

COLLEGE ALGEBRA FORMULA CHEAT SHEET

COLLEGE ALGEBRA FORMULA CHEAT SHEET: YOUR ULTIMATE GUIDE TO MASTERING ALGEBRAIC CONCEPTS

EMBARKING ON THE JOURNEY THROUGH COLLEGE ALGEBRA CAN FEEL LIKE NAVIGATING A COMPLEX MAZE OF EQUATIONS, FUNCTIONS, AND THEOREMS. FOR MANY STUDENTS, A RELIABLE COLLEGE ALGEBRA FORMULA CHEAT SHEET BECOMES AN INDISPENSABLE TOOL, OFFERING QUICK ACCESS TO ESSENTIAL DEFINITIONS AND MANIPULATIONS. THIS COMPREHENSIVE GUIDE AIMS TO BE PRECISELY THAT – YOUR GO-TO RESOURCE FOR ALL THE KEY FORMULAS AND CONCEPTS YOU’LL ENCOUNTER IN A TYPICAL COLLEGE ALGEBRA COURSE. WE’LL COVER EVERYTHING FROM BASIC ALGEBRAIC PROPERTIES TO MORE ADVANCED TOPICS LIKE LOGARITHMS, EXPONENTS, AND QUADRATIC EQUATIONS, ENSURING YOU HAVE THE FOUNDATIONAL KNOWLEDGE AND THE HANDY REFERENCE YOU NEED TO EXCEL. WHETHER YOU’RE PREPPING FOR AN EXAM, TACKLING HOMEWORK, OR SIMPLY SEEKING TO SOLIDIFY YOUR UNDERSTANDING, THIS DETAILED BREAKDOWN OF COLLEGE ALGEBRA FORMULAS WILL EQUIP YOU WITH THE CONFIDENCE TO CONQUER ANY ALGEBRAIC CHALLENGE. GET READY TO DEMYSTIFY THOSE EQUATIONS AND UNLOCK YOUR FULL POTENTIAL IN COLLEGE ALGEBRA WITH THIS EXTENSIVE FORMULA REPOSITORY.

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FUNDAMENTAL ALGEBRAIC PROPERTIES AND OPERATIONS

AT THE HEART OF COLLEGE ALGEBRA LIE FUNDAMENTAL PROPERTIES THAT GOVERN HOW WE MANIPULATE EXPRESSIONS AND SOLVE EQUATIONS. UNDERSTANDING THESE BASIC BUILDING BLOCKS IS CRUCIAL FOR SUCCESS IN MORE COMPLEX TOPICS. THIS SECTION OF YOUR COLLEGE ALGEBRA FORMULA CHEAT SHEET WILL FOCUS ON THESE CORE PRINCIPLES, ENSURING YOU HAVE A SOLID FOUNDATION.

THE COMMUTATIVE PROPERTY

THE COMMUTATIVE PROPERTY STATES THAT THE ORDER IN WHICH YOU ADD OR MULTIPLY NUMBERS DOES NOT CHANGE THE RESULT. THIS APPLIES TO BOTH ADDITION AND MULTIPLICATION.

- ADDITION: $A + B = B + A$
- MULTIPLICATION: $A \cdot B = B \cdot A$

THE ASSOCIATIVE PROPERTY

THE ASSOCIATIVE PROPERTY DEALS WITH GROUPING. IT INDICATES THAT THE WAY YOU GROUP NUMBERS IN ADDITION OR MULTIPLICATION DOES NOT AFFECT THE OUTCOME.

- ADDITION: $(A + B) + C = A + (B + C)$
- MULTIPLICATION: $(A \cdot B) \cdot C = A \cdot (B \cdot C)$

THE DISTRIBUTIVE PROPERTY

THE DISTRIBUTIVE PROPERTY IS A CORNERSTONE OF ALGEBRAIC MANIPULATION, ALLOWING US TO MULTIPLY A SUM BY A NUMBER BY MULTIPLYING EACH ADDEND INDIVIDUALLY AND THEN ADDING THE PRODUCTS.

$$A(B + C) = A \cdot B + A \cdot C$$

THIS PROPERTY IS PARTICULARLY USEFUL WHEN EXPANDING EXPRESSIONS AND SIMPLIFYING EQUATIONS.

THE ADDITIVE IDENTITY

THE ADDITIVE IDENTITY IS THE NUMBER THAT, WHEN ADDED TO ANY NUMBER, LEAVES THAT NUMBER UNCHANGED. THIS IDENTITY IS ZERO.

$$A + 0 = A$$

THE MULTIPLICATIVE IDENTITY

THE MULTIPLICATIVE IDENTITY IS THE NUMBER THAT, WHEN MULTIPLIED BY ANY NUMBER, LEAVES THAT NUMBER UNCHANGED. THIS IDENTITY IS ONE.

$$A \cdot 1 = A$$

THE ADDITIVE INVERSE

THE ADDITIVE INVERSE OF A NUMBER IS THE NUMBER THAT, WHEN ADDED TO THE ORIGINAL NUMBER, RESULTS IN ZERO. FOR ANY NUMBER 'A', ITS ADDITIVE INVERSE IS '-A'.

$$A + (-A) = 0$$

THE MULTIPLICATIVE INVERSE

THE MULTIPLICATIVE INVERSE OF A NON-ZERO NUMBER IS THE NUMBER THAT, WHEN MULTIPLIED BY THE ORIGINAL NUMBER, RESULTS IN ONE. FOR ANY NON-ZERO NUMBER 'A', ITS MULTIPLICATIVE INVERSE IS '1/A'.

$$A (1/A) = 1$$

EXPONENTS AND RADICALS: ESSENTIAL RULES

UNDERSTANDING EXPONENTS AND RADICALS IS FUNDAMENTAL TO SIMPLIFYING EXPRESSIONS AND SOLVING VARIOUS TYPES OF EQUATIONS IN COLLEGE ALGEBRA. THIS SECTION PROVIDES A CONCISE COLLEGE ALGEBRA FORMULA CHEAT SHEET FOR THESE CRITICAL CONCEPTS.

