

# MathML Samples

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## Elementary Math #1

$$\begin{array}{r} 123 \\ \times 321 \\ \hline 123 \\ 246 \\ 369 \\ \hline \end{array}$$

## Elementary Math #2

$$\begin{array}{r} 3 \quad 43\overline{)1306} \quad 5 \\ 2 \quad 1306 \quad .3 \\ \underline{12} \phantom{0} \\ 10 \\ \underline{9} \phantom{0} \\ 16 \\ \underline{15} \phantom{0} \\ 1.0 \\ \underline{9} \phantom{0} \\ 1 \end{array}$$

## Simultaneous Equations

$$\begin{aligned} 8.44x + 55y &= 0 \\ 3.1x - 0.7y &= -1.1 \end{aligned}$$

## Quadratic Formula

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

## Standard Deviation

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2}$$

## Divergence

$$\nabla \cdot \vec{v} = \frac{\partial v_x}{\partial x} + \frac{\partial v_y}{\partial y} + \frac{\partial v_z}{\partial z}$$

## Complex Number

$$c = \underbrace{a}_{\text{real}} + \underbrace{bi}_{\text{imaginary}}$$

## De Morgan's Laws <sup>(1)</sup>

$$\overline{\bigcup_{i \in I} A_i} \equiv \bigcap_{i \in I} \overline{A_i}$$

## Binomial Coefficient

$$C(n, k) = C_k^n = {}_n C_k = \binom{n}{k} = \frac{n!}{k!(n-k)!}$$

## Bernoulli Trials

$$P(k) = \binom{n}{k} p^k (1-p)^{n-k}$$

## Normal Distribution

$$f(x, \mu, \sigma) = \frac{e^{-\frac{(x-\mu)^2}{2\sigma^2}}}{\sigma\sqrt{2\pi}}$$

## Lorenz Equations

$$\begin{aligned}\dot{x} &= \sigma(y - x) \\ \dot{y} &= \rho x - y - xz \\ \dot{z} &= -\beta z + xy\end{aligned}$$

## Cross Product

$$\mathbf{V}_1 \times \mathbf{V}_2 = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ \frac{\partial X}{\partial u} & \frac{\partial Y}{\partial u} & 0 \\ \frac{\partial X}{\partial v} & \frac{\partial Y}{\partial v} & 0 \end{vmatrix}$$

## Axiom of Power Set

$$\forall A \exists P \forall B [B \in P \iff \forall C (C \in B \Rightarrow C \in A)]$$

## Cauchy's Integral Formula

$$f(a) = \frac{1}{2\pi i} \oint_{\gamma} \frac{f(z)}{z-a} dz$$

## Einstein's Field Equations

$$R_{\mu\nu} - \frac{1}{2} g_{\mu\nu} R + g_{\mu\nu} \Lambda = \frac{8\pi G}{c^4} T_{\mu\nu}$$

<sup>(1)</sup> In AH Formatter V6.6 and later, if the OpenType MATH feature is enabled, characters such U+22C3 '∪' may be drawn at lower position. This is because some OpenType fonts that include MATH features provide 'largeop' glyphs for characters such as U+22C3. If you specify "U+22C0-22C3" for [exceptOpenTypeMATHVariants](#) in the AH Formatter [Option Setting File](#), then the characters can be drawn aligned with the baseline.

## Legendre's Differential Equation

$$\frac{d}{dx} \left[ (1-x^2) \frac{d}{dx} P_n(x) \right] + n(n+1)P_n(x) = 0$$

## Sophomore's Dream

$$\int_0^1 x^x dx = \sum_{n=1}^{\infty} (-1)^{n+1} n^{-n} = - \sum_{n=1}^{\infty} (-n)^{-n}$$

## Maxwell's Equations

$$\begin{cases} \nabla \times \overleftarrow{\mathbf{B}} - \frac{1}{c} \frac{\partial \overleftarrow{\mathbf{E}}}{\partial t} = \frac{4\pi}{c} \overleftarrow{\mathbf{j}} \\ \nabla \cdot \overleftarrow{\mathbf{E}} = 4\pi\rho \\ \nabla \times \overleftarrow{\mathbf{E}} + \frac{1}{c} \frac{\partial \overleftarrow{\mathbf{B}}}{\partial t} = \overleftarrow{\mathbf{0}} \\ \nabla \cdot \overleftarrow{\mathbf{B}} = 0 \end{cases}$$

## Schwinger-Dyson Equation

$$\langle \psi | \mathcal{T} \left\{ \frac{\delta}{\delta \phi} F[\phi] \right\} | \psi \rangle = -i \langle \psi | \mathcal{T} \left\{ F[\phi] \frac{\delta}{\delta \phi} S[\phi] \right\} | \psi \rangle$$

## Ramanujan Identity

$$\frac{1}{(\sqrt{\phi\sqrt{5}} - \phi)e^{\frac{25}{\pi}}} = 1 + \frac{e^{-2\pi}}{1 + \frac{e^{-4\pi}}{1 + \frac{e^{-6\pi}}{1 + \frac{e^{-8\pi}}{1 + \dots}}}}$$

