

typst-CAS Test Suite

A Lightweight Computer Algebra System for Typst

1. Expression Construction

Variable	x
Number	42
Pi	π
Euler	e
Sum	$x + 3$
Product	$2x$
Power	x^2
Fraction	$\frac{x}{3}$
Composed	$3x^2 - 2x + 5$
Abs	$ x $
Log	$\log_2(x)$
Log Impl	$\log_2(x)$
Log(a,b)	$\log_2(8)$

Trig (6)

$\sin(x)$ $\cos(x)$ $\tan(x)$ $\csc(x)$ $\sec(x)$ $\cot(x)$

Inverse Trig (6)

$\arcsin(x)$ $\arccos(x)$ $\arctan(x)$ $\operatorname{arccsc}(x)$ $\operatorname{arcsec}(x)$ $\operatorname{arccot}(x)$

Hyperbolic (6)

$\sinh(x)$ $\cosh(x)$ $\tanh(x)$ $\operatorname{csch}(x)$ $\operatorname{sech}(x)$ $\operatorname{coth}(x)$

Inverse Hyperbolic (6)

$\operatorname{arsinh}(x)$ $\operatorname{arcosh}(x)$ $\operatorname{artanh}(x)$ $\operatorname{arcsch}(x)$ $\operatorname{arcsech}(x)$ $\operatorname{arcoth}(x)$

Other

$\ln(x)$ e^x \sqrt{x}

Summation & Product

$\sum_{k=1}^n k^2$ $\prod_{k=1}^n k$

Matrix

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \quad \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

2. Simplification

$x + 0$:

$x + 0 \Rightarrow x$

$$\mathbf{x} \times \mathbf{1}:$$

$$x \cdot 1 \Rightarrow x$$

$$\mathbf{x} \times \mathbf{0}:$$

$$x \cdot 0 \Rightarrow 0$$

$$\mathbf{x}^{\wedge} \mathbf{1}:$$

$$x^1 \Rightarrow x$$

$$\mathbf{x}^{\wedge} \mathbf{0}:$$

$$x^0 \Rightarrow 1$$

$$\mathbf{2} + \mathbf{3}:$$

$$2 + 3 \Rightarrow 5$$

$$\mathbf{4} \times \mathbf{5}:$$

$$4 \cdot 5 \Rightarrow 20$$

$$\mathbf{2}^{\wedge} \mathbf{3}:$$

$$2^3 \Rightarrow 8$$

$$-(\neg \mathbf{x}):$$

$$-(\neg x) \Rightarrow x$$

$$\mathbf{x} + \mathbf{x}:$$

$$x + x \Rightarrow 2x$$

$$\mathbf{3x} + \mathbf{2x}:$$

$$3x + 2x \Rightarrow 5x$$

$$\mathbf{x} \times \mathbf{x}:$$

$$x \cdot x \Rightarrow x^2$$

$$\mathbf{x} / \mathbf{x}:$$

$$\frac{x}{x} \Rightarrow 1$$

$$\mathbf{6} / \mathbf{4}:$$

$$\frac{6}{4} \Rightarrow \frac{3}{2}$$

Function identities

$$\ln(\mathbf{e}):$$

$$\ln(e) \Rightarrow 1$$

$$\exp(\mathbf{0}):$$

$$e^0 \Rightarrow 1$$

$$\sinh(\mathbf{0}):$$

$$\sinh(0) \Rightarrow 0$$

$$\cosh(\mathbf{0}):$$

$$\cosh(0) \Rightarrow 1$$

$$\tanh(\mathbf{0}):$$

$$\tanh(0) \Rightarrow 0$$

Logarithm rules

$$\ln(\mathbf{x \cdot y}):$$

$$\ln(x \cdot y) \Rightarrow \ln(x) + \ln(y)$$

$$\ln(x/y):$$

$$\ln\left(\frac{x}{y}\right) \Rightarrow \ln(x) - \ln(y)$$

$$\ln(x^2):$$

$$\ln(x^2) \Rightarrow 2 \ln(x)$$

Absolute value

$$|-5|:$$

$$|-5| \Rightarrow 5$$

$$|3|:$$

$$|3| \Rightarrow 3$$

$$|-x|:$$

$$|-x| \Rightarrow |x|$$

Expansion

Substitute $x = y + 1$ into $x^2 + 3x$:

