

# College Algebra Formulas Cheat Sheet

## Algebra

$$1. (a + b)^2 = a^2 + 2ab + b^2$$

$$2. (a - b)^2 = a^2 - 2ab + b^2$$

$$3. a^2 - b^2 = (a - b)(a + b)$$

$$4. ax^2 + bx + c =$$

$$a \left( x - \frac{-b + \sqrt{b^2 - 4ac}}{2a} \right) \left( x - \frac{-b - \sqrt{b^2 - 4ac}}{2a} \right),$$

$$\text{if } b^2 - 4ac \geq 0$$

## Trigonometry

### Definitions

$$1. \tan x = \frac{\sin x}{\cos x}$$

$$2. \cot x = \frac{\cos x}{\sin x}$$

$$3. \sec x = \frac{1}{\cos x}$$

$$4. \csc x = \frac{1}{\sin x}$$

### Identities

$$1. \cos^2 x + \sin^2 x = 1$$

$$2. \sin 2x = 2 \sin x \cos x$$

$$\begin{aligned} 3. \cos 2x &= \\ &= \cos^2 x - \sin^2 x \\ &= 2 \cos^2 x - 1 \\ &= 1 - 2 \sin^2 x \end{aligned}$$

$$4. \tan^2 x + 1 = \sec^2 x$$

$$5. \cot^2 x + 1 = \csc^2 x$$

$$6. \tan 2x = \frac{2 \tan x}{1 - \tan^2 x}$$

$$7. \cot 2x = \frac{\cot^2 x - 1}{2 \cot x}$$

### Derivatives

$$1. (\sin x)' = \cos x$$

$$2. (\cos x)' = -\sin x$$

$$3. (\tan x)' = \sec^2 x$$

$$4. (\cot x)' = -\csc^2 x$$

$$5. (\sec x)' = \tan x \sec x$$

$$6. (\csc x)' = -\cot x \csc x$$

$$7. (\arcsin x)' = \frac{1}{\sqrt{1 - x^2}}$$

$$8. (\arccos x)' = \frac{-1}{\sqrt{1 - x^2}}$$

$$9. (\arctan x)' = \frac{1}{1 + x^2}$$

### Integrals

$$1. \int \cos x \, dx = \sin x$$

$$2. \int \sin x \, dx = -\cos x$$

$$3. \int \sec^2 x \, dx = \tan x$$

$$4. \int \csc^2 x \, dx = -\cot x$$

$$5. \int \cot x \, dx = \ln |\sin x|$$

$$6. \int \tan x \, dx = \\ = -\ln |\cos x|$$

$$7. \int \sec x \, dx = \\ = \ln |\tan x + \sec x|$$

$$8. \int \csc x \, dx =$$

$$= -\ln |\cot x + \csc x|$$

## Hyperbolic functions

### Definitions

$$1. \sinh x = \frac{e^x - e^{-x}}{2}$$

$$3. \operatorname{csch} x = \frac{1}{\sinh x}$$

$$5. \tanh x = \frac{\sinh x}{\cosh x}$$

$$2. \cosh x = \frac{e^x + e^{-x}}{2}$$

$$4. \operatorname{sech} x = \frac{1}{\cosh x}$$

$$6. \coth x = \frac{\cosh x}{\sinh x}$$

### Identities

$$1. \cosh^2 x - \sinh^2 x = 1$$

$$2. 1 - \tanh^2 x = \operatorname{sech}^2 x$$

$$3. \coth^2 x - 1 = \operatorname{csch}^2 x$$

$$4. \sinh 2x = 2 \sinh x \cosh x$$

$$\begin{aligned} 5. \cosh 2x &= \\ &= \cosh^2 x + \sinh^2 x \\ &= 2 \cosh^2 x - 1 \\ &= 2 \sinh^2 x + 1 \end{aligned}$$

### Derivatives

$$1. (\sinh x)' = \cosh x$$

$$2. (\cosh x)' = \sinh x$$

$$3. (\tanh x)' = \operatorname{sech}^2 x$$

$$4. (\coth x)' = -\operatorname{csch}^2 x$$

$$5. (\operatorname{sech} x)' =$$

$$= -\tanh x \operatorname{sech} x$$

$$6. (\operatorname{csch} x)' =$$

$$= -\coth x \operatorname{csch} x$$

$$\begin{aligned} 7. (\operatorname{arcsinh} x)' &= \\ &= \frac{1}{\sqrt{x^2 + 1}} \end{aligned}$$

$$\begin{aligned} 8. (\operatorname{arcosh} x)' &= \\ &= \frac{1}{\sqrt{x^2 - 1}} \end{aligned}$$

$$\begin{aligned} 9. (\operatorname{artanh} x)' &= \\ &= \frac{1}{x^2 - 1} \end{aligned}$$

**College algebra formulas cheat sheet** is an essential resource for students aiming to excel in their algebra courses. This cheat sheet compiles key formulas, concepts, and theorems that are frequently encountered throughout college-level algebra. Whether you are preparing for exams, completing homework assignments, or simply brushing up on your knowledge, having a consolidated reference can significantly enhance your understanding and performance. This article will explore various topics within college algebra, providing a comprehensive overview of the essential formulas you need to master.

# Basic Algebraic Concepts

Understanding fundamental algebraic concepts is crucial for success in college algebra. Here are some of the basic definitions and properties:

## Variables and Expressions

- Variable: A symbol (often a letter) that represents one or more numbers.
- Expression: A combination of numbers, variables, and operations (like addition, subtraction, multiplication, and division).

