Name: Date: Period:

Solving a Quadratic Equation by Completing the Square

An equation in which one side is a **perfect square trinomial** can be easily solved by taking the square root of each side.

	Leading Coefficient = 1	**Leading Coefficient ≠ 1**
	$x^2 + 8x - 4 = 0$	$4x^2 + 8x - 12 = 0$
1. Isolate the x^2 and x terms ... so, move the constant to the other side of the equal sign.	$x^2 + 8x = 4$	$4x^2 + 8x = 12$
1a. The leading coefficient must be 1 for completing the square ...	Leading coefficient of x^2 is 1	Factor out leading coefficient of 4. **Be careful!!** When we have a coefficient ≠ 1, add a **double parenthesis** to side without the variables. Both sides must be **multiplied** by 4. Also, Factor the 4 out of **BOTH** terms on the left.
2. Add +_____ to **BOTH** sides of the equal sign to KEEP THE EQUATION BALANCED. Fill in the +_____ with the # that completes the square (half of the coefficient of the x-term squared).	$x^2 + 8x + \_\_\_\_ = 4 + \_\_\_\_\_$ Half the middle term squared: $\frac{1}{2}(8) = 4^2 = 16$ $x^2 + 8x + \mathbf{16} = 4 + \mathbf{16}$	$\mathbf{4}\,(x^2 + 2x + \_\_\_\_\_) = 12 + \mathbf{(4)(\_\_\_)}$ Half the middle term squared: $\frac{1}{2}(2) = 1^2 = 1$ $\mathbf{4}\,(x^2 + 2x + \mathbf{1}) = 12 + \mathbf{(4)(1)}$
3. Factor the perfect square trinomial and simplify other side.	$(x + 4)^2 = 20$	$4\,(x + 1)^2 = 16$ ***Divide BOTH sides by 4 to **ISOLATE** the radical **BEFORE** taking the square root. $(x + 1)^2 = 4$
4. Take the square root of each side and Solve for x. **Note 1:** A SQUARE and a SQUARE ROOT cancel each other out **Note 2:** Remember to consider both plus and minus results. ***** Don't forget that you must ISOLATE the radical before taking the square root of both sides!!**	$x + 4 = \pm\sqrt{20}$ $-4 \quad -4$ $x = -4 \pm\sqrt{20}$ Simplify: $\sqrt{20} \Rightarrow \sqrt{4}\sqrt{5} \Rightarrow \pm 2\sqrt{5}$ $x = -4 + 2\sqrt{5}$ | $x = -4 - 2\sqrt{5}$	$x + 1 = \pm\sqrt{4}$ $-1 \quad -1$ $x = -1 \pm\sqrt{4}$ $x = -1 + 2$ | $x = -1 - 2$ $x = 1$ | $x = -3$

Let's Try these on the back:

1. $x^2 + 6x + 1 = 0$
2. $x^2 - 4x - 18 = 0$
3. $x^2 + 20x + 40 = 0$
4. $x^2 - 2x - 1 = 0$
5. $-x^2 - 2x + 24 = 0$
6. $3p^2 - 21 = 6p$