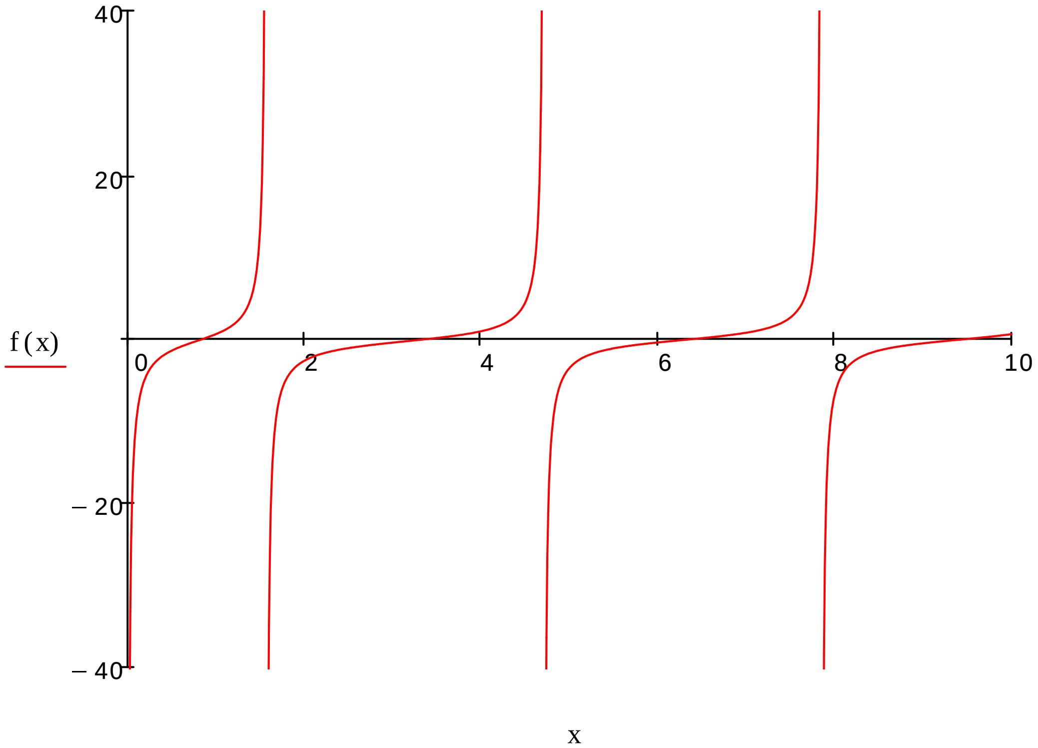
Solution of a Single Algebraic Equation

$f(x) := \tan(x) - \frac{1}{x}$ A transcendental equation which (indirectly) gives the natural frequencies of a bar with and end mass.



$IG := 1$

$root(f(IG), IG) = 0.86$

Also you can define a function where the root function can be used any time you like with an initial guess.

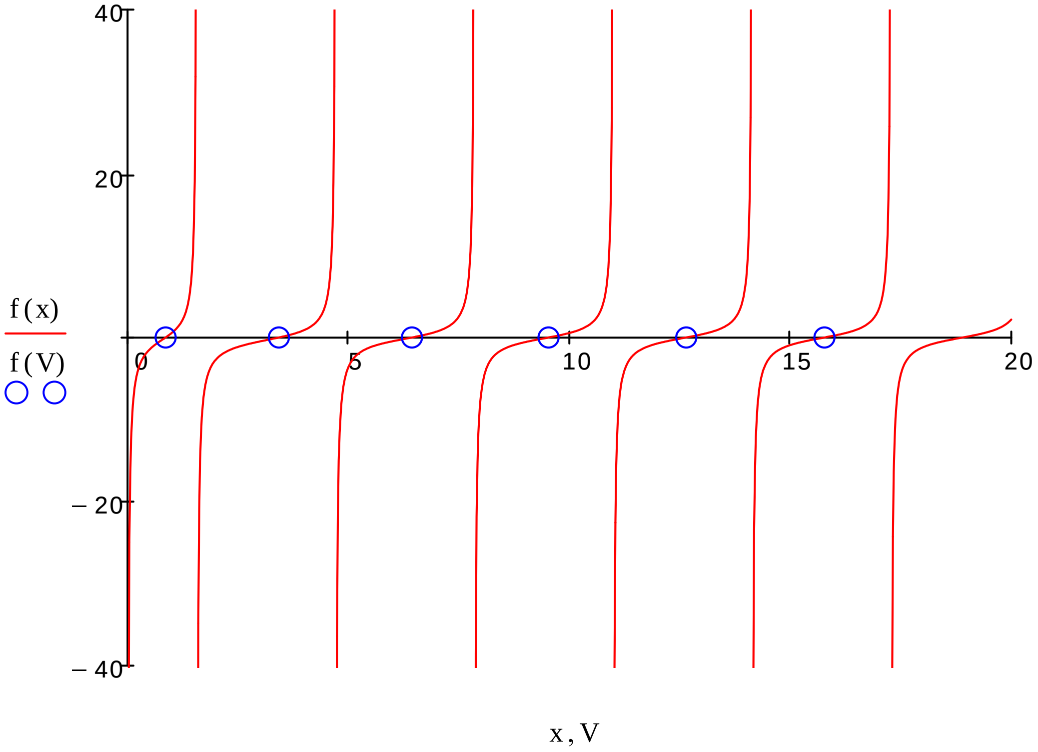
$R(x) := root(f(x), x)$ where here x is the initial guess

