Enhanced Peer System

Formula Input Notation Guide

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INTRODUCTION

The Enhanced Peer System accepts mathematical formulas in ASCII format while internally processing them using mathematical notation. This guide provides:

• Complete character map of supported symbols
• ASCII equivalents for LaTeX mathematical notation
• Complex formula examples in both formats
• Input guidelines and best practices

All formulas can be entered directly into the validation system using standard ASCII characters.

BASIC ARITHMETIC OPERATIONS

Operation	LaTeX	ASCII Input	Description
Addition	a + b	a + b	Addition operator
Subtraction	a - b	a - b	Subtraction operator
Multiplication	a × b	a * b or a*b	Multiplication operator
Division	a ÷ b	a / b	Division operator
Exponentiation	a^b	a**b or a^b	Power operation
Modulo	a mod b	a % b	Remainder operation

GREEK LETTERS & MATHEMATICAL CONSTANTS

Greek Letters:

α	alpha	β	beta	γ	gamma	δ	delta
ε	epsilon	ζ	zeta	η	eta	θ	theta
ι	iota	κ	kappa	λ	lambda	μ	mu
ν	nu	ξ	xi	π	pi	ρ	rho
σ	sigma	τ	tau	φ	phi	χ	chi
ψ	psi	ω	omega	Γ	GAMMA	Δ	DELTA

Mathematical Constants:

π	pi or PI	≈ 3.14159	Mathematical constant pi
e	e or E	≈ 2.71828	Natural logarithm base
φ	phi or golden_ratio	≈ 1.61803	Golden ratio
γ	euler_gamma or gamma	≈ 0.57721	Euler-Mascheroni constant
i	i or I	√(-1)	Imaginary unit
∞	inf or infinity	∞	Infinity

Common Mathematical Functions:

√x	sqrt(x)	Square root function
|x|	abs(x)	Absolute value function
$\log_{10}(x)$	log(x)	Base-10 logarithm
ln(x)	ln(x)	Natural logarithm
e^x	exp(x) or e**x	Exponential function
sin(x)	sin(x)	Sine function
cos(x)	cos(x)	Cosine function
tan(x)	tan(x)	Tangent function

ADVANCED MATHEMATICAL FUNCTIONS

Calculus Operations:

d/dx f(x)	d/dx f(x) or derivative(f, x)	First derivative
∫f(x)dx	integral(f(x))	Indefinite integral
$\int_a^b$ f(x)dx	integral_a_b(f(x))	Definite integral
$\lim_{x \to a}$ f(x)	limit_x_a(f(x)) or limit(f, x, a)	Limit operation
$\sum_{i=1}^{n} a_i$	sum(i=1 to n, a_i)	Summation
$\prod_{i=1}^{n} a_i$	product(i=1 to n, a_i)	Product

Number Theory Functions:

⌊x⌋	floor(x)	Greatest integer ≤ x
⌈x⌉	ceil(x)	Smallest integer ≥ x
gcd(a,b)	gcd(a,b)	GCD of a and b
lcm(a,b)	lcm(a,b)	LCM of a and b
(n choose k)	binomial(n,k) or n_choose_k	Binomial coefficient
a^b mod m	powmod(a,b,m)	Modular exponentiation
φ(n)	euler_phi(n) or phi(n)	Euler's totient function
π(x)	prime_counting(x) or pi(x)	Number of primes ≤ x

Special Functions:

ζ(s)	zeta(s)	Riemann zeta function
Γ(z)	gamma(z)	Gamma function
B(x,y)	beta(x,y)	Beta function
$J_n(x)$	bessel_J(n, x)	Bessel function of first kind
$_2F_1(a,b;c;z)$	hypergeometric_2F1(a,b;c;z)	Hypergeometric function

COMPLEX FORMULA EXAMPLES

Example 1: Basel Problem

LaTeX:

```
ζ(2) = Σ_{n=1}^∞ 1/n² = π²/6
```

ASCII Input:

```
zeta(2) = sum(n=1 to inf, 1/n**2) = pi**2/6
```

Example 2: Euler's Identity

LaTeX:

```
e^(iπ) + 1 = 0
```

ASCII Input:

```
e**(i*pi) + 1 = 0 or exp(i*pi) + 1 = 0
```

Example 3: Gaussian Integral

LaTeX:

```
∫_-∞^∞ e^(-x²)dx = √π
```

ASCII Input:

```
integral_-inf_to_inf(exp(-x**2)) = sqrt(pi)
```

Example 4: Stirling's Approximation

LaTeX:

```
n! ≈ √(2πn) (n/e)^n
```

ASCII Input:

```
n! ≈ sqrt(2*pi*n) * (n/e)**n
```

Example 5: Binomial Theorem

LaTeX:

```
(x + y)^n = Σ_{k=0}^n (n choose k) x^(n-k) y^k
```

ASCII Input:

```
(x + y)**n = sum(k=0 to n, binomial(n,k) * x**(n-k) * y**k)
```