RULES OF EXPONENTS

THESE RULES ALLOW US TO EFFICIENTLY MANIPULATE EXPRESSIONS WITH EXPONENTS.

- PRODUCT OF POWERS: $x^m x^n = x^{(m+n)}$
- QUOTIENT OF POWERS: $x^m / x^n = x^{(m-n)}$
- POWER OF A POWER: $(x^m)^n = x^{(mn)}$
- POWER OF A PRODUCT: $(xy)^n = x^n y^n$
- POWER OF A QUOTIENT: $(x/y)^n = x^n / y^n$
- ZERO EXPONENT: $x^0 = 1$ (FOR $x \neq 0$)
- NEGATIVE EXPONENT: $x^{-n} = 1 / x^n$ (FOR $x \neq 0$)

RULES OF RADICALS

RADICALS ARE ESSENTIALLY FRACTIONAL EXPONENTS, AND THEIR MANIPULATION FOLLOWS SIMILAR PATTERNS.

- PRODUCT PROPERTY OF RADICALS: $\sqrt[n]{(A B)} = \sqrt[n]{(A)} \sqrt[n]{(B)}$
- QUOTIENT PROPERTY OF RADICALS: $\sqrt[n]{(A / B)} = \sqrt[n]{(A)} / \sqrt[n]{(B)}$
- POWER OF A RADICAL: $(\sqrt[n]{(A)})^m = \sqrt[n]{(A^m)}$
- ROOT OF A RADICAL: $\sqrt[m]{(\sqrt[n]{(A)})} = \sqrt[mn]{(A)}$
- SIMPLIFYING RADICALS: TO SIMPLIFY A RADICAL, FIND THE LARGEST PERFECT NTH POWER THAT DIVIDES THE RADICAND.

REMEMBERING THESE EXPONENT AND RADICAL RULES WILL SIGNIFICANTLY STREAMLINE YOUR WORK WITH ALGEBRAIC EXPRESSIONS.

POLYNOMIALS: FACTORING AND OPERATIONS

POLYNOMIALS ARE EXPRESSIONS CONSISTING OF VARIABLES AND COEFFICIENTS, INVOLVING ONLY THE OPERATIONS OF ADDITION, SUBTRACTION, MULTIPLICATION, AND NON-NEGATIVE INTEGER EXPONENTS. MASTERING POLYNOMIAL OPERATIONS AND FACTORING IS A CORE SKILL IN COLLEGE ALGEBRA, AND THIS PART OF YOUR COLLEGE ALGEBRA FORMULA CHEAT SHEET IS DEDICATED TO IT.

OPERATIONS WITH POLYNOMIALS

ADDING AND SUBTRACTING POLYNOMIALS INVOLVES COMBINING LIKE TERMS. MULTIPLYING POLYNOMIALS OFTEN USES THE DISTRIBUTIVE PROPERTY.

- ADDING POLYNOMIALS: $(3x^2 + 2x - 1) + (x^2 - 5x + 4) = (3+1)x^2 + (2-5)x + (-1+4) = 4x^2 - 3x + 3$
- SUBTRACTING POLYNOMIALS: $(3x^2 + 2x - 1) - (x^2 - 5x + 4) = 3x^2 + 2x - 1 - x^2 + 5x - 4 = (3-1)x^2 + (2+5)x + (-1-4) = 2x^2 + 7x - 5$
- MULTIPLYING POLYNOMIALS: $(x + 2)(x - 3) = x(x - 3) + 2(x - 3) = x^2 - 3x + 2x - 6 = x^2 - x - 6$

FACTORING TECHNIQUES

FACTORING IS THE PROCESS OF EXPRESSING A POLYNOMIAL AS A PRODUCT OF SIMPLER POLYNOMIALS. COMMON FACTORING METHODS INCLUDE:

- GREATEST COMMON FACTOR (GCF): FACTOR OUT THE LARGEST COMMON FACTOR FROM ALL TERMS.
- FACTORING BY GROUPING: USED FOR FOUR-TERM POLYNOMIALS.
- DIFFERENCE OF SQUARES: $A^2 - B^2 = (A - B)(A + B)$
- SUM OF CUBES: $A^3 + B^3 = (A + B)(A^2 - AB + B^2)$
- DIFFERENCE OF CUBES: $A^3 - B^3 = (A - B)(A^2 + AB + B^2)$
- TRINOMIAL FACTORING: FACTORING QUADRATIC EXPRESSIONS OF THE FORM $AX^2 + BX + C$.