$R(1) = 0.86$ $R(2) = 3.426$

$i := 0..5$

$IG_i := 0.2 + i \cdot \pi$ Create an initial guess vector by analyzing the plot of the function.

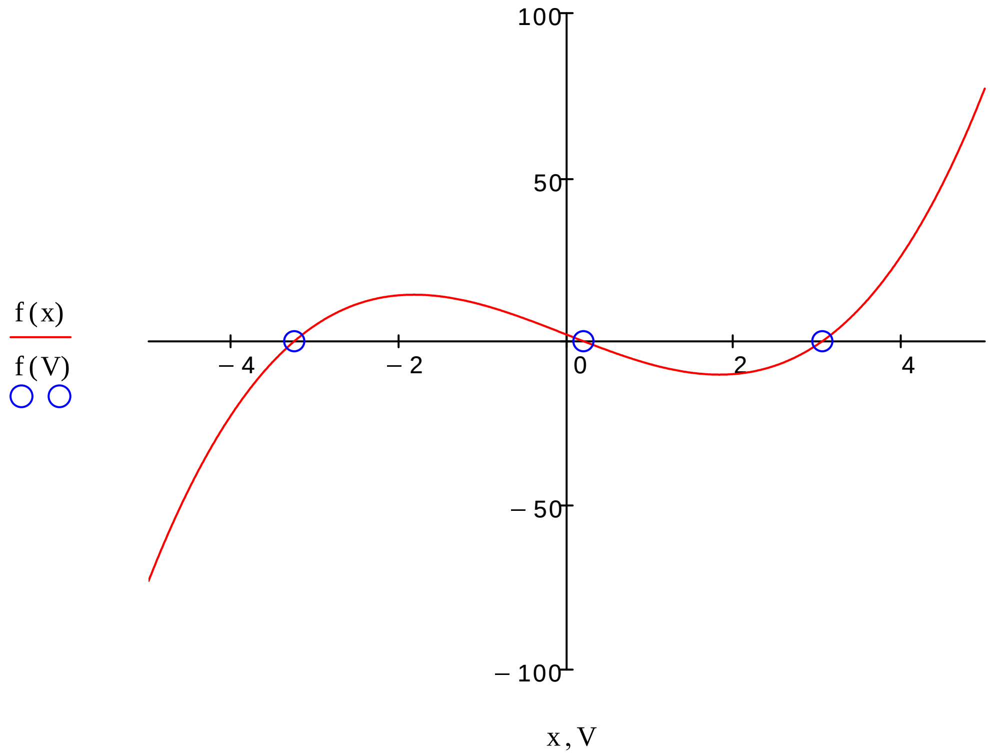
$V := \overrightarrow{R(IG)}$ Obtain the solution by using the initial guess vector as the argument of the function and using the vectorizing sign (arrow above) so that Mathcad calculates the function for each element of the input vector.



