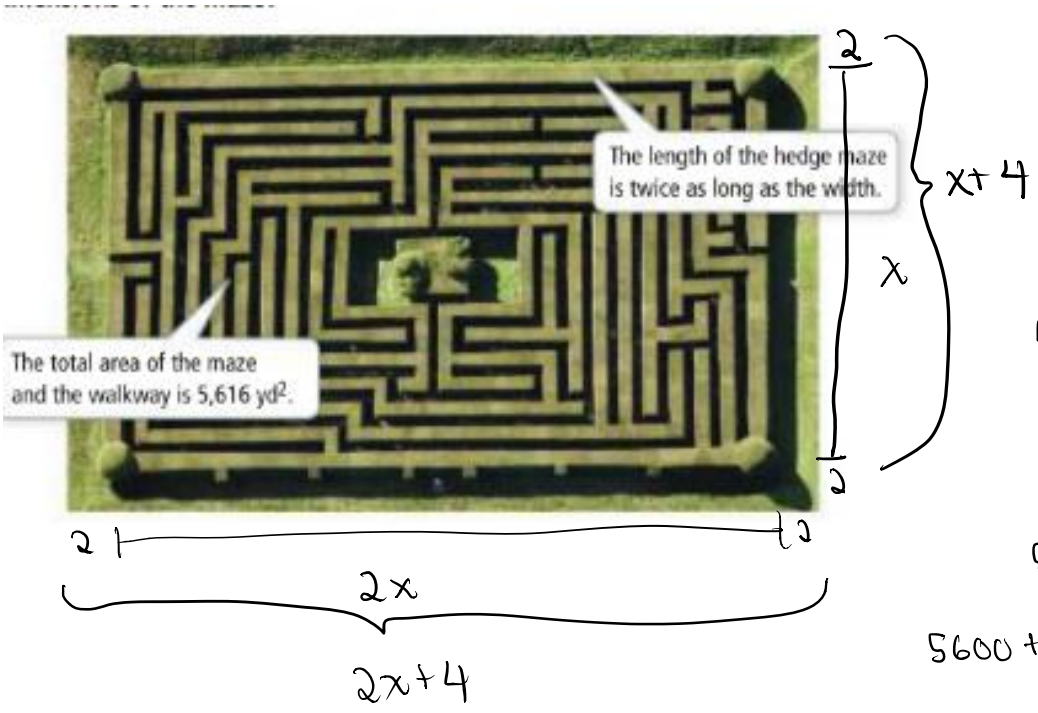

$2x + 4$

$W = 50 + 4 = 54$ yd

$L = 2(50) + 4 = 104$ yd

Dimensions: 54×104 yds

Area $= 5616$ yd^2

Area $= l \cdot w$

$5616 = (2x+4)(x+4)$

$5616 = 2x^2 + 8x + 4x + 16$

$5616 = 2x^2 + 12x + 16$

$-16 \qquad\qquad -16$

$5600 = 2x^2 + 12x$

$5600 + 2(9) = 2(x^2 + 6x + 9)$

$\frac{6}{2} = 3 \qquad 3^2 = 9$

$\frac{5618}{2} = \frac{2(x+3)^2}{2}$

$\sqrt{2809} = \sqrt{(x+3)^2}$

$\pm 53 = x + 3$

$-3 \qquad -3$

$x = 50$

$x = -56$