## Order of Operations

To evaluate expressions correctly, follow the order of operations, often remembered by the acronym PEMDAS:

1. Parentheses
2. Exponents
3. Multiplication and Division (from left to right)
4. Addition and Subtraction (from left to right)

## Properties of Real Numbers

- Commutative Property:
  - Addition:  $(a + b = b + a)$
  - Multiplication:  $(a \cdot b = b \cdot a)$
- Associative Property:
  - Addition:  $((a + b) + c = a + (b + c))$
  - Multiplication:  $((a \cdot b) \cdot c = a \cdot (b \cdot c))$
- Distributive Property:
  - $(a(b + c) = ab + ac)$

## Linear Equations

Linear equations represent relationships where the highest power of the variable is one. The standard form is  $(Ax + By = C)$ .

# Slope and Intercept Form

The slope-intercept form of a linear equation is given by:

$$y = mx + b$$

Where:

-  $m$  = slope of the line

-  $b$  = y-intercept (the value of  $y$  when  $x = 0$ )

## Finding the Slope

The slope between two points  $(x_1, y_1)$  and  $(x_2, y_2)$  is calculated as:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

## Solving Linear Equations

To solve a linear equation, isolate the variable on one side. For example, to solve for  $x$ :

- $2x + 3 = 7$
- Subtract 3 from both sides:  $2x = 4$
- Divide by 2:  $x = 2$

## Quadratic Equations

Quadratic equations are polynomial equations of the form  $ax^2 + bx + c = 0$ .

## Standard Form and Factoring

- The standard form is  $ax^2 + bx + c = 0$ .
- To factor, look for two numbers that multiply to  $ac$  and add to  $b$ .

## Quadratic Formula

If factoring is difficult, use the quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Where:

- $(b^2 - 4ac)$  is called the discriminant.
- If the discriminant is positive, there are two real solutions; if it is zero, there is one real solution; if negative, there are two complex solutions.

## Functions and Graphs

Functions are a fundamental concept in algebra. A function relates an input to a single output.

### Function Notation

A function  $f$  is often written as:

$$f(x) = y$$

Where  $x$  is the input and  $y$  is the output.

### Types of Functions

- Linear Functions:  $f(x) = mx + b$
- Quadratic Functions:  $f(x) = ax^2 + bx + c$
- Polynomial Functions: Functions with terms like  $(ax^n)$ .
- Rational Functions: Functions that can be expressed as the ratio of two polynomials.

## Exponential and Logarithmic Functions

Exponential and logarithmic functions are crucial in various applications, including growth and decay models.

### Exponential Functions

The general form of an exponential function is:

$$f(x) = a \cdot b^x$$

$$f(x) = a \cdot b^x$$

\]

Where:

-  $a$  is the initial value

-  $b$  is the base (rate of growth if  $b > 1$  or decay if  $0 < b < 1$ )

## Logarithmic Functions

The logarithmic function is the inverse of the exponential function:

\[

$$y = \log_b(x) \implies b^y = x$$

\]

Key properties of logarithms include:

1.  $\log_b(xy) = \log_b(x) + \log_b(y)$
2.  $\log_b\left(\frac{x}{y}\right) = \log_b(x) - \log_b(y)$
3.  $\log_b(x^r) = r \cdot \log_b(x)$

## Systems of Equations

A system of equations consists of two or more equations with the same variables.

## Methods for Solving

1. Substitution Method: Solve one equation for one variable and substitute into the other.
2. Elimination Method: Add or subtract equations to eliminate a variable.
3. Graphical Method: Graph each equation and find the intersection point.

## Statistics in Algebra

Understanding basic statistics can be beneficial in interpreting data.

## Mean, Median, and Mode

- Mean: Average of a set of numbers, calculated by summing all values and dividing by the count.
- Median: The middle value when the data set is ordered.
- Mode: The value that appears most frequently in a data set.

# Conclusion

This college algebra formulas cheat sheet provides a concise summary of the key concepts, formulas, and methods necessary for mastering college algebra. From understanding basic algebraic principles to solving complex equations and working with functions, having these essential formulas at your fingertips will aid in your academic success. Remember to practice regularly and refer back to this cheat sheet as you navigate through your algebra coursework, ensuring you solidify your understanding and application of these essential mathematical tools.

## Frequently Asked Questions

### **What are the most important formulas to include in a college algebra cheat sheet?**

Key formulas include the quadratic formula, factoring techniques, polynomial identities, exponential and logarithmic properties, and the distance and midpoint formulas.

### **How can a cheat sheet help in studying for college algebra?**

A cheat sheet condenses essential formulas and concepts, aiding in quick reference and reinforcing memory, thereby enhancing understanding and retention of material.

### **Is there a standard format for a college algebra formulas cheat sheet?**

While there is no standard format, most cheat sheets organize formulas by topic, such as functions, equations, inequalities, and graphs, often using clear headings and bullet points for easy navigation.

### **Can I use a cheat sheet during exams in college algebra?**

Usage of a cheat sheet during exams varies by institution and instructor. Always check the exam guidelines to see if it's permitted.

### **What topics should I prioritize when creating my college algebra cheat sheet?**

Focus on functions, equations (linear, quadratic, polynomial), systems of equations, inequalities, and graphing techniques, as these are frequently tested.

### **Are there online resources to help create a college**

# algebra formulas cheat sheet?

Yes, websites like Khan Academy, Purplemath, and various educational YouTube channels offer guides and examples for creating effective cheat sheets.

## How can I effectively use my cheat sheet for practice problems?

Refer to your cheat sheet while solving practice problems to reinforce your understanding, and gradually try to solve problems without looking at the sheet to enhance retention.

# What is the best way to organize a college algebra formulas cheat sheet?

Organize the cheat sheet by grouping related concepts together, using headings for each section, and including examples for complex formulas to clarify their applications.

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