PRACTICE THESE FACTORING TECHNIQUES TO BECOME PROFICIENT IN SIMPLIFYING AND SOLVING POLYNOMIAL EQUATIONS.

RATIONAL EXPRESSIONS AND EQUATIONS

RATIONAL EXPRESSIONS ARE FRACTIONS WHERE THE NUMERATOR AND DENOMINATOR ARE POLYNOMIALS. WORKING WITH THESE EXPRESSIONS REQUIRES CAREFUL ATTENTION TO THE RULES OF FRACTIONS AND ALGEBRAIC MANIPULATION, MAKING THIS A VITAL SECTION FOR YOUR COLLEGE ALGEBRA FORMULA CHEAT SHEET.

SIMPLIFYING RATIONAL EXPRESSIONS

TO SIMPLIFY A RATIONAL EXPRESSION, FACTOR THE NUMERATOR AND DENOMINATOR COMPLETELY AND CANCEL OUT ANY COMMON FACTORS.

EXAMPLE: $(x^2 - 4) / (x - 2) = [(x - 2)(x + 2)] / (x - 2) = x + 2$ (PROVIDED $x \neq 2$)

OPERATIONS WITH RATIONAL EXPRESSIONS

ADDING, SUBTRACTING, MULTIPLYING, AND DIVIDING RATIONAL EXPRESSIONS INVOLVE FINDING COMMON DENOMINATORS AND APPLYING THE RULES OF FRACTION ARITHMETIC.

- MULTIPLYING: $(A/B) (C/D) = (AC) / (BD)$
- DIVIDING: $(A/B) / (C/D) = (A/B) (D/C) = (AD) / (BC)$
- ADDING/SUBTRACTING: TO ADD OR SUBTRACT, FIND A COMMON DENOMINATOR FOR ALL EXPRESSIONS.

SOLVING RATIONAL EQUATIONS

TO SOLVE A RATIONAL EQUATION, FIRST FIND THE LEAST COMMON DENOMINATOR (LCD) OF ALL FRACTIONS IN THE EQUATION. MULTIPLY BOTH SIDES OF THE EQUATION BY THE LCD TO ELIMINATE THE DENOMINATORS. ALWAYS CHECK FOR EXTRANEOUS SOLUTIONS BY SUBSTITUTING THE OBTAINED SOLUTIONS BACK INTO THE ORIGINAL EQUATION.

EXAMPLE: $2/x + 3/(x+1) = 4$

LCD IS $x(x+1)$.

$$2(x+1) + 3x = 4x(x+1)$$

$$2x + 2 + 3x = 4x^2 + 4x$$

$$5x + 2 = 4x^2 + 4x$$

$$0 = 4x^2 - x - 2$$

SOLVE THIS QUADRATIC EQUATION FOR X.

LINEAR EQUATIONS AND INEQUALITIES

LINEAR EQUATIONS AND INEQUALITIES REPRESENT RELATIONSHIPS WHERE VARIABLES ARE RAISED TO THE FIRST POWER. THEY ARE FUNDAMENTAL IN ALGEBRA AND FORM THE BASIS FOR UNDERSTANDING MORE COMPLEX FUNCTIONS. THIS SECTION OF YOUR COLLEGE ALGEBRA FORMULA CHEAT SHEET COVERS THEIR KEY ASPECTS.

SOLVING LINEAR EQUATIONS

THE GOAL IS TO ISOLATE THE VARIABLE. THIS INVOLVES USING INVERSE OPERATIONS TO MOVE TERMS AND SIMPLIFY THE EQUATION.

GENERAL FORM: $AX + B = C$

STEPS:

1. SUBTRACT 'B' FROM BOTH SIDES: $AX = C - B$
2. DIVIDE BOTH SIDES BY 'A': $X = (C - B) / A$

SOLVING LINEAR INEQUALITIES

THE PROCESS IS SIMILAR TO SOLVING LINEAR EQUATIONS, BUT WITH A CRUCIAL DIFFERENCE WHEN MULTIPLYING OR DIVIDING BY A NEGATIVE NUMBER – THE INEQUALITY SIGN MUST BE REVERSED.

GENERAL FORM: $AX + B < C$ (OR $>, \leq, \geq$)

STEPS:

1. SUBTRACT 'B' FROM BOTH SIDES: $AX < C - B$
2. IF 'A' IS POSITIVE, DIVIDE BY 'A': $X < (C - B) / A$
3. IF 'A' IS NEGATIVE, DIVIDE BY 'A' AND REVERSE THE INEQUALITY SIGN: $X > (C - B) / A$

GRAPHING LINEAR EQUATIONS AND INEQUALITIES

LINEAR EQUATIONS GRAPH AS STRAIGHT LINES. LINEAR INEQUALITIES GRAPH AS A SHADED REGION.

- SLOPE-INTERCEPT FORM: $Y = MX + B$ (M IS THE SLOPE, B IS THE Y-INTERCEPT)
- POINT-SLOPE FORM: $Y - Y_1 = M(X - X_1)$
- GRAPHING INEQUALITIES: USE A SOLID LINE FOR $\leq$ OR $\geq$, AND A DASHED LINE FOR $<$ OR $>$. SHADE THE REGION THAT SATISFIES THE INEQUALITY.

