Equation Calculations with the FX9860Giii

From the **Main Menu**, enter into the **EQUA** mode.

- [SIML] **[F1]** {simultaneous linear equations with 2 to 6 unknowns}
- [POLY] **[F2]** {polynomials of degree 2 to 6}
- [SOLV] **[F3]** {solve calculations – 1 solution 'at a time'}
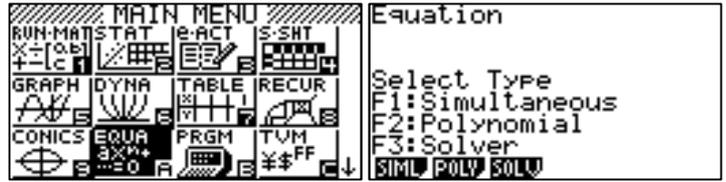
Simultaneous   **High-order Equations**   **Solve Calculations**

A. Simultaneous Linear Equations [F1]

You can solve simultaneous linear equations with two to six unknowns.

- Simultaneous Linear Equation with **Two Unknowns**:

$$a_1x + b_1y = c_1$$
$$a_2x + b_2y = c_2$$

- Simultaneous Linear Equation with **Three Unknowns**:

$$a_1x + b_1y + c_1z = d_1$$
$$a_2x + b_2y + c_2z = d_2$$
$$a_3x + b_3y + c_3z = d_3$$
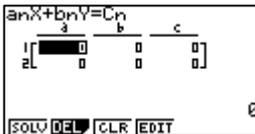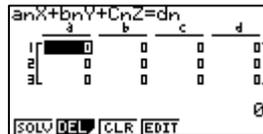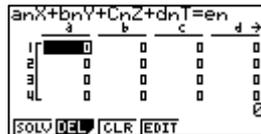
[F1]   [F2]   [F3]   [F4]   [F5]

Specify the number of unknowns (variables). Then sequentially input the coefficients.

Note: The cell that is selected for input is highlighted. Each time you input a coefficient, the highlighting shifts in the sequence: $a_1 \rightarrow b_1 \rightarrow c_1 \rightarrow \ldots a_n \rightarrow b_n \rightarrow c_n \rightarrow \ldots$ (n = 2 to 6). Enter in the coefficient value and press **[EXE]** to move to the next coefficient space.

You can input fractions, surds and decimals etc., as coefficients.

To change any coefficient that you already stored, move the cursor to the coefficient you want to edit and re-enter the value.

Pressing [F3] (CLR) will clear all coefficients to zero.
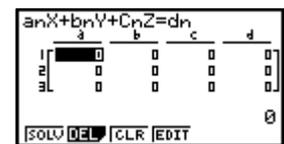
Example:

Solve the following simultaneous linear equations for x, y and z.

$$4x + y - 2z = -2$$
$$x + 6y + 3z = 2$$
$$-5x + 4y + z = -7$$
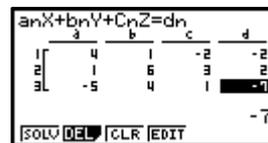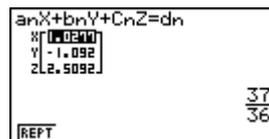
[F1](SOLV) to solve:

After the calculation is complete, you can press [F2] (REPT), change coefficient values, and then re-calculate.

Notes:

1. Simultaneous linear equations are solved by inverting the matrix containing the coefficients of the equations. For example, the following shows the solution (x, y, z) of a simultaneous linear equation with three unknowns. Because of this, the precision is reduced as the value of the matrix determinant approaches zero (becomes unstable).
2. An error occurs if the calculator is unable to find a solution.

B. **High-order Equations [F2]**

The FX9860Giii calculator can be used to solve high-order equations (Polynomials) from 2nd to 6th degree.

- Quadratic Equation: $ax^2 + bx + c = 0$ ($a \neq 0$)
- Cubic Equation: $ax^3 + bx^2 + cx + d = 0$ ($a \neq 0$)
- Quartic Equation: $ax^4 + bx^3 + cx^2 + dx + e = 0$ ($a \neq 0$) …

Select the **POLY** [F2] (Polynomial) mode, and specify the degree of the equation (Highest power of 'x').

[F1]	[F2]	[F3]	[F4]	[F5]
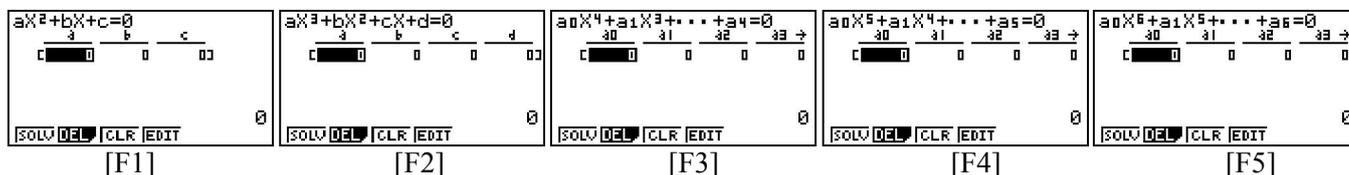
Sequentially input the coefficients. The cell that is currently selected for input is highlighted. Each time you input a coefficient, the highlighting shifts in the sequence: a → b → c → … You can input fractions, surds and decimals etc., as coefficients. To change any coefficient that you already stored, move the cursor to the coefficient you want to edit and re-enter the value.
Pressing [F3] (CLR) clears all coefficients to zero.