## Rogers-Ramanujan Identity

$$\sum_{n=0}^{\infty} \frac{q^{n^2}}{(q)_{\infty}} = \frac{1}{\prod_{n=1}^{\infty} (1 - q^{5n-4})(1 - q^{5n-1})}, \quad \text{for } |q| < 1$$
$$= 1 + q + q^2 + q^3 + 2q^4 + 2q^5 + 3q^6 + \dots$$

## Moore Determinant

$$M = \begin{bmatrix} \alpha_1 & \alpha_1^q & \dots & \alpha_1^{q^{n-1}} \\ \alpha_2 & \alpha_2^q & \dots & \alpha_2^{q^{n-1}} \\ \vdots & \vdots & \ddots & \vdots \\ \alpha_m & \alpha_m^q & \dots & \alpha_m^{q^{n-1}} \end{bmatrix}$$

## Differentiable Manifold

$$\gamma_1 \equiv \gamma_2 \iff \begin{cases} \gamma_1(0) = \gamma_2(0) = p, \text{ and} \\ \left. \frac{d}{dt} \phi \circ \gamma_1(t) \right|_{t=0} = \left. \frac{d}{dt} \phi \circ \gamma_2(t) \right|_{t=0} \end{cases}$$

## Sphere Volume

Spherical coordinates derivation of the volume of a sphere ( $\frac{4}{3}\pi R^3$ ). The formula  $S$  for a sphere of radius  $R$  in spherical coordinates is:  $S = \{0 \leq \phi \leq 2\pi, 0 \leq \theta \leq \pi, 0 \leq \rho \leq R\}$

$$\begin{aligned} \text{Volume} &= \iiint_S \rho^2 \sin \theta \, d\rho \, d\theta \, d\phi \\ &= \int_0^{2\pi} d\phi \int_0^\pi \sin \theta \, d\theta \int_0^R \rho^2 \, d\rho \\ &= \phi \Big|_0^{2\pi} (-\cos \theta) \Big|_0^\pi \frac{1}{3} \rho^3 \Big|_0^R \\ &= 2\pi \times 2 \times \frac{1}{3} R^3 \\ &= \frac{4}{3} \pi R^3 \end{aligned}$$

## Cichoń's Diagram

$$\begin{array}{ccccccc} \text{cov}(\mathcal{L}) & \longrightarrow & \text{non}(\mathcal{K}) & \longrightarrow & \text{cof}(\mathcal{K}) & \longrightarrow & \text{cof}(\mathcal{L}) & \longrightarrow & 2^{\aleph_0} \\ & & \uparrow & & \uparrow & & \uparrow & & \\ & & \mathfrak{b} & \longrightarrow & \mathfrak{d} & & & & \\ & & \uparrow & & \uparrow & & & & \\ \aleph_1 & \longrightarrow & \text{add}(\mathcal{L}) & \longrightarrow & \text{add}(\mathcal{K}) & \longrightarrow & \text{cov}(\mathcal{K}) & \longrightarrow & \text{non}(\mathcal{L}) \end{array}$$

## Multiscripts & Greek Alphabet

$$\begin{array}{c} \kappa \epsilon^\lambda \\ \iota \zeta_\mu \\ \xi \mathfrak{B}^\eta \\ \epsilon \mathfrak{B}_\theta \\ \beta \mathfrak{A}^\gamma \\ \alpha \mathfrak{A}_\delta \\ \chi \tilde{\mathfrak{F}}^\psi \\ \phi \mathfrak{F}_\omega \end{array} \prod \begin{array}{c} \xi \mathfrak{D}^\sigma \\ \nu \mathfrak{D}_\pi \\ \sigma \mathfrak{E}^\tau \\ \rho \mathfrak{E}_\upsilon \end{array}$$

## Stacked Exponents

$$g(z) = e^{-\sum_{i=0}^{\infty} z^{\frac{2}{a-i}}}$$

## Nested Roots

$$\frac{\sqrt{1 + \sqrt[3]{2 + \sqrt[5]{3 + \sqrt[7]{4 + \sqrt[11]{5 + \sqrt[13]{6 + \sqrt[17]{7 + \sqrt[19]{A}}}}}}}}}}}}}{e^\pi} = x^m$$

## Nested Matrices

$$\left( \begin{array}{cc} \begin{pmatrix} a_1 & a_2 & a_3 & a_4 \\ a_5 & a_6 & a_7 & a_8 \end{pmatrix} & \begin{pmatrix} b_1 \\ b_2 \end{pmatrix} \\ \mathbf{0} & \begin{pmatrix} c_1 & c_2 \\ c_3 & c_4 \end{pmatrix} \end{array} \right) \begin{pmatrix} b_3 \\ b_4 \end{pmatrix}$$

**Font Sizes**

scriptlevel: **-3**, -2, -1, 0, 1, 2, 3