Chapter 9

Graph Solve

You can use any of the following methods to analyze function graphs and approximate results.

- Calculating the root
- Determination of the local maximum value and local minimum value
- Determination of the y-intercept
- Determination of the intersection of two graphs
- Determination of the coordinates at any point (y for a given x/x for a given y)
- Determination of the integral for any range

9-1 Before Using Graph Solve

9-2 Analyzing a Function Graph

9-1 Before Using Graph Solve

After using the **GRAPH Mode** to draw the graph, press SHIFT F5 (G-Solv) to display a function menu that contains the following items.

- {**ROOT**}/{**MAX**}/{**MIN**}/{**Y-ICPT**}/{**ISCT**} ... {root}/{local maximum value}/{local minimum value}/{y-intercept}/{intersections of two graphs}
- {**Y-CAL**}/{**X-CAL**}/{$\int dx$} ... {y-coordinate for a given x-coordinate}/{x-coordinate for a given y-coordinate}/{integral for a given range}

9-2 Analyzing a Function Graph

The following two graphs are used for all of the examples in this section, except for the example for determining the points of intersection for two graphs.

Memory location Y1 = $x + 1$ Y2 = $x(x + 2)(x - 2)$

Use the View Window to specify the following parameters.

(A)

Xmin	=	–5	Ymin	=	–5
Xmax	=	5	Ymax	=	5
Xscale	=	1	Yscale	=	1

(B)

Xmin	=	–6.3	Ymin	=	–3.1
Xmax	=	6.3	Ymax	=	3.1
Xscale	=	1	Yscale	=	1

■ Determining Roots

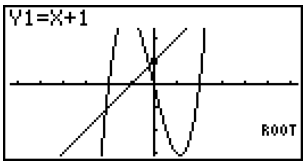
Example **To determine the roots for $y = x(x + 2)(x - 2)$**

View Window: **(B)**

[SHIFT] [F5] (G-Solv)

[F1] (ROOT)

(This puts the unit into standby waiting for selection of a graph.)

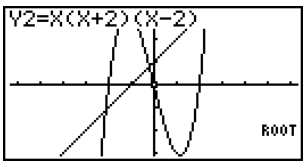


• A " ■ " cursor appears on the graph that has the lowest memory area number.

Specify the graph you want to use.

[▼]

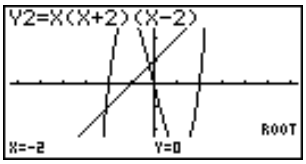
• Use [▲] and [▼] to move the cursor to the graph whose roots you want to find.



Determine the root.

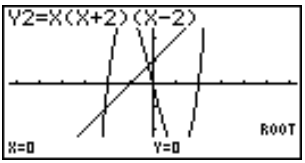
[EXE]

• Roots are found starting from the left.



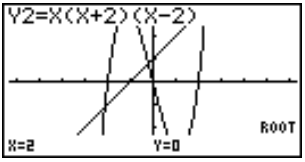
Search for the next root to the right.

▶



- If there is no root to the right, nothing happens when you press ▶.

▶



- You can use ◀ to move back to the left.
- If there is only one graph, pressing F1 (ROOT) directly displays the root (selection of the graph is not required).
- Note that the above operation can be performed on rectangular coordinate (Y=) and inequality graphs only.

■ Determining Local Maximum Values and Local Minimum Values

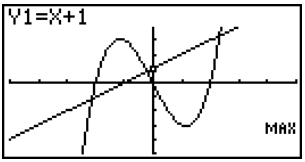
Example **To determine the local maximum value and local minimum value for $y = x(x + 2)(x - 2)$**

View Window: **(A)**

SHIFT F5 (G-Solv)

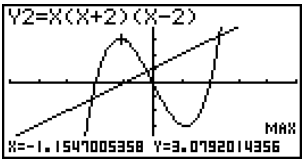
F2 (MAX)

(This puts the unit into standby waiting for selection of a graph.)



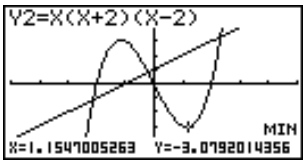
Specify the graph and determine the local maximum value.

▼ EXE



Specify the graph and determine the local minimum value.

SHIFT F5 (G-Solv)
F3 (MIN) ▼ EXE



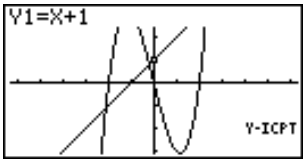
- If there is more than one local maximum/minimum value, you can use ◀ and ▶ to move between them.
- If there is only one graph, pressing F2 (MAX) / F3 (MIN) directly displays the local maximum/minimum value (selection of the graph is not required).
- Note that the above operation can be performed on rectangular coordinate (Y=) and inequality graphs only.

■ Determining *y*-intercepts

Example **To determine the *y*-intercept for $y = x + 1$**

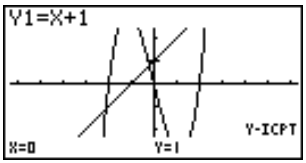
View Window: **(B)**

SHIFT F5 (G-Solv)
F4 (Y-ICPT)
(This puts the unit into standby waiting for selection of a graph.)



Determine the *y*-intercept.

EXE



- *y*-intercepts are the points where the graph intersects the *y*-axis.
- If there is only one graph, pressing F4 (Y-ICPT) directly displays the *y*-intercepts (selection of the graph is not required).
- Note that the above operation can be performed on rectangular coordinate (Y=) and inequality graphs only.

