

CALCULUS REVIEW: INTRODUCTION TO MATHEMATICA

→ General Introduction:

$$\frac{2+3}{5}$$

$$\frac{453}{63}$$
$$\frac{151}{21}$$

$$\mathbf{N[\%, 10]}$$
$$7.190476190$$

$$\mathbf{Sqrt[10]}$$
$$\sqrt{10}$$

$$\mathbf{N[\text{Pi}, 5]}$$
$$3.1416$$

→ Algebraic Operation:

$$\mathbf{Expand [(1+x)^2]}$$
$$1 + 2x + x^2$$

$$\mathbf{Factor [\%]}$$
$$(1+x)^2$$

$$\mathbf{Simplify [x^2 + 2x + 1]}$$
$$(1+x)^2$$

→ Integration and Differentiation

$$\mathbf{Integrate [1/(x^4-1), x]}$$
$$\frac{1}{4} (-2 \text{ArcTan}[x] + \text{Log}[-1+x] - \text{Log}[1+x])$$

$$\mathbf{Simplify[\%]}$$
$$\frac{1}{4} (-2 \text{ArcTan}[x] + \text{Log}[-1+x] - \text{Log}[1+x])$$

$$\mathbf{D[\%, x]}$$
$$\frac{1}{4} \left(\frac{1}{-1+x} - \frac{1}{1+x} - \frac{2}{1+x^2} \right)$$

$$\mathbf{Simplify[\%]}$$
$$\frac{1}{-1+x^4}$$

$$\mathbf{D[x^n, x]}$$

$$n x^{-1+n}$$

$$\mathbf{D[x^n, \{x, 2\}]}$$
$$(-1+n) n x^{-2+n}$$

$$\mathbf{D[\text{Log}[x], x]}$$
$$\frac{1}{x}$$

$$\mathbf{D[\text{Sin}[x], x]}$$
$$\text{Cos}[x]$$

$$\mathbf{D[\text{Sin}[x], \{x, 3\}]}$$
$$-\text{Cos}[x]$$

$$\mathbf{\text{Integrate}[x, x]}$$
$$\frac{x^2}{2}$$

$$\mathbf{\text{Integrate}[x, \{x, 0, 1\}]}$$
$$\frac{1}{2}$$

$$\mathbf{\text{NIntegrate}[x, \{x, 0, 1\}]}$$
$$0.5$$

$$\mathbf{\text{Integrate}[\text{Exp}[x], x]}$$
$$e^x$$

$$\mathbf{\text{NIntegrate}[\text{Exp}[x^2], \{x, 0, 1\}]}$$
$$1.46265$$

→ Solving Linear and Nonlinear Equations

$$\mathbf{\text{Solve}[x^2 + x - 1 == 0, x]}$$
$$\left\{ \left\{ x \rightarrow \frac{1}{2} (-1 - \sqrt{5}) \right\}, \left\{ x \rightarrow \frac{1}{2} (-1 + \sqrt{5}) \right\} \right\}$$

$$\mathbf{\text{NSolve}[x^2 + x - 1 == 0, x]}$$
$$\left\{ \{x \rightarrow -1.61803\}, \{x \rightarrow 0.618034\} \right\}$$

$$\mathbf{\text{NSolve}[x^3 - 3 x^2 + 2 x + 1 == 0, x]}$$
$$\left\{ \{x \rightarrow -0.324718\}, \{x \rightarrow 1.66236 - 0.56228 i\}, \{x \rightarrow 1.66236 + 0.56228 i\} \right\}$$

$$\mathbf{\text{Solve}[a x + b == c, x]}$$
$$\left\{ \left\{ x \rightarrow \frac{-b+c}{a} \right\} \right\}$$

$$\mathbf{\text{Solve}[a x^2 + b x + c == 0, x]}$$
$$\left\{ \left\{ x \rightarrow \frac{-b - \sqrt{b^2 - 4 a c}}{2 a} \right\}, \left\{ x \rightarrow \frac{-b + \sqrt{b^2 - 4 a c}}{2 a} \right\} \right\}$$

Solve [a x ^3 + b x^2 + c x + d ==0, x]

$$\left\{ \left\{ x \rightarrow -\frac{b}{3a} - \frac{2^{1/3}(-b^2+3ac)}{3a \left(-2b^3+9abc-27a^2d + \sqrt{4(-b^2+3ac)^3 + (-2b^3+9abc-27a^2d)^2} \right)^{1/3}} + \frac{\left(-2b^3+9abc-27a^2d + \sqrt{4(-b^2+3ac)^3 + (-2b^3+9abc-27a^2d)^2} \right)^{1/3}}{3 \cdot 2^{1/3}a} \right\}, \right.$$

$$\left. \left\{ x \rightarrow -\frac{b}{3a} + \frac{(1+i\sqrt{3})(-b^2+3ac)}{\left(3 \cdot 2^{2/3}a \left(-2b^3+9abc-27a^2d + \sqrt{4(-b^2+3ac)^3 + (-2b^3+9abc-27a^2d)^2} \right)^{1/3} \right)} - \frac{1}{6 \cdot 2^{1/3}a} \left((1-i\sqrt{3}) \left(-2b^3+9abc-27a^2d + \sqrt{4(-b^2+3ac)^3 + (-2b^3+9abc-27a^2d)^2} \right)^{1/3} \right) \right\}, \right.$$

$$\left. \left\{ x \rightarrow -\frac{b}{3a} + \frac{(1-i\sqrt{3})(-b^2+3ac)}{\left(3 \cdot 2^{2/3}a \left(-2b^3+9abc-27a^2d + \sqrt{4(-b^2+3ac)^3 + (-2b^3+9abc-27a^2d)^2} \right)^{1/3} \right)} - \frac{1}{6 \cdot 2^{1/3}a} \left((1+i\sqrt{3}) \left(-2b^3+9abc-27a^2d + \sqrt{4(-b^2+3ac)^3 + (-2b^3+9abc-27a^2d)^2} \right)^{1/3} \right) \right\} \right\}$$