Example 6: Riemann Hypothesis Critical Line

LaTeX:

```
ζ(1/2 + it) = 0 for non-trivial zeros
```

ASCII Input:

```
zeta(1/2 + i*t) = 0  # for non-trivial zeros
```

Example 7: Gamma Function Reflection

LaTeX:

```
Γ(z)Γ(1-z) = π/ sin(πz)
```

ASCII Input:

```
gamma(z) * gamma(1-z) = pi / sin(pi*z)
```

Example 8: Zeta Functional Equation

LaTeX:

```
ζ(s) = 2^s π^(s-1) sin(πs/2) Γ(1-s) ζ(1-s)
```

ASCII Input:

```
zeta(s) = 2**s * pi**(s-1) * sin(pi*s/2) * gamma(1-s) * zeta(1-s)
```

INPUT GUIDELINES AND BEST PRACTICES

General Rules:

- Use standard mathematical operators: +, -, *, /, **
- Function names should be lowercase: sin, cos, tan, sqrt, log, exp
- Greek letters can be spelled out: alpha, beta, gamma, delta, etc.
- Complex numbers use i for the imaginary unit
- Parentheses should be used to clarify order of operations
- Subscripts use underscore: x_1, a_n
- Superscripts use caret: x^2, a^n
- Infinity can be entered as inf or infinity

Special Characters and Escaping:

- Use underscores for subscripts (avoid confusion with function calls)
- Use carets for exponentiation
- Greek letters: spell them out (alpha, beta, gamma, etc.)
- Complex numbers: use i (not j) for consistency with mathematical notation
- Limits: use limit_variable_value(function) format
- Integrals: use integral_lower_upper(function) format
- Sums: use sum(index=start to end, expression) format
- Products: use product(index=start to end, expression) format

Common Pitfalls to Avoid:

- Don't use mathematical symbols directly (√, ×, ÷) - use ASCII equivalents
- Don't mix LaTeX and ASCII notation in the same expression
- Be careful with operator precedence - use parentheses when unsure
- Remember that implicit multiplication (like 2x) should be written as 2*x
- Don't use spaces in variable names - use underscores instead
- Be consistent with notation throughout complex expressions

COMPLETE SYMBOL REFERENCE

Symbol	ASCII Input	Category	Symbol	ASCII Input	Category
α	alpha	Greek Letter	sin	sin	Trigonometry
β	beta	Greek Letter	cos	cos	Trigonometry
γ	gamma	Greek Letter	tan	tan	Trigonometry
δ	delta	Greek Letter	sec	sec	Trigonometry
ε	epsilon	Greek Letter	csc	csc	Trigonometry
ζ	zeta	Greek Letter	cot	cot	Trigonometry
η	eta	Greek Letter	arcsin	asin, arcsin	Trigonometry
θ	theta	Greek Letter	arccos	acos, arccos	Trigonometry
ι	iota	Greek Letter	arctan	atan, arctan	Trigonometry
κ	kappa	Greek Letter	sinh	sinh	Hyperbolic
λ	lambda	Greek Letter	cosh	cosh	Hyperbolic
μ	mu	Greek Letter	tanh	tanh	Hyperbolic
ν	nu	Greek Letter	ln	ln	Logarithm
ξ	xi	Greek Letter	log	log	Logarithm
π	pi	Greek Letter/Constant	exp	exp	Exponential
ρ	rho	Greek Letter	√	sqrt	Root
σ	sigma	Greek Letter	||	abs	Absolute Value
τ	tau	Greek Letter	gcd	gcd	Number Theory
υ	upsilon	Greek Letter	lcm	lcm	Number Theory
φ	phi	Greek Letter	(n k)	binomial, choose	Combinatorics
χ	chi	Greek Letter	φ(n)	euler_phi, phi_n	Number Theory
ψ	psi	Greek Letter	μ(n)	mobius, mu_n	Number Theory
ω	omega	Greek Letter	ζ(s)	zeta	Special Function
∞	inf, infinity	Special Symbol	Γ(z)	gamma	Special Function
∂	d or partial	Calculus	B(x,y)	beta	Special Function
∇	grad or del	Vector Calculus	det	det, determinant	Linear Algebra
∫	integral	Calculus	tr	trace, tr	Linear Algebra
∑	sum	Discrete Math	||	norm	Linear Algebra
∏	product	Discrete Math	×	cross or *	Vector Product
lim	limit	Calculus	·	dot or @	Dot Product