FUNCTIONS: NOTATION, EVALUATION, AND TYPES

FUNCTIONS ARE A CENTRAL CONCEPT IN COLLEGE ALGEBRA, DESCRIBING RELATIONSHIPS BETWEEN INPUT AND OUTPUT VALUES. UNDERSTANDING FUNCTION NOTATION, HOW TO EVALUATE THEM, AND THE DIFFERENT TYPES OF FUNCTIONS IS ESSENTIAL FOR PROGRESS.

FUNCTION NOTATION

A FUNCTION IS TYPICALLY DENOTED BY $f(x)$, WHERE 'f' IS THE NAME OF THE FUNCTION AND 'x' IS THE INPUT VARIABLE. THIS NOTATION SIGNIFIES THAT 'f' IS A RULE THAT ASSIGNS AN OUTPUT TO EACH INPUT 'x'.

EXAMPLE: IF $f(x) = 2x + 3$, THEN $f(4)$ MEANS TO SUBSTITUTE 4 FOR x IN THE FUNCTION.

EVALUATING FUNCTIONS

TO EVALUATE A FUNCTION AT A SPECIFIC VALUE, SUBSTITUTE THAT VALUE FOR THE VARIABLE IN THE FUNCTION'S EXPRESSION AND SIMPLIFY.

IF $f(x) = 2x + 3$, THEN:

- $f(4) = 2(4) + 3 = 8 + 3 = 11$
- $f(-1) = 2(-1) + 3 = -2 + 3 = 1$
- $f(a+1) = 2(a+1) + 3 = 2a + 2 + 3 = 2a + 5$

TYPES OF FUNCTIONS

COLLEGE ALGEBRA COVERS A VARIETY OF FUNCTION TYPES, EACH WITH UNIQUE PROPERTIES AND GRAPHICAL REPRESENTATIONS.

- LINEAR FUNCTIONS: $f(x) = mx + b$ (GRAPHS AS A STRAIGHT LINE)
- QUADRATIC FUNCTIONS: $f(x) = ax^2 + bx + c$ (GRAPHS AS A PARABOLA)
- POLYNOMIAL FUNCTIONS: $f(x) = a_n x^n + \dots + a_1 x + a_0$
- RATIONAL FUNCTIONS: $f(x) = P(x) / Q(x)$, WHERE $P(x)$ AND $Q(x)$ ARE POLYNOMIALS
- EXPONENTIAL FUNCTIONS: $f(x) = a^x$ (WHERE $a > 0$ AND $a \neq 1$)
- LOGARITHMIC FUNCTIONS: $f(x) = \log_a(x)$ (THE INVERSE OF EXPONENTIAL FUNCTIONS)
- ABSOLUTE VALUE FUNCTIONS: $f(x) = |x|$

FAMILIARIZE YOURSELF WITH THE CHARACTERISTICS AND GRAPHS OF THESE DIFFERENT FUNCTION TYPES.

QUADRATIC EQUATIONS AND FUNCTIONS

QUADRATIC EQUATIONS, INVOLVING A VARIABLE RAISED TO THE SECOND POWER, AND THEIR CORRESPONDING QUADRATIC FUNCTIONS ARE A CORNERSTONE OF COLLEGE ALGEBRA. THIS SECTION PROVIDES THE ESSENTIAL FORMULAS FOR TACKLING THESE.

THE QUADRATIC FORMULA

FOR A QUADRATIC EQUATION IN THE STANDARD FORM $ax^2 + bx + c = 0$ (WHERE $a \neq 0$), THE SOLUTIONS (ROOTS) CAN BE FOUND USING THE QUADRATIC FORMULA:

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

THE DISCRIMINANT, $\Delta = b^2 - 4ac$, TELLS US ABOUT THE NATURE OF THE ROOTS:

- IF $\Delta > 0$, THERE ARE TWO DISTINCT REAL SOLUTIONS.
- IF $\Delta = 0$, THERE IS EXACTLY ONE REAL SOLUTION (A REPEATED ROOT).
- IF $\Delta < 0$, THERE ARE TWO COMPLEX CONJUGATE SOLUTIONS.

PROPERTIES OF QUADRATIC FUNCTIONS

A QUADRATIC FUNCTION $f(x) = ax^2 + bx + c$ HAS A PARABOLIC GRAPH. KEY FEATURES INCLUDE:

- VERTEX: THE HIGHEST OR LOWEST POINT ON THE PARABOLA. THE X-COORDINATE OF THE VERTEX IS GIVEN BY $-b / (2a)$.
- AXIS OF SYMMETRY: A VERTICAL LINE PASSING THROUGH THE VERTEX, WITH THE EQUATION $x = -b / (2a)$.
- OPENING DIRECTION: IF $a > 0$, THE PARABOLA OPENS UPWARDS. IF $a < 0$, IT OPENS DOWNWARDS.
- Y-INTERCEPT: THE POINT WHERE THE GRAPH CROSSES THE Y-AXIS, FOUND BY EVALUATING $f(0) = c$.

COMPLETING THE SQUARE

THIS METHOD IS USED TO REWRITE A QUADRATIC EXPRESSION IN THE FORM $A(x - h)^2 + k$, WHICH IS USEFUL FOR FINDING THE VERTEX AND SOLVING EQUATIONS.

