

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)

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

Hyperbolic (6)

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

Inverse Hyperbolic (6)

$\text{arcsinh}(x)$ $\text{arccosh}(x)$ $\text{arctanh}(x)$ $\text{arccsch}(x)$ $\text{arcsech}(x)$ $\text{arccoth}(x)$

Other

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

Summation & Product

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

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

$x + 0:$

$$x + 0 \Rightarrow x$$

x × 1:

$$x \cdot 1 \Rightarrow x$$

x × 0:

$$x \cdot 0 \Rightarrow 0$$

x¹:

$$x^1 \Rightarrow x$$

x⁰:

$$x^0 \Rightarrow 1$$

2 + 3:

$$2 + 3 \Rightarrow 5$$

4 × 5:

$$4 \cdot 5 \Rightarrow 20$$

2³:

$$2^3 \Rightarrow 8$$

-(-x):

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

x + x:

$$x + x \Rightarrow 2x$$

3x + 2x:

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

x × x:

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

x / x:

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

6 / 4:

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

Function identities

ln(e):

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

exp(0):

$$e^0 \Rightarrow 1$$

sinh(0):

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

cosh(0):

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

tanh(0):

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

Logarithm rules

ln(x·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(x²):

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

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

d/dx (x³):

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

d/dx (sin x):

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

d/dx (cos x):

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

d/dx (tan x):

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

d/dx (csc x):

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

d/dx (sec x):

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

d/dx (cot x):

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

d/dx (ln x):

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

d/dx (e^x):

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

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):

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

d/dx (arcsec x):

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

d/dx (arccot x):

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

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):

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

d/dx (sech x):

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

d/dx (coth x):

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

Higher-Order Derivatives

d²/dx² (x⁴):

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

d³/dx³ (sin x):

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

4. Integration

ʃ x² dx:

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

ʃ 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

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

$$\lim_{x \rightarrow 2} \frac{1}{(x^2 - 4)/(x - 2)}$$

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:

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

System of Equations (Cramer's Rule)

Solve Ax = b:

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

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

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} + y^{\frac{1}{3}}\$:

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

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

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

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

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

Content Product

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