Roots of Polynomials

$f(x) := x^3 - 10x + 2$

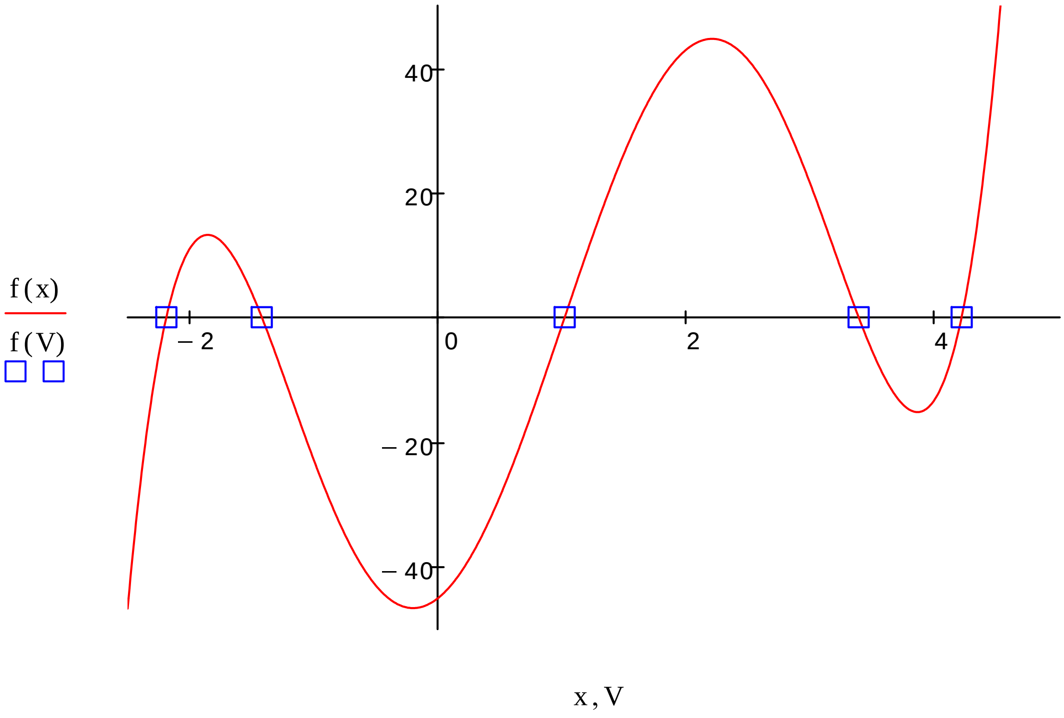
$v := f(x)\ \text{coeffs} \rightarrow \begin{pmatrix} 2 \\ -10 \\ 0 \\ 1 \end{pmatrix}$ $\quad V := \text{polyroots}(v) \quad V = \begin{pmatrix} -3.258 \\ 0.201 \\ 3.057 \end{pmatrix}$



A 5th order ploynomial

$f(x) := x^5 - 5 \cdot x^4 - 6 \cdot x^3 + 38 \cdot x^2 + 16x - 45$

$v := f(x)\ \text{coeffs} \rightarrow \begin{pmatrix} -45 \\ 16 \\ 38 \\ -6 \\ -5 \\ 1 \end{pmatrix}$ $\quad V := \text{polyroots}(v) \quad V = \begin{pmatrix} -2.188 \\ -1.42 \\ 1.017 \\ 3.382 \\ 4.21 \end{pmatrix}$



An other 5th order ploynomial where there exist complex roots

$f(x) := x^5 - 7\cdot x^4 - 6\cdot x^3 + 38\cdot x^2 + 16x - 45$

$v := f(x) \text{ coeffs } \rightarrow \begin{pmatrix} -45 \\ 16 \\ 38 \\ -6 \\ -7 \\ 1 \end{pmatrix}$ $\quad V := \text{polyroots}(v) \quad V = \begin{pmatrix} -1.647 - 0.238i \\ -1.647 + 0.238i \\ 1.06 \\ 2.173 \\ 7.06 \end{pmatrix}$

Solution of a Set of Equations

Finding intersection of circle and a line.