$$\Rightarrow (y + 1)^2 + 3(y + 1)$$

$$\Rightarrow y^2 + 5y + 4 \text{ (expanded)}$$

3. Differentiation

$$\mathbf{d/dx} \text{ (} x^3 \text{):}$$

$$x^3 \Rightarrow 3x^2$$

$$\mathbf{d/dx} \text{ (sin } x \text{):}$$

$$\sin(x) \Rightarrow \cos(x)$$

$$\mathbf{d/dx} \text{ (cos } x \text{):}$$

$$\cos(x) \Rightarrow -\sin(x)$$

$$\mathbf{d/dx} \text{ (tan } x \text{):}$$

$$\tan(x) \Rightarrow \frac{1}{\cos(x)^2}$$

$$\mathbf{d/dx} \text{ (csc } x \text{):}$$

$$\csc(x) \Rightarrow -(\csc(x) \cdot \cot(x))$$

$$\mathbf{d/dx} \text{ (sec } x \text{):}$$

$$\sec(x) \Rightarrow \sec(x) \cdot \tan(x)$$

$$\mathbf{d/dx} \text{ (cot } x \text{):}$$

$$\cot(x) \Rightarrow -\left(\frac{1}{\sin(x)^2}\right)$$

$$\mathbf{d/dx} \text{ (ln } x \text{):}$$

$$\ln(x) \Rightarrow \frac{1}{x}$$

$$\mathbf{d/dx} \text{ (e}^x \text{):}$$

$$e^x \Rightarrow e^x$$

d/dx (arcsin x):

$$\arcsin(x) \Rightarrow \frac{1}{\sqrt{1-x^2}}$$

d/dx (arccos x):

$$\arccos(x) \Rightarrow -\left(\frac{1}{\sqrt{1-x^2}}\right)$$

d/dx (arctan x):

$$\arctan(x) \Rightarrow \frac{1}{1+x^2}$$

d/dx (arccsc x):

$$\operatorname{arccsc}(x) \Rightarrow -\left(\frac{1}{x \cdot \sqrt{x^2-1}}\right)$$

d/dx (arcsec x):

$$\operatorname{arcsec}(x) \Rightarrow \frac{1}{x \cdot \sqrt{x^2-1}}$$

d/dx (arccot x):

$$\operatorname{arccot}(x) \Rightarrow -\left(\frac{1}{1+x^2}\right)$$

d/dx (sinh x):

$$\sinh(x) \Rightarrow \cosh(x)$$

d/dx (cosh x):

$$\cosh(x) \Rightarrow \sinh(x)$$

d/dx (tanh x):

$$\tanh(x) \Rightarrow \frac{1}{\cosh(x)^2}$$

d/dx (csch x):

$$\operatorname{csch}(x) \Rightarrow -(\operatorname{csch}(x) \cdot \coth(x))$$

d/dx (sech x):

$$\operatorname{sech}(x) \Rightarrow -(\operatorname{sech}(x) \cdot \tanh(x))$$

d/dx (coth x):

$$\coth(x) \Rightarrow -\operatorname{csch}(x)^2$$

Higher-Order Derivatives

d²/dx² (x⁴):

$$x^4 \Rightarrow 12x^2$$

d³/dx³ (sin x):

$$\sin(x) \Rightarrow -\cos(x)$$

4. Integration

∫ x² dx:

$$x^2 \Rightarrow \frac{x^3}{3}$$

∫ sin(x) dx:

$$\sin(x) \Rightarrow -\cos(x)$$

$$\int \cos(x) \, dx:$$

$$\cos(x) \Rightarrow \sin(x)$$

$$\int e^x \, dx:$$

$$e^x \Rightarrow e^x$$

$$\int 1/x \, dx:$$

$$\frac{1}{x} \Rightarrow \ln(x)$$

$$\int \sec(x) \, dx:$$

$$\sec(x) \Rightarrow \ln(\sec(x) + \tan(x))$$

$$\int \csc(x) \, dx:$$

$$\csc(x) \Rightarrow -\ln(\csc(x) + \cot(x))$$

$$\int \cot(x) \, dx:$$

$$\cot(x) \Rightarrow \ln(\sin(x))$$

$$\int \sinh(x) \, dx:$$

$$\sinh(x) \Rightarrow \cosh(x)$$

$$\int \cosh(x) \, dx:$$

$$\cosh(x) \Rightarrow \sinh(x)$$

$$\int \tanh(x) \, dx:$$

$$\tanh(x) \Rightarrow \ln(\cosh(x))$$

Definite Integrals

$$\int_0^1 x^2 \, dx:$$

$$\frac{1}{3}$$

$$\int_1^3 2x \, dx:$$

$$2\left(\frac{9}{2}\right) - 2\left(\frac{1}{2}\right)$$

5. Taylor Series

Taylor of e^x at $x=0$ (order 4):