TO COMPLETE THE SQUARE FOR $x^2 + bx$:

1. TAKE HALF OF THE COEFFICIENT OF x ($b/2$).
2. SQUARE THE RESULT: $(b/2)^2$.
3. ADD AND SUBTRACT THIS VALUE: $x^2 + bx + (b/2)^2 - (b/2)^2 = (x + b/2)^2 - (b/2)^2$

LOGARITHMS AND EXPONENTIAL FUNCTIONS

EXPONENTIAL AND LOGARITHMIC FUNCTIONS ARE INVERSE OPERATIONS AND PLAY A CRUCIAL ROLE IN MODELING GROWTH AND DECAY. THIS SECTION OF YOUR COLLEGE ALGEBRA FORMULA CHEAT SHEET PROVIDES THE ESSENTIAL RULES AND FORMULAS.

EXPONENTIAL FUNCTIONS

AN EXPONENTIAL FUNCTION HAS THE FORM $f(x) = a^x$, WHERE ' a ' IS THE BASE ($a > 0$, $a \neq 1$).

- DOMAIN: ALL REAL NUMBERS.
- RANGE: ALL POSITIVE REAL NUMBERS.
- KEY PROPERTIES: $f(x) = a^x$ IS CONTINUOUS, ONE-TO-ONE, AND INCREASING IF $a > 1$, DECREASING IF $0 < a < 1$.

LOGARITHMIC FUNCTIONS

THE LOGARITHMIC FUNCTION IS THE INVERSE OF THE EXPONENTIAL FUNCTION. $\log_a(y) = x$ IS EQUIVALENT TO $a^x = y$.

- BASE 10 LOGARITHM: $\log(x) = \log_{10}(x)$
- NATURAL LOGARITHM: $\ln(x) = \log_e(x)$ (WHERE ' e ' IS EULER'S NUMBER, APPROXIMATELY 2.71828)

LOGARITHM PROPERTIES

THESE PROPERTIES ARE ESSENTIAL FOR SIMPLIFYING AND MANIPULATING LOGARITHMIC EXPRESSIONS:

- PRODUCT RULE: $\log_a(xy) = \log_a(x) + \log_a(y)$
- QUOTIENT RULE: $\log_a(x/y) = \log_a(x) - \log_a(y)$
- POWER RULE: $\log_a(x^n) = n \log_a(x)$

- CHANGE OF BASE FORMULA: $\log_A(x) = \log_B(x) / \log_B(A)$
- INVERSE PROPERTIES: $A^{(\log_A(x))} = x$ AND $\log_A(A^x) = x$

SOLVING EXPONENTIAL AND LOGARITHMIC EQUATIONS

TO SOLVE EXPONENTIAL EQUATIONS, USE LOGARITHMS TO BRING THE VARIABLE DOWN. TO SOLVE LOGARITHMIC EQUATIONS, USE EXPONENTIATION TO ELIMINATE THE LOGARITHMS, ENSURING TO CHECK FOR DOMAIN RESTRICTIONS.

SYSTEMS OF EQUATIONS AND INEQUALITIES

SYSTEMS OF EQUATIONS AND INEQUALITIES INVOLVE FINDING SOLUTIONS THAT SATISFY MULTIPLE CONDITIONS SIMULTANEOUSLY. THIS IS A COMMON APPLICATION OF ALGEBRAIC PRINCIPLES.

METHODS FOR SOLVING SYSTEMS OF LINEAR EQUATIONS

THERE ARE SEVERAL ALGEBRAIC METHODS TO SOLVE SYSTEMS OF TWO OR MORE LINEAR EQUATIONS:

- SUBSTITUTION METHOD: SOLVE ONE EQUATION FOR ONE VARIABLE, THEN SUBSTITUTE THAT EXPRESSION INTO THE OTHER EQUATION.
- ELIMINATION METHOD: MULTIPLY ONE OR BOTH EQUATIONS BY CONSTANTS SO THAT THE COEFFICIENTS OF ONE VARIABLE ARE OPPOSITES, THEN ADD THE EQUATIONS TO ELIMINATE THAT VARIABLE.
- GRAPHICAL METHOD: GRAPH BOTH EQUATIONS AND FIND THE POINT(S) OF INTERSECTION.

SOLVING SYSTEMS OF NONLINEAR EQUATIONS

SIMILAR METHODS (SUBSTITUTION, ELIMINATION) CAN BE USED, BUT THE ALGEBRA CAN BECOME MORE COMPLEX, OFTEN INVOLVING QUADRATIC OR HIGHER-DEGREE EQUATIONS.

SYSTEMS OF LINEAR INEQUALITIES

TO SOLVE A SYSTEM OF LINEAR INEQUALITIES, GRAPH EACH INEQUALITY ON THE SAME COORDINATE PLANE. THE SOLUTION SET IS THE REGION WHERE ALL SHADED AREAS OVERLAP.

MATRICES AND DETERMINANTS

MATRICES ARE RECTANGULAR ARRAYS OF NUMBERS, AND THEIR STUDY PROVIDES POWERFUL TOOLS FOR SOLVING SYSTEMS OF EQUATIONS AND IN VARIOUS FIELDS OF MATHEMATICS AND SCIENCE. THIS SECTION INCLUDES KEY FORMULAS FOR MATRICES AND THEIR DETERMINANTS.