$x := 1$ $y := 1$ Initial guesses

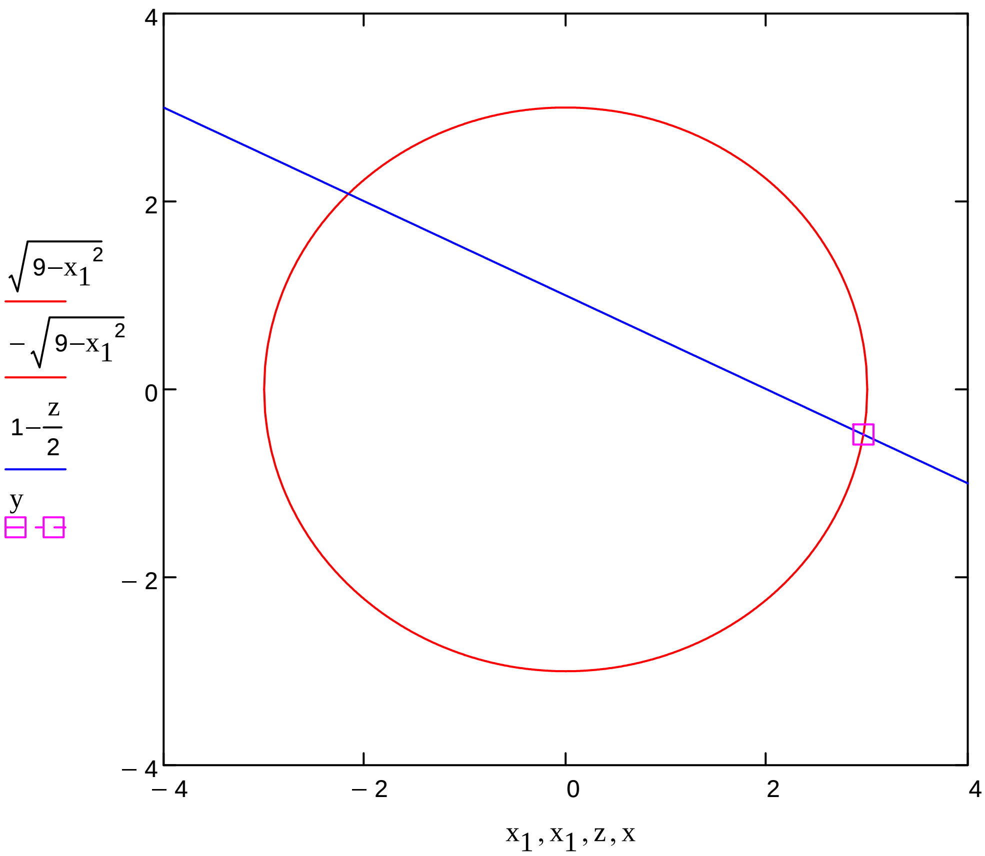
Given

$x^2 + y^2 = 3^2$ Circle equation

$x + 2 \cdot y = 2$ Line equation

$\begin{pmatrix} x \\ y \end{pmatrix} := \mathrm{Find}(x, y)$ $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2.961 \\ -0.481 \end{pmatrix}$

$x_1 := -3, -2.99 .. 3$



It is possible to obtain symbolic solutions for some problems.

Given

$x^2 + y^2 = a^2$ Circle equation

$x + 2 \cdot y = b$ Line equation

$$\text{Find}(x, y) \text{ simplify } \rightarrow \begin{pmatrix} \frac{b}{5} + \frac{2 \cdot \sqrt{5 \cdot a^2 - b^2}}{5} & \frac{b}{5} - \frac{2 \cdot \sqrt{5 \cdot a^2 - b^2}}{5} \\ \frac{2 \cdot b}{5} - \frac{\sqrt{5 \cdot a^2 - b^2}}{5} & \frac{2 \cdot b}{5} + \frac{\sqrt{5 \cdot a^2 - b^2}}{5} \end{pmatrix}$$

$a := 3 \qquad b := 2$

$$\begin{pmatrix} \frac{b}{5} + \frac{2 \cdot \sqrt{5 \cdot a^2 - b^2}}{5} & \frac{b}{5} - \frac{2 \cdot \sqrt{5 \cdot a^2 - b^2}}{5} \\ \frac{2 \cdot b}{5} - \frac{\sqrt{5 \cdot a^2 - b^2}}{5} & \frac{2 \cdot b}{5} + \frac{\sqrt{5 \cdot a^2 - b^2}}{5} \end{pmatrix} = \begin{pmatrix} 2.961 & -2.161 \\ -0.481 & 2.081 \end{pmatrix}$$

This way we've obtained both intersection points!

Other Solve Block Functions

Isolve, Minerr, Maximize, Minimize