Examples:

1. Solve the cubic equation $x^3 - 2x^2 - x + 2 = 0$
   Enter the coefficients: [1] [EXE] [-] [2] [EXE] [-] [1] [EXE] [2]

   [F1](SOLV) to solve:
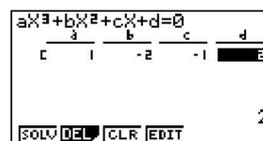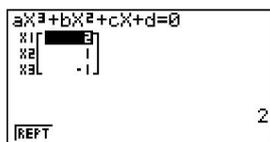
2. Solve the cubic equation $x^3 + 3x^2 + 3x + 1 = 0$
   Enter the coefficients: [1] [EXE] [3] [EXE] [3] [EXE] [1]

   Multiple Solutions identified with the × **3**
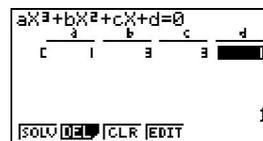
3. Solve the cubic equation $x^3 + 2x^2 + 3x + 2 = 0$
   Enter the coefficients: [1] [EXE] [2] [EXE] [3] [EXE] [2]
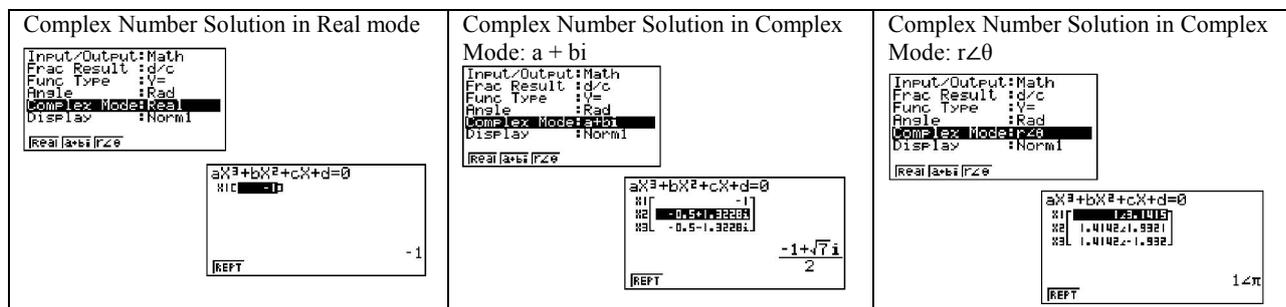
Complex Number Solution in Real mode	Complex Number Solution in Complex Mode: a + bi	Complex Number Solution in Complex Mode: r∠θ

After the calculation is complete, you can press [F2] (REPT), change coefficient values, and then re-calculate.

Notes:

1. It may take time for the calculation result of a high-order equation of 3rd degree or higher to appear on the display.
2. An error occurs if the calculator is unable to find a solution.

C. **Solve Calculations [F3]**

The Solve Calculation mode lets you determine the value of any variable in a formula. Select the SOLV (Solver) mode, and input the equation as it is written.

In the table of variables that appears on the display, input values for each variable. Select the variable for which you want to solve to obtain the solution by placing the cursor over the variable to be calculated. "**Lft**" and "**Rgt**" indicate the left and right sides that are calculated using the solution and should match if solved.

Example 1:

An object is thrown vertically, with an initial velocity, V, taking time, T, to reach height, H. Use the formula, $H = VT – \frac{1}{2}GT^2$ to solve for initial velocity V when H = 24 (meters), T = 2 (seconds) and gravitational acceleration is G = 9.8 (m/s^2).

     Enter the formula $H = VT – \frac{1}{2}GT^2$ using the [ALPHA] and numeric keys:

     Enter the variable values: [2] [4] [EXE] [↓] [2] [EXE] [9] [.] [8] [EXE]

     Move cursor to highlight V, then [EXE] or [F6] (SOLV) to solve:
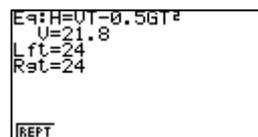
Example 2:

Solve $4x + 2 = 2x + 12$

     Enter the formula 4x + 2 = 2x + 12 using the numeric keys:
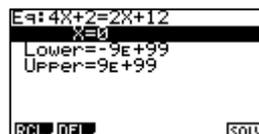
     [EXE] or [F6] (SOLV) to solve:
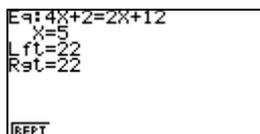
Example 3:

Solve $e^{3x+4} = 1024$

     Enter the formula $e^{3x+4} = 1024$ using the numeric keys:
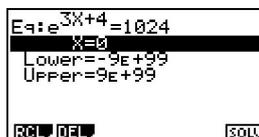
     [EXE] or [F6] (SOLV) to solve:
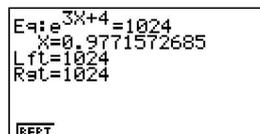
Notes:

1. If you do not input the equals sign, the calculator assumes that the expression is to the left of the equals sign, and there is a zero to the right.
2. An error occurs if you input more than one equals sign.
3. You can also specify values for Upper and Lower to define the upper and lower limits of the range of solutions.
4. An error occurs if the solution falls outside the range you specify.
5. Solutions are approximated using an enhanced Newton-Raphson method.
6. The Lft and Rgt values are displayed for confirmation, the closer the difference between the Lft and Rgt values is to zero, more accurate the result.
7. A Solve operation will produce a single solution. Use POLY when you want to obtain multiple solutions for a high-order equation (such as $ax^2 + bx + c = 0$).