

Reference: Solving Quadratic Equations

- **Standard form** for a quadratic equation is: $ax^2 + bx + c = 0$
- To solve an equation with a quadratic expression in it, try these methods:
 - **Factoring:** Get the equation into standard form, first. Then factor the expression so it looks more like $(mx + n)(px + q) = 0$. Your solutions are the x values which make the factors equal zero.
 - **Square roots:** If $b=0$, you can simply get the x^2 by itself and then square root both sides. Don't forget that taking a square root gives you two solutions, usually written with a “ \pm ”.
 - **Complete the square:** See example below.
 - **Quadratic formula:** Use the magic formula! This one method *works on every solvable quadratic*. But, it's cumbersome. I recommend you check for a factoring or square root solution before trying this. (Completing the square is probably harder than the formula.)
- The “magic” quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
(You must put the equation in standard form first!!)
- The expression inside the quadratic formula's radical, $b^2 - 4ac$, is called the **discriminant**. As long as it's *written in standard form*, the discriminant of a quadratic equation indicates how many solutions there are:
 - If the discriminant is positive, there are two real solutions.
 - If the discriminant is zero, there is one real solution.
 - If the discriminant is negative, there are zero real solutions.
- **Example** using the “complete the square” method: $3x^2 + 18x - 9 = 0$
 - Get x 's on one side and the numbers on the other. $3x^2 + 18x = 9$
 - Calculate the c you need for a perfect square: $c = b^2/4a$. $c = (18^2/12) = 27$
 - Add your c to both sides. $3x^2 + 18x + 27 = 9 + 27$
 - Factor out GCF on left side, if any. Simplify right side. $3(x^2 + 6x + 9)^2 = 36$
 - Write left side in fully factored form. $3(x+3)^2 = 36$
 - Divide away the GCF, if any. $(x+3)^2 = 12$
 - Square root both sides. Don't forget the \pm !! $x+3 = \pm\sqrt{12}$
 - Get x alone. $x = -3 \pm \sqrt{12}$
 - Simplify any square roots / fractions. Done! $x = -3 \pm 2\sqrt{3}$