Completing the Square & Solving Quadratic Equations by Completing the Square

After this lesson you should be able to determine the roots of a quadratic equation by the method of **completing the square.**

A perfect square is anything times itself…look at the following perfect square trinomials and what they become in factored form.

Perfect square trinomial	Factored as a perfect square
$X^2 + 8x + 16$	$(x+4)(x+4) = (x + 4)^2$
$X^2 + 12x + 36$	$(x + 6)(x + 6) = (x + 6)^2$
$X^2 – 18x + 81$	$(x – 9)(x – 9) = (x – 9)^2$
$X^2 – 40x + 400$	$(x – 20)(x – 20) = (x – 20)^2$

What pattern do you notice in all the perfect square trinomials (hint: the pattern is with the __ and __ terms when written in standard form)?

Is the following trinomial a perfect square? $X^2 – 6x – 16$ _____ because _____.

Is the following trinomial a perfect square? $X^2 + 16x + 64$ _____ because _____.

What would the c-term need to be in the following trinomial to be a perfect square? $X^2 – 20x + C$

Now factor that trinomial.

Steps for SOLVING by Completing the Square:

1. Be sure that the coefficient of the highest power is one. If it is not, divide each term by that value to create a leading coefficient of one.	$x^2+8x-4=0$
2. Move the constant term to the right hand side.	$x^2+8x=4$
3. Prepare to add the needed value to create the perfect square trinomial. Be sure to balance the equation. The boxes may help you remember to balance.	$x^2+8x+\square=4+\square$
4. To find the needed value for the perfect square trinomial, take half of the coefficient of the *middle term* (*x*-term), square it, and add that value to both sides of the equation. Take half and square $x^2+8x+\square=4+\square$	$x^2+8x+\boxed{16}=4+\boxed{16}$
5. Factor the perfect square trinomial.	$(x+4)^2=20$
6. Take the square root of each side and solve. Remember to consider both plus and minus results. When written in simplest radical form we would get…	$x+4=\pm\sqrt{20}$ $X = -\sqrt{20}-4$ AND $X = +\sqrt{20}-4$ $X = -2\sqrt{5}-4$ *and* $+2\sqrt{5}-4$

Follow the Exact steps from the notes above to solve by completing the square.

$X^2+6x+1=0$	$X^2-10x-4=0$	$X^2+12x+8=0$