

Polynomial Root Finder and Simultaneous Equation Solver

CATEGORY

Tool

DESCRIPTION

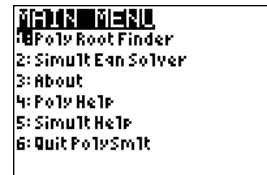
This application enables the user to enter quickly coefficients for a polynomial or a system of linear equations and then to identify real and complex roots.



DIDACTICAL SUGGESTIONS

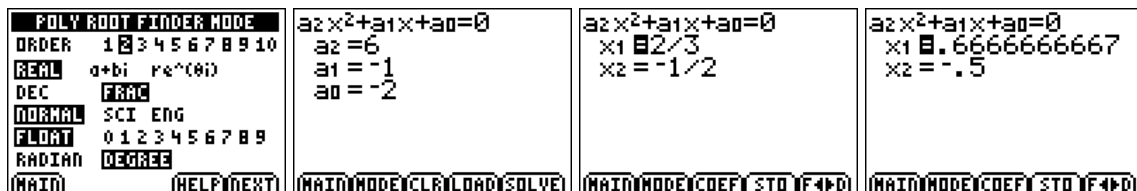
For polynomials it is possible to save the corresponding function in the $Y=$ editor to make a visualisation of the solution, the roots of the saved function. And where possible this application also gives a symbolic representation of the infinite set of solutions of a system of linear equations.

As the name of this application tells, it consists of two parts: Polynomial Root Finder to solve polynomial equations and Simultaneous Equation Solver to solve systems of linear equations. The following example shows how to use this APP.

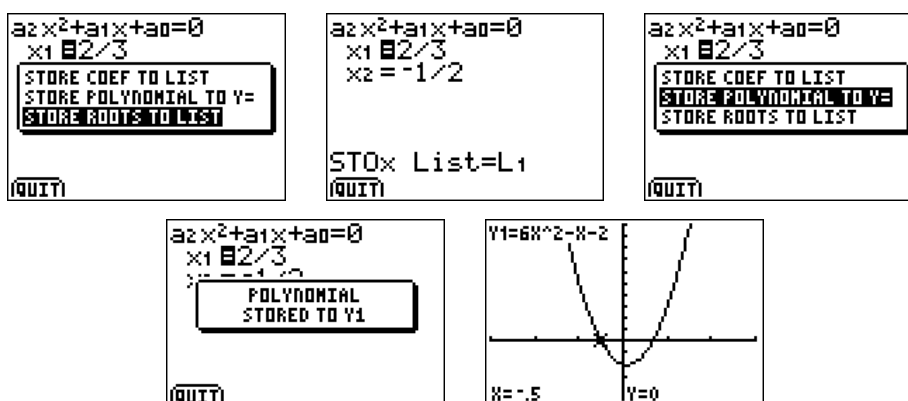


1: Poly Root Finder

To solve the equation $6x^2 - x - 2 = 0$ first select the degree of the equation, press NEXT (= F5 or [GRAPH]), enter the coefficients of the polynomial and press SOLVE (F5 or [GRAPH]). F4/D gives a decimal approximation.



With the option STO the solution can be saved in an empty list and the polynomial in a Y variable to check the results graphically.



It is also possible to calculate complex roots. Therefore the MODE-settings need to be changed into a+bi (FLOAT 2) or re^θi.

<pre> POLY ROOT FINDER MODE ORDER 1 2 3 4 5 6 7 8 9 10 REAL 0+0i re^θi DEC FRAC NORMAL SCI ENG FLOAT 0 1 2 3 4 5 6 7 8 9 RADIAN DEGREE (MAIN) (HELP/NEXT) </pre>	<pre> a3x^3+...+a1x+a0=0 a3=1 a2=0 a1=0 a0=8 (MAIN/MODE/CLR/LOAD/SOLVE) </pre>	<pre> a3x^3+...+a1x+a0=0 x1=-2.00 x2=1.00+1.73i x3=1.00-1.73i (MAIN/MODE/COEF/STO/IF/▶) </pre>	<pre> a3x^3+...+a1x+a0=0 x1=-2.00 (MAIN/MODE/COEF/STO/IF/▶) </pre>
	MODE: a+bi	MODE: REAL	

2: Simultaneous Equation Solver

Solving a system of linear equations is very similar to solving a polynomial equation. First you need to select the number of equations and variables (unknowns) and then enter the coefficients. Via F5 or [GRAPH] you get the solution. Some examples.

$$\bullet \begin{cases} x + y - z = 4 \\ 3x + y - z = 6 \\ x + y - 2z = 4 \end{cases}$$

<pre> SIMULT EQN SOLVER MODE EQUATIONS 2 3 4 5 6 7 8 9 10 UNKNOWN 2 3 4 5 6 7 8 9 10 DEC FRAC NORMAL SCI ENG FLOAT 0 1 2 3 4 5 6 7 8 9 RADIAN DEGREE (MAIN) (HELP/NEXT) </pre>	<pre> SYSTEM MATRIX (3x4) [1 1 -1 4] [3 1 -1 6] [1 1 -2 4] (3,4)=4 (MAIN/MODE/CLR/LOAD/SOLVE) </pre>	<pre> SOLUTION x1=1 x2=3 x3=0 (MAIN/MODE/SYSM/STO/IF/▶) </pre>
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With STO the system can be stored in an empty matrix and the solution in an empty list.

$$\bullet \begin{cases} x + 2y + 3z = 4 \\ 5x + 6y + 7z = 8 \end{cases}$$

<pre> SYSTEM MATRIX (2x4) [1 2 3 4] [5 6 7 8] (2,4)=8 (MAIN/MODE/CLR/LOAD/SOLVE) </pre>	<pre> SOLUTION SET x1=-2+x3 x2=3-2x3 x3=x3 (MAIN/MODE/SYSM/STO/RREF) </pre>	<pre> RREF (2x4) [1 0 -1 -2] [0 1 2 3] (MAIN/BACR/SYSM/STO/RREF) </pre>
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In this case the option F4D is replaced by the option RREF that generates the Row Reduced Echelon Form.

$$\bullet \begin{cases} 2x - 6y + 14z = 11 \\ x - 3y + 7z = -3 \end{cases}$$

<pre> SYSTEM MATRIX (2x4) [2 -6 14 11] [1 -3 7 -3] (2,4)=-3 (MAIN/MODE/CLR/LOAD/SOLVE) </pre>	<pre> SOLUTION NO SOLUTION FOUND (MAIN/MODE/SYSM/RREF) </pre>	<pre> RREF (2x4) [1 -3 7 0] [0 0 0 1] (MAIN/BACR/SYSM/STO/RREF) </pre>
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POINT OF VIEW

Polynomial Root Finder and Simultaneous Equation Solver is a very useful tool to solve equations and systems of equations especially in situations in which it is not necessary to do the calculations by hand.