MATRIX OPERATIONS

- ADDITION/SUBTRACTION: PERFORMED ELEMENT-WISE ON MATRICES OF THE SAME DIMENSIONS.
- SCALAR MULTIPLICATION: MULTIPLY EACH ELEMENT OF THE MATRIX BY THE SCALAR.
- MATRIX MULTIPLICATION: THE PRODUCT OF AN $m \times n$ MATRIX AND AN $n \times p$ MATRIX IS AN $m \times p$ MATRIX. THE ELEMENT IN ROW i , COLUMN j OF THE PRODUCT IS THE DOT PRODUCT OF ROW i OF THE FIRST MATRIX AND COLUMN j OF THE SECOND MATRIX.

DETERMINANTS

A DETERMINANT IS A SCALAR VALUE CALCULATED FROM THE ELEMENTS OF A SQUARE MATRIX. IT PROVIDES INFORMATION ABOUT THE MATRIX, SUCH AS WHETHER IT IS INVERTIBLE.

- FOR A 2×2 MATRIX $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, THE DETERMINANT IS $ad - bc$.
- FOR A 3×3 MATRIX, DETERMINANTS CAN BE CALCULATED USING COFACTOR EXPANSION OR BY THE SARRUS RULE.

CRAMER'S RULE

CRAMER'S RULE USES DETERMINANTS TO SOLVE SYSTEMS OF LINEAR EQUATIONS.

FOR A SYSTEM $AX = B$, WHERE A IS THE COEFFICIENT MATRIX, X IS THE VARIABLE VECTOR, AND B IS THE CONSTANT VECTOR:

$$x_i = \frac{\det(A_i)}{\det(A)}$$

WHERE A_i IS THE MATRIX A WITH THE i -TH COLUMN REPLACED BY THE VECTOR B .

CONIC SECTIONS

CONIC SECTIONS ARE CURVES FORMED BY THE INTERSECTION OF A PLANE AND A DOUBLE CONE. THE FOUR MAIN CONIC SECTIONS ARE CIRCLES, ELLIPSES, PARABOLAS, AND HYPERBOLAS. UNDERSTANDING THEIR STANDARD FORMS AND PROPERTIES IS KEY.

STANDARD FORMS OF CONIC SECTIONS

- CIRCLE: $(x - h)^2 + (y - k)^2 = r^2$ (CENTER (h, k) , RADIUS r)
- PARABOLA: $(x - h)^2 = 4p(y - k)$ OR $(y - k)^2 = 4p(x - h)$ (VERTEX (h, k))
- ELLIPSE: $(x - h)^2 / a^2 + (y - k)^2 / b^2 = 1$ OR $(x - h)^2 / b^2 + (y - k)^2 / a^2 = 1$ (CENTER (h, k))
- HYPERBOLA: $(x - h)^2 / a^2 - (y - k)^2 / b^2 = 1$ OR $(y - k)^2 / a^2 - (x - h)^2 / b^2 = 1$ (CENTER (h, k))

IDENTIFYING CONIC SECTIONS

THE GENERAL FORM OF A CONIC SECTION IS $AX^2 + BXY + CY^2 + DX + EY + F = 0$. THE TYPE OF CONIC SECTION CAN BE IDENTIFIED BY THE DISCRIMINANT $B^2 - 4AC$.

- IF $B^2 - 4AC < 0$, IT'S AN ELLIPSE OR CIRCLE.
- IF $B^2 - 4AC = 0$, IT'S A PARABOLA.
- IF $B^2 - 4AC > 0$, IT'S A HYPERBOLA.

SEQUENCES AND SERIES

SEQUENCES ARE ORDERED LISTS OF NUMBERS, AND SERIES ARE THE SUMS OF THE TERMS OF SEQUENCES. COLLEGE ALGEBRA OFTEN INTRODUCES ARITHMETIC AND GEOMETRIC SEQUENCES AND SERIES.

ARITHMETIC SEQUENCES AND SERIES

- SEQUENCE FORMULA: $A_n = A_1 + (n - 1)d$ (A_n IS THE NTH TERM, A_1 IS THE FIRST TERM, d IS THE COMMON DIFFERENCE)
- SERIES SUM FORMULA: $S_n = n/2 (A_1 + A_n)$ OR $S_n = n/2 [2A_1 + (n - 1)d]$

GEOMETRIC SEQUENCES AND SERIES

- SEQUENCE FORMULA: $A_n = A_1 r^{(n-1)}$ (A_n IS THE NTH TERM, A_1 IS THE FIRST TERM, r IS THE COMMON RATIO)
- FINITE SERIES SUM FORMULA: $S_n = A_1 (1 - r^n) / (1 - r)$ (FOR $r \neq 1$)
- INFINITE SERIES SUM FORMULA: $S = A_1 / (1 - r)$ (CONVERGES IF $|r| < 1$)

CONCLUSION: YOUR PATH TO ALGEBRAIC MASTERY

THIS COMPREHENSIVE COLLEGE ALGEBRA FORMULA CHEAT SHEET SERVES AS A VALUABLE REFERENCE AS YOU NAVIGATE THE INTRICACIES OF COLLEGE ALGEBRA. BY UNDERSTANDING AND PRACTICING THESE FORMULAS AND CONCEPTS, YOU BUILD A ROBUST FOUNDATION FOR MORE ADVANCED MATHEMATICAL STUDIES AND PROBLEM-SOLVING. KEEP THIS GUIDE HANDY, AND REMEMBER THAT CONSISTENT PRACTICE IS THE KEY TO MASTERING THESE ALGEBRAIC TOOLS.