$$1 + x + \frac{1}{2} \cdot x^2 + \frac{1}{6} \cdot x^3 + \frac{1}{24} \cdot x^4$$

Taylor of $\sin(x)$ at $x=0$ (order 5):

$$x + \frac{-1}{6} \cdot x^3 + \frac{1}{120} \cdot x^5$$

6. Limits

$\lim_{x \rightarrow 0} \sin(x)/x:$

$$1$$

$\lim_{x \rightarrow 2} (x^2-4)/(x-2):$

$$4$$

7. Equation Solving

Linear: $2x + 6 = 0$:

$$2x + 6 \Rightarrow -3$$

Linear: $3x - 9 = 0$:

$$3x - 9 \Rightarrow 3$$

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

$$x^2 - 4 = 0 \Rightarrow x = 2 \text{ or } x = -2$$

8. Polynomial Factoring

$x^2 - 5x + 6$:

$$x^2 - 5x + 6 \Rightarrow (x - 2) \cdot (x - 3)$$

$x^2 - 4$:

$$x^2 - 4 \Rightarrow (x - 2) \cdot (x + 2)$$

$x^3 - 6x^2 + 11x - 6$:

$$x^3 - 6x^2 + 11x - 6 \Rightarrow (x - 1) \cdot (x - 2) \cdot (x - 3)$$

9. Numeric Evaluation

Evaluate at $x = 2$:

$$3x^2 + 2x + 1 = 17$$

Evaluate:

$$\sin\left(\frac{\pi}{2}\right) = 1$$

Evaluate:

$$|-7| = 7$$

Evaluate:

$$\log_2(8) = 3$$

Summation Evaluation

Evaluate:

$$\sum_{k=1}^{10} k^2 = 385$$

Evaluate:

$$\prod_{k=1}^5 k = 120$$

10. Matrix Algebra

$A + B$:

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} + \begin{pmatrix} 5 & 6 \\ 7 & 8 \end{pmatrix} = \begin{pmatrix} 6 & 8 \\ 10 & 12 \end{pmatrix}$$

$A \times B$:

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \cdot \begin{pmatrix} 5 & 6 \\ 7 & 8 \end{pmatrix} = \begin{pmatrix} 19 & 22 \\ 43 & 50 \end{pmatrix}$$

$\det(A)$:

$$\det \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} = -2$$

A^T:

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}^{\top} = \begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$$

System of Equations (Cramer’s Rule)

Solve $Ax = b$:

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 5 \\ 6 \end{pmatrix}$$

$$x = -4, \; y = \frac{9}{2}$$

12. Substitution

Substitute $x = y + 1$ into $x^2 + 3x$:

$$\Rightarrow (y + 1)^2 + 3(y + 1)$$

$$\Rightarrow y^2 + 5y + 4 \text{ (expanded)}$$

13. Parser Round-Trip

Parse, simplify, differentiate " $x^3 + 2x^2 - x + 5$ "

$$\text{parsed: } x^3 + 2x^2 - x + 5$$

$$\text{simplified: } x^3 + 2x^2 - x + 5$$

$$\text{d/dx: } 3x^2 + 4x - 1$$

Parse and solve " $x^2 - 5x + 6 = 0$ "

$$x^2 - 5x + 6 = 0 \Rightarrow x = 3 \text{ or } 2$$

14. Content Parsing

Content $x^2 + \frac{1}{2}$:

$$x^2 + \frac{1}{2}$$

Content $\sqrt{x} + \text{root}(3, y)$:

$$\sqrt{x} + y^{\frac{1}{3}}$$

Content $\sum_{k=1}^n k^2$:

$$\sum_{k=1}^n k^2$$

Content $\sin(x) + \cos(x)$:

$$\sin(x) + \cos(x)$$

Content Product

$$\prod_{i=1}^n i$$