→ Solving Systems of Equations:

Solve [{2 x + 4 y ==5, x - y ==1}, {x,y}]

$$\left\{ \left\{ x \rightarrow \frac{3}{2}, y \rightarrow \frac{1}{2} \right\} \right\}$$

NSolve [{2 x + 4 y ==5, x - y ==1}, {x,y}]

$$\left\{ \left\{ x \rightarrow 1.5, y \rightarrow 0.5 \right\} \right\}$$

Solve [{2 x + 3 y - 5 z ==0, x + y + z==1, 2 x - 3 y + 2 z ==1}, {x,y,z}]

$$\left\{ \left\{ x \rightarrow \frac{17}{35}, y \rightarrow \frac{1}{5}, z \rightarrow \frac{11}{35} \right\} \right\}$$

Solve [{2 x^2 + y^2 ==9, x - 2 y ==2}, {x,y}]

$$\left\{ \left\{ x \rightarrow \frac{2}{9} (1 - \sqrt{73}), y \rightarrow \frac{1}{9} (-8 - \sqrt{73}) \right\}, \left\{ x \rightarrow \frac{2}{9} + \frac{2\sqrt{73}}{9}, y \rightarrow \frac{1}{9} (-8 + \sqrt{73}) \right\} \right\}$$

NSolve [{2 x^2 + y^2 ==9, x - 2 y ==2}, {x,y}]

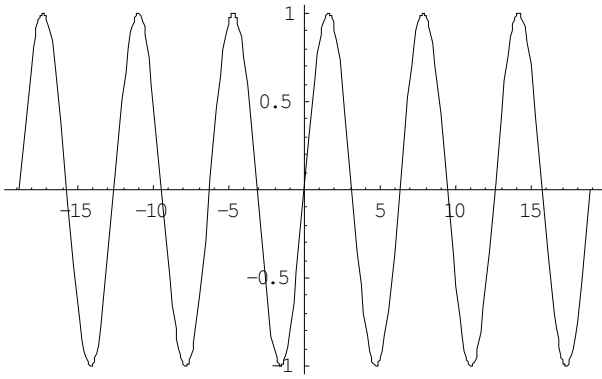
$$\left\{ \left\{ x \rightarrow 2.12089, y \rightarrow 0.0604449 \right\}, \left\{ x \rightarrow -1.67645, y \rightarrow -1.83822 \right\} \right\}$$

NSolve[1/x - x^2 + 5 x ==1, x]

$$\left\{ \left\{ x \rightarrow 4.83598 \right\}, \left\{ x \rightarrow 0.082012 + 0.447278 i \right\}, \left\{ x \rightarrow 0.082012 - 0.447278 i \right\} \right\}$$

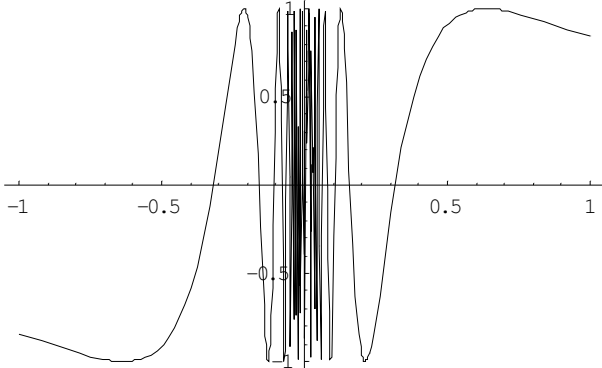
→ Plotting Functions

Plot [Sin[x], {x, -6 Pi, 6 Pi}]



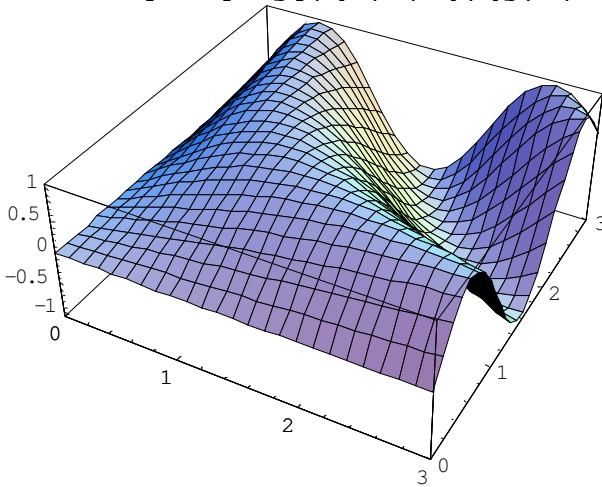
-Graphics-

`Plot [Sin[1/x], {x, -1, 1}]`



-Graphics-

`Plot3D [Sin[x y], {x, 0, 3}, {y, 0, 3}]`



-SurfaceGraphics-