FREQUENTLY ASKED QUESTIONS

WHAT ARE THE MOST ESSENTIAL FORMULAS FOR A COLLEGE ALGEBRA CHEAT SHEET?

KEY FORMULAS INCLUDE THOSE FOR SOLVING QUADRATIC EQUATIONS (QUADRATIC FORMULA), FACTORING TECHNIQUES

(DIFFERENCE OF SQUARES, PERFECT SQUARE TRINOMIALS), PROPERTIES OF EXPONENTS AND LOGARITHMS, DISTANCE FORMULA, MIDPOINT FORMULA, AND SLOPE-INTERCEPT FORM OF A LINEAR EQUATION.

HOW CAN I BEST ORGANIZE MY COLLEGE ALGEBRA CHEAT SHEET FOR QUICK ACCESS DURING EXAMS?

ORGANIZE BY TOPIC (E.G., EQUATIONS, FUNCTIONS, EXPONENTS/LOGARITHMS, GEOMETRY) USING CLEAR HEADINGS AND SUBHEADINGS. USE BULLET POINTS OR NUMBERED LISTS FOR FORMULAS AND BRIEF DEFINITIONS. CONSIDER USING DIFFERENT COLORS FOR EMPHASIS AND LEAVING SOME WHITE SPACE TO AVOID CLUTTER.

WHAT ARE SOME COMMON ALGEBRAIC IDENTITIES THAT SHOULD BE ON A CHEAT SHEET?

ESSENTIAL IDENTITIES INCLUDE: THE SQUARE OF A BINOMIAL ($(A+B)^2 = A^2 + 2AB + B^2$, $(A-B)^2 = A^2 - 2AB + B^2$), THE DIFFERENCE OF SQUARES ($A^2 - B^2 = (A-B)(A+B)$), AND THE SUM/DIFFERENCE OF CUBES ($A^3 + B^3 = (A+B)(A^2 - AB + B^2)$, $A^3 - B^3 = (A-B)(A^2 + AB + B^2)$).

BEYOND BASIC FORMULAS, WHAT ADVANCED CONCEPTS MIGHT BE USEFUL ON A COLLEGE ALGEBRA CHEAT SHEET?

DEPENDING ON THE COURSE, USEFUL ADVANCED CONCEPTS COULD INCLUDE: THE REMAINDER THEOREM, THE RATIONAL ROOT THEOREM, VERTEX FORM OF A PARABOLA, FORMULAS FOR ARITHMETIC AND GEOMETRIC SEQUENCES, LOGARITHMIC PROPERTIES (CHANGE OF BASE, PRODUCT, QUOTIENT, POWER RULES), AND TRIGONOMETRIC IDENTITIES IF APPLICABLE.

ARE THERE ANY SPECIFIC FORMULAS RELATED TO FUNCTIONS THAT ARE CRUCIAL FOR A COLLEGE ALGEBRA CHEAT SHEET?

YES, ESSENTIAL FUNCTION FORMULAS INCLUDE: THE DEFINITION OF A FUNCTION, DOMAIN AND RANGE, FUNCTION NOTATION ($f(x)$), INVERSE FUNCTIONS, COMPOSITE FUNCTIONS ($f(g(x))$), AND COMMON FUNCTION TRANSFORMATIONS (SHIFTS, STRETCHES, REFLECTIONS).

WHAT ARE THE BEST PRACTICES FOR USING A COLLEGE ALGEBRA CHEAT SHEET DURING STUDY AND EXAMS?

USE IT ACTIVELY DURING PRACTICE PROBLEMS TO BUILD FAMILIARITY. DURING EXAMS, USE IT AS A REFERENCE FOR SPECIFIC FORMULAS, BUT TRY TO RELY ON YOUR UNDERSTANDING FIRST. AVOID TRYING TO MEMORIZE THE CHEAT SHEET ITSELF; ITS PURPOSE IS TO AID RECALL OF FORMULAS YOU'VE ALREADY LEARNED.

ADDITIONAL RESOURCES

HERE ARE 9 BOOK TITLES RELATED TO COLLEGE ALGEBRA CONCEPTS, FORMATTED AS REQUESTED:

1. *THE FOUNDATION OF FUNCTIONS: A COLLEGE ALGEBRA PRIMER*

THIS BOOK PROVIDES A COMPREHENSIVE INTRODUCTION TO THE FUNDAMENTAL CONCEPTS OF FUNCTIONS, A CORNERSTONE OF COLLEGE ALGEBRA. IT DELVES INTO VARIOUS FUNCTION TYPES, THEIR GRAPHICAL REPRESENTATIONS, AND KEY PROPERTIES LIKE DOMAIN, RANGE, AND TRANSFORMATIONS. STUDENTS WILL FIND THIS AN INVALUABLE RESOURCE FOR BUILDING A STRONG UNDERSTANDING OF THE ALGEBRAIC LANGUAGE OF RELATIONSHIPS.