■ Determining Points of Intersection for Two Graphs

Example **To draw the following three graphs and then determine the points of intersection for the Graph Y1 and Graph Y3.**

View Window: **(A)**

Y1 = x + 1

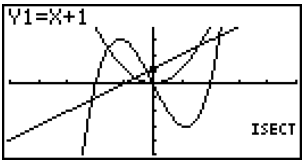
Y2 = x (x + 2) (x − 2)

Y3 = x^2

SHIFT F5 (G-Solv)

F5 (ISCT)

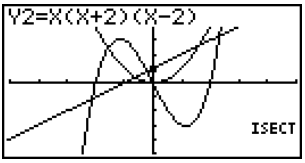
(This puts the unit into standby waiting for selection of a graph.)



Specify Graph Y1.

EXE

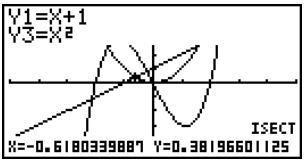
• Pressing EXE changes " ■ " into " ◆ " for specification of the first graph.



Specify the second graph (Graph Y3, here) to determine the points of intersection.

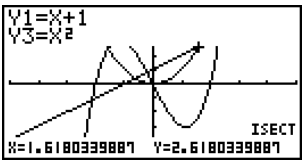
▼ EXE

• Use ▲ and ▼ to move " ■ " on the second graph.
• Intersections are found starting from the left.



▶

• The next intersection to the right is found. If there is no intersection to the right, nothing happens when you perform this operation.



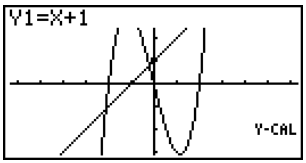
• You can use ◀ to move back to the left.
• If there are only two graphs, pressing F5 (ISCT) directly displays the intersections (selection of the graph is not required).
• Note that the above operation can be performed on rectangular coordinate (Y=) and inequality graphs only.

■ Determining a Coordinate (x for a given y/y for a given x)

Example **To determine the y-coordinate for x = 0.5 and the x-coordinate for y = 3.2 in the graph $y = x\,(x + 2)\,(x - 2)$**

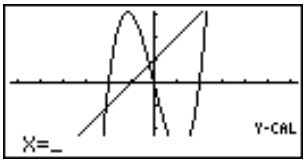
View Window: **(B)**

SHIFT F5 (G-Solv) F6 (▷) F1 (Y-CAL)



Specify a graph.

▼ EXE



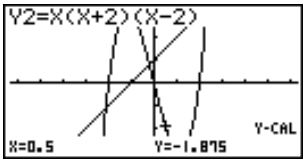
- At this time, the unit waits for input of an x-coordinate value.

Input the x-coordinate value.

0 • 5

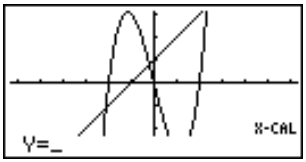
Determine the corresponding y-coordinate value.

EXE



Specify a graph.

SHIFT F5 (G-Solv) F6 (▷)
F2 (X-CAL) ▼ EXE



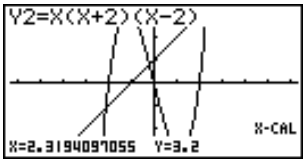
- At this time, the unit waits for input of a y-coordinate value.

Input the y-coordinate value.

3 • 2

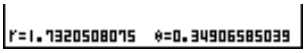
Determine the corresponding x-coordinate value.

EXE

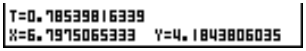


- If there is more than one x-coordinate value for a given y-coordinate value or more than one y-coordinate value for a given x-coordinate value, use ▶ and ◀ to move between them.
- The display used for the coordinate values depends on the graph type as shown below.

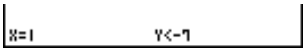
• Polar Coordinate Graph



• Parametric Graph



• Inequality Graph



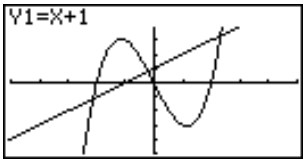
- Note that you can not determine a y-coordinate for a given x-coordinate with a parametric graph.
- If there is only one graph, pressing F1 (Y-CAL) / F2 (X-CAL) directly displays the x-coordinate/y-coordinate (selection of the graph is not required).

■ Determining the Integral for Any Range

Example $\int_{-1.5}^{0} x\,(x+2)\,(x-2)\,dx$

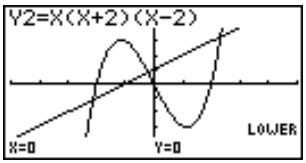
View Window: **(A)**

SHIFT F5 (G-Solv) F6 (▷)
F3 ($\int dx$)
(Graph selection standby)



Select graph.

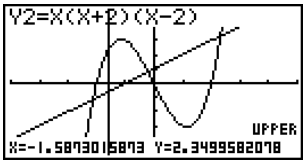
▼ EXE



- The display is prompting input of the lower limit of the integration range.

Move the pointer and input the lower limit.

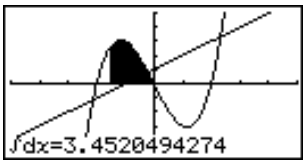
◀~◀ EXE



Input the upper limit and determine the integral.

(▶) ~ (▶) (Upper limit; $x = 0$)

[EXE]



- The lower limit must be less than the upper limit when specifying the integration range.
- Note that the above operation can be performed on rectangular coordinate (Y=) graphs only.

■ Graph Solve Precautions

- Depending on the View Window parameter settings, there may be some error in solutions produced by Graph Solve.
- If no solution can be found for any of the above operations, the message “Not Found” appears on the display.
- The following conditions can interfere with calculation precision and may make it impossible to obtain a solution.
  - — When the solution is a point of tangency to the x-axis.
  - — When the solution is a point of tangency between two graphs.