Quadratic Equations

**Formula Sheet**

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| **Name** | **Definition** | **Formula** |
| Order of Operations | You need to know the order of operations to solve equations. To remember the order of operations, use the acronym PEMDAS. |

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| **P** | **P**arentheses |
| **E** | **E**xponents |
| **MD** | **M**ultiplication and **D**ivision (left-to-right) |
| **AS** | **A**ddition and **S**ubtraction (left-to-right) |

Within each level, evaluate left to right. |
| Quadratic Equation | Any equation containing one term in which the unknown variable is squared and no term in which it is raised to a higher power.  | Standard Form: $$ax^{2}+bx+c=0$$, where $$a\ne 0 $$Vertex Form: $$y=a\left(x−h\right)^{2}+k$$Factored Form: a form in which a quadratic equation is expressed as a product of two algebraic expressions* $$\left(x\pm a\right)\left(x\pm b\right)=0$$
* Other forms of factors are $$x $$, $$\left(ax\pm b\right)$$ , and $$\left(ax\pm b\right)$$
* where $$a $$and $$b $$are constants
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| Perfect Squares | A number obtained from squaring an integer (multiplying a number by itself). |

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| $$n^{}$$ | $$n^{2}$$ |
| 0 | 0 |
| 1 | 1 |
| 2 | 4 |
| 3 | 9 |
| 4 | 16 |
| 5 | 25 |
| 6 | 36 |
| 7 | 49 |
| 8 | 64 |
| 9 | 81 |
| 10 | 100 |
| 11 | 121 |
| 12 | 144 |

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| Zero Product Property | A property stating that if the product of two expressions or quantities is equal to zero, then at least one of the expressions or quantities is equal to zero. | If $$a⋅b=0 $$then $$a=0 $$, $$b=0 $$, or both $$a $$and $$b $$ar zero. |
| Solutions of Quadratic Equations | Quadratic equations contain a variable that is squared. The result of having a squared variable is that every quadratic equation has either zero, one, or two solutions. | Once you have rewritten the quadratic equation into a form in which one side is only a squared variable and the other side is only a numeric expression then:* If the numeric expression is less than zero, there are no solutions.
* If the numeric expression is equal to zero, there is one solution.
* If the numeric expression is greater than zero, there are two solutions.
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| Perfect Square Trinomial | A trinomial that follows a specific pattern and can be written as a square of a binomial.  | * The first and last terms of the trinomial $$\left(a^{2}−b^{2}\right)$$ are positive perfect squares.
* The middle term ($$2ab $$ or $$−2ab $$) is twice the product of $$a $$and $$b $$.
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| Difference of Two Squares | If there are only two terms that are perfect squares, and they are separated by a minus sign, it can be written as a difference of two squares. | $$a^{2}−b^{2}=\left(a+b\right)\left(a−b\right)$$  |
| Completing the Square | Completing the square is a method of factoring. The process makes an expression into a perfect square trinomial and can be used to solve a quadratic equation.  | Starting from the standard form of a quadratic equation, $$ax^{2}+bx+c=0$$, follow these steps:1. Move the constant term, $$c $$, to the right side of equation: $$ax^{2}+bx=−c$$
2. Divide the coefficient of the middle term, $$b $$, by 2, then square the quotient: $$\left(\frac{b}{2}\right)^{2}$$
3. Add the number to both sides of the equation: $$ax^{2}+bx+\left(\frac{b}{2}\right)^{2}=−c+\left(\frac{b}{2}\right)^{2}$$
4. Simplify and factor.
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| Quadratic Formula | A formula that gives the solutions of any quadratic equation in standard form.  | $$x=\frac{−b\pm \sqrt{b^{2}−4ac}}{2a}$$where $$a $$, $$b $$, and $$c $$are from the standard form of a quadratic equation: $$ax^{2}+bx+c=0$$ |
| Discriminant of a Parabola | In the quadratic formula, $$b^{2}−4ac$$ is known as the discriminant of a parabola. The discriminant is used to determine what type of solutions a quadratic equation has.  | * If $$b^{2}−4ac$$ is positive, then there are two solutions
* If $$b^{2}−4ac$$ is zero, then there is one solution
* If $$b^{2}−4ac$$ is negative, then there are no solutions
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| Key Features of a Parabola | When you pot points using a quadratic equation, the graph is a parabola. It is shaped like an upward or downward U. There are four key parts of a parabola: the axis of symmetry, the vertex, the zero(s), and the *y*-intercept. |  |
| Vertex Form of a Quadratic Equation | When a quadratic equation is in vertex form, the axis of symmetry and vertex are easily identifiable.  | * Axis of Symmetry: $$x=h $$
* Vertex: $$\left(h,k\right)$$
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