2. *EQUATIONS UNVEILED: SOLVING THE MYSTERIES OF COLLEGE ALGEBRA*

THIS TITLE FOCUSES ON THE ART AND SCIENCE OF SOLVING EQUATIONS, A CRITICAL SKILL IN COLLEGE ALGEBRA. IT SYSTEMATICALLY BREAKS DOWN DIFFERENT TYPES OF EQUATIONS, FROM LINEAR AND QUADRATIC TO EXPONENTIAL AND LOGARITHMIC, OFFERING CLEAR STRATEGIES AND STEP-BY-STEP EXAMPLES. MASTERING THE TECHNIQUES PRESENTED HERE WILL EMPOWER STUDENTS TO TACKLE COMPLEX PROBLEMS WITH CONFIDENCE.

3. *POLYNOMIALS AND THEIR POWER: A COLLEGE ALGEBRA EXPLORATION*

EXPLORE THE FASCINATING WORLD OF POLYNOMIALS, FROM BASIC OPERATIONS TO ADVANCED FACTORING AND GRAPHING. THIS BOOK DEMYSTIFIES THE BEHAVIOR OF POLYNOMIAL FUNCTIONS, INCLUDING ROOTS, MULTIPLICITY, AND END BEHAVIOR. IT'S DESIGNED TO EQUIP STUDENTS WITH THE TOOLS TO ANALYZE AND MANIPULATE THESE ESSENTIAL ALGEBRAIC EXPRESSIONS.

4. *LOGARITHMS AND EXPONENTIALS: BRIDGING THE GAPS IN COLLEGE ALGEBRA*

THIS BOOK ILLUMINATES THE INTERCONNECTED CONCEPTS OF LOGARITHMS AND EXPONENTIAL FUNCTIONS, CRUCIAL FOR MANY SCIENTIFIC AND FINANCIAL APPLICATIONS. IT PROVIDES CLEAR EXPLANATIONS OF THEIR PROPERTIES, INVERSE RELATIONSHIPS, AND PRACTICAL USES IN SOLVING REAL-WORLD PROBLEMS. UNDERSTANDING THESE TOPICS IS KEY TO UNLOCKING ADVANCED MATHEMATICAL TOPICS.

5. *MATRICES AND SYSTEMS: THE STRUCTURE OF COLLEGE ALGEBRA*

DIVE INTO THE SYSTEMATIC WORLD OF MATRICES AND SYSTEMS OF LINEAR EQUATIONS. THIS TITLE OFFERS PRACTICAL METHODS FOR SOLVING MULTIPLE EQUATIONS SIMULTANEOUSLY, HIGHLIGHTING THE EFFICIENCY AND ELEGANCE OF MATRIX OPERATIONS. IT'S AN ESSENTIAL GUIDE FOR STUDENTS WHO NEED TO UNDERSTAND ORGANIZED SETS OF DATA AND THEIR RELATIONSHIPS.

6. *RATIONAL EXPRESSIONS AND FUNCTIONS: NAVIGATING THE FRACTIONS OF COLLEGE ALGEBRA*

THIS GUIDE TACKLES THE OFTEN-PERPLEXING TOPIC OF RATIONAL EXPRESSIONS AND FUNCTIONS. IT OFFERS CLEAR METHODOLOGIES FOR SIMPLIFYING, ADDING, SUBTRACTING, MULTIPLYING, AND DIVIDING THESE ALGEBRAIC FRACTIONS, AS WELL AS UNDERSTANDING THEIR GRAPHS AND ASYMPTOTES. MASTERING THESE SKILLS IS VITAL FOR ADVANCED ALGEBRAIC MANIPULATION.

7. *SEQUENCES AND SERIES: THE PATTERNS OF COLLEGE ALGEBRA*

DISCOVER THE BEAUTY OF ORDERED NUMBERS AND THEIR SUMMATIONS WITH THIS BOOK ON SEQUENCES AND SERIES. IT INTRODUCES ARITHMETIC AND GEOMETRIC PROGRESSIONS, ALONG WITH COMMON SERIES FORMULAS AND CONVERGENCE CONCEPTS. THIS TITLE HELPS STUDENTS RECOGNIZE AND WORK WITH PATTERNS THAT APPEAR FREQUENTLY IN MATHEMATICS AND BEYOND.

8. *CONIC SECTIONS: THE GEOMETRIC FORMS OF COLLEGE ALGEBRA*

THIS BOOK EXPLORES THE VISUALLY ENGAGING WORLD OF CONIC SECTIONS – CIRCLES, ELLIPSES, PARABOLAS, AND HYPERBOLAS. IT DETAILS THEIR ALGEBRAIC EQUATIONS, KEY PROPERTIES, AND HOW THEY ARE DERIVED FROM INTERSECTING A CONE WITH A PLANE. STUDENTS WILL GAIN A DEEPER APPRECIATION FOR THE INTERPLAY BETWEEN ALGEBRA AND GEOMETRY.

9. *RADICALS AND ROOTS: THE CORE OPERATIONS OF COLLEGE ALGEBRA*

FOCUSING ON THE MANIPULATION OF ROOTS AND RADICAL EXPRESSIONS, THIS TITLE PROVIDES A SOLID FOUNDATION FOR WORKING WITH THESE FUNDAMENTAL ALGEBRAIC COMPONENTS. IT COVERS SIMPLIFYING RADICALS, RATIONALIZING DENOMINATORS, AND SOLVING EQUATIONS INVOLVING ROOTS. THIS BOOK ENSURES STUDENTS HAVE A FIRM GRASP ON THESE ESSENTIAL OPERATIONS.

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