GENERAL MATHEMATICS

Book 1

Designer's Den

Contents

Numbers

- Whole Numbers: These include all the natural numbers along with the number 0: 0, 1, 2, 3, 4, 5, ...
- Integers: Integers include both positive and negative whole numbers along with zero: ..., -3, -2, -1, 0, 1, 2, 3, ...
- Rational Numbers: Rational numbers are numbers that can be expressed as fractions, where the numerator and denominator are integers. Examples include 1/2, -3/4, 5/6, etc.
- Irrational Numbers: Irrational numbers cannot be expressed as fractions and have non-repeating, non-terminating decimal representations. Examples include √2 (square root of 2), π (pi), and e (Euler's number).
- Even Numbers: These are the numbers that are divisible by 2, resulting in no remainder when divided by 2. Examples include -4, -2, 0, 2, 4, ...
- Odd Numbers: These are the numbers that are not divisible by 2, resulting in a remainder of 1 when divided by 2. Examples include -3, -1, 1, 3, 5, ...
- Prime Numbers: Prime numbers are positive integers greater than 1 that have no divisors other than 1 and itself. Examples include 2, 3, 5, 7, 11, ...

Digital mathematical functions

Common practices:

Decimal separator: Dot

Angles: Degrees

Sine of an angle: sin(angle)

Cosine of an angle: cos(angle)

Tangent of an angle: tan(angle)

Square root of a number: sqrt(num)

Absolute value of a number: abs(num)

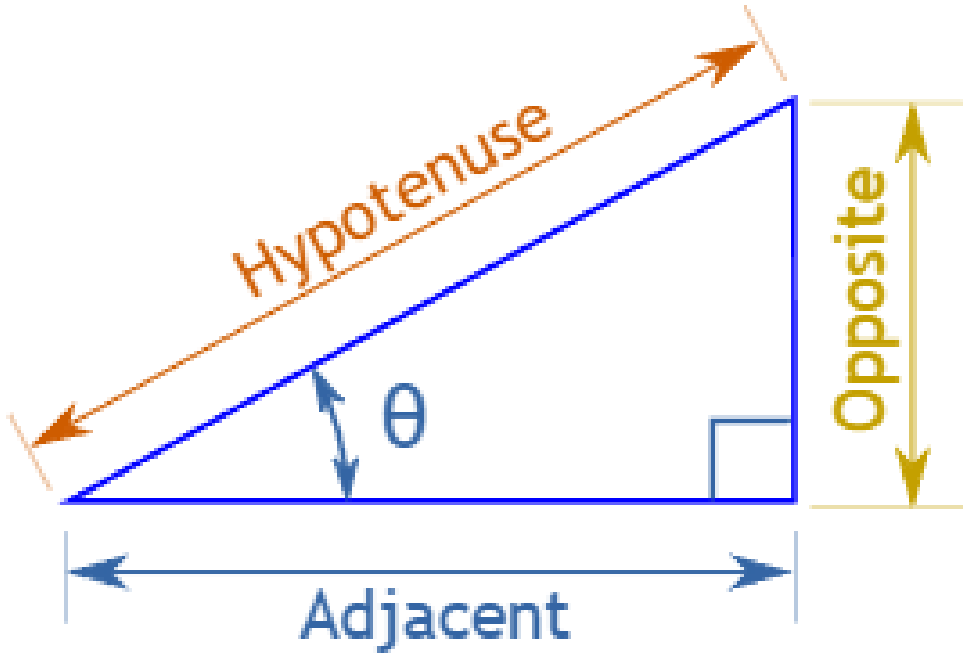
Trigonometry

For right-angled triangles:

$$\sin\theta = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

$$\cos\theta = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

$$\tan\theta = \frac{\text{Opposite}}{\text{Adjacent}}$$



Derivation

Common formulas:

Common Derivatives

$$\frac{d}{dx}(x)=1$$

$$\frac{d}{dx}(\sin x)=\cos x$$

$$\frac{d}{dx}(\cos x)=-\sin x$$

$$\frac{d}{dx}(\tan x)=\sec^2 x$$

$$\frac{d}{dx}(\sec x)=\sec x\tan x$$

$$\frac{d}{dx}(\csc x)=-\csc x\cot x$$

$$\frac{d}{dx}(\cot x)=-\csc^2 x$$

$$\frac{d}{dx}\left(\sin^{-1} x\right)=\frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}\left(\cos^{-1} x\right)=-\frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}\left(\tan^{-1} x\right)=\frac{1}{1+x^2}$$

$$\frac{d}{dx}\left(a^x\right)=a^x\ln(a)$$

$$\frac{d}{dx}\left(\mathbf{e}^x\right)=\mathbf{e}^x$$

$$\frac{d}{dx}(\ln(x))=\frac{1}{x},\quad x>0$$

$$\frac{d}{dx}(\ln|x|)=\frac{1}{x},\quad x\neq 0$$

$$\frac{d}{dx}(\log_a(x))=\frac{1}{x\ln a},\quad x>0$$

Integration

Common formulas:

$$\int k\,dx = k\,x + c$$

$$\int x^n\,dx = \frac{1}{n+1}x^{n+1} + c, n \neq -1$$

$$\int x^{-1}\,dx = \int \frac{1}{x}dx = \ln|x| + c$$

$$\int \frac{1}{ax+b}dx = \frac{1}{a}\ln|ax+b| + c$$

$$\int \ln u\,du = u\ln(u) - u + c$$

$$\int \mathbf{e}^u\,du = \mathbf{e}^u + c$$

Common Integrals

$$\int \cos u\,du = \sin u + c$$

$$\int \sin u\,du = -\cos u + c$$

$$\int \sec^2 u\,du = \tan u + c$$

$$\int \sec u \tan u\,du = \sec u + c$$

$$\int \csc u \cot u du = -\csc u + c$$

$$\int \csc^2 u\,du = -\cot u + c$$

$$\int \tan u\,du = \ln|\sec u| + c$$

$$\int \sec u\,du = \ln|\sec u + \tan u| + c$$

$$\int \frac{1}{a^2+u^2}du = \frac{1}{a}\tan^{-1}\left(\frac{u}{a}\right) + c$$

$$\int \frac{1}{\sqrt{a^2-u^2}}du = \sin^{-1}\left(\frac{u}{a}\right) + c$$