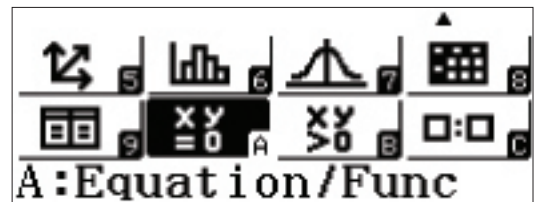


The fx-991EX numerically solves equations elegantly. It is accomplished with the help of the Natural Textbook Display™ in the Equation/Func mode. The Equation/Func mode uses Newton's method to find solutions to equations. The fx-991EX has the power to handle Simultaneous Equations with up to 4 unknowns and Polynomial Equations up to the 4th degree.

SIMULTANEOUS EQUATIONS

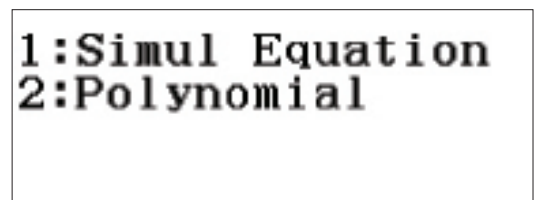
From the Main Menu, use the arrow keys to highlight the Equation/Func icon and press \square or press \leftarrow (A).



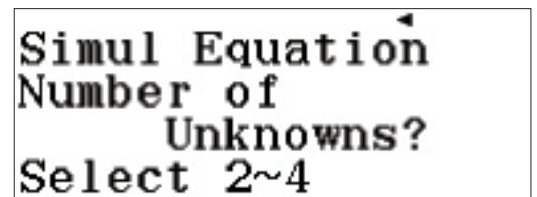
To solve the following system of simultaneous equations

$$\begin{cases} 2x + y = 5 \\ -4x + 6y = 12 \end{cases}$$

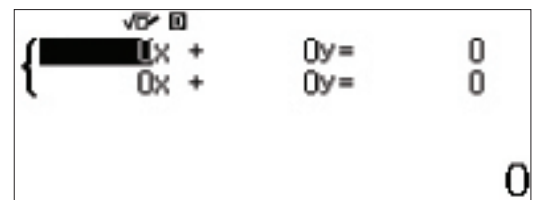
select \square (Simul Equation).



Choose the number of Unknowns. For this example, press \square (Unknowns).

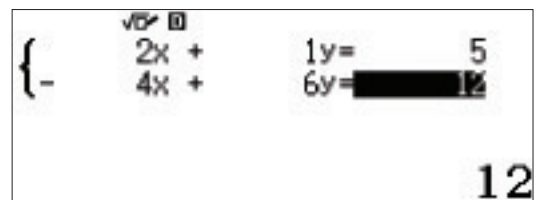


A 2x2 system of equations template is displayed. The template is in $Ax + BY = C$ form in which A, B and C can be any value. For fractional values, use the $\frac{\square}{\square}$ key.



Type in each value followed by the \square key.

Press \square \square \square \square , etc.



EQUATION/FUNC

To solve, press \square and use the arrow keys (\blacktriangledown \blacktriangle) to toggle between solutions.

X = $\frac{9}{8}$

The solutions are shown in natural display format. For decimal approximations, press \square .

y = $\frac{11}{4}$

To change the values in the system of equations without changing the type of equation or system, press \square .

$\begin{cases} 2x + 4x + 1y = 5 \\ 6y = 12 \end{cases}$ 2

To change the type of equation or system size, press \square and select from the on-screen menus.

1: Simul Equation
2: Polynomial

Simul Equation
Number of
Unknowns?
Select 2~4

$\begin{cases} 1x + 0y = 0 \\ 0x + 0y = 0 \end{cases}$ 0

The fx-991EX also solves inconsistent systems, both independent and dependent. Enter the displayed inconsistent and independent system

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

Press \square to see the solution.

No Solution

Enter the displayed inconsistent dependent system.

$$\begin{cases} 2x + 3y = 6 \\ 4x + 6y = 12 \end{cases}$$

Press \equiv to see the solution.

Infinite Solution

To input a larger system of simultaneous equation

$$\begin{cases} 1x + 1y + 1z = 9 \\ 3x + 2y - 1z = 8 \\ 3x + 1y + 2z = 1 \end{cases}$$

press OPTN 1 (Simul Equation) 3 (Unknowns).

$$\begin{cases} 1y + 1z = 9 \\ 2y - 1z = 8 \\ 1y + 2z = 1 \end{cases}$$

Enter the coefficients for each equation and press \equiv to solve.

X = $-\frac{34}{7}$

y = $\frac{85}{7}$

Z = $\frac{12}{7}$

POLYNOMIAL EQUATIONS

The fx-991EX has the computing power to solve polynomial equations up to 4th degree.

To start solving polynomial equations, in the Equation/Func icon, press **OPTN** **2** (Polynomial).

1: Simul Equation
2: Polynomial

Select the degree of the polynomial. For this example, use a 3rd degree polynomial. Press **3** (Degree).

Polynomial
Degree?
Select 2~4

Fill out the template for a 3rd degree polynomial. Type in each coefficient followed by the **=** key.

ax^3+bx^2+cx+d
 $\frac{\sqrt{\square}}{\square}$ $\frac{t}{\square}$
 $\square x^3+ 0x^2+ 0x$
 $+ 0$
=

$$x^3 + 4x^2 + x - 6 = 0$$

Press **=** to solve the equation.

ax^3+bx^2+cx+d
 $\frac{\sqrt{\square}}{\square}$ $\frac{t}{\square}$
 $1x^3+ 4x^2+ 1x$
 -6
=

Use the arrow keys (**▲** **▼**) to toggle through the solutions.

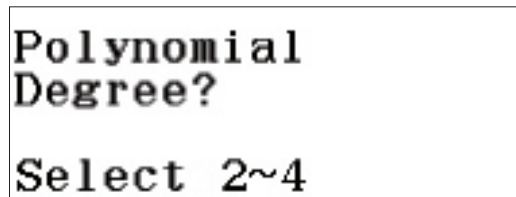
$ax^3+bx^2+cx+d=0$
 $x_1 =$
1

$ax^3+bx^2+cx+d=0$
 $x_2 =$
-2

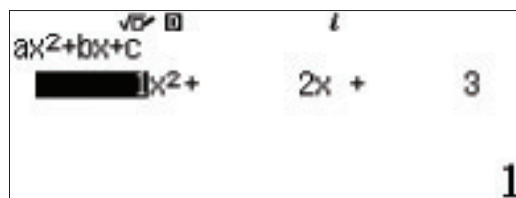
$ax^3+bx^2+cx+d=0$
 $x_3 =$
-3

The fx-991EX has the power to solve polynomials in the complex plane.

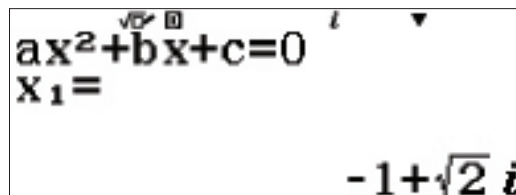
Press **OPTN** and change the type of polynomial to quadratic (**2**).



Enter the coefficients that appear in the displayed screen into the quadratic template, and press **EXE**.



The solutions are displayed in simplified radical form including the imaginary unit.



Press **▼** to see the second imaginary solution.

