Chapter 23  The Graphing Calculator

To display the calculator, select Graphing Calculator from the Window menu. The calculator is displayed in front of the other windows. Resize or re-position the Graphing Calculator window as desired.

Private and Shared Calculators

The Graphing Calculator feature supplies everyone with two calculators: a private and a shared calculator.

Anyone can open and use the private calculator, which is visible only to you. Participants do not need any permissions to use the private calculator, however, they can access it only if the Follow Moderator option is turned off (which it is by default).

The shared calculator resides on the Moderator’s application. The Moderator must give each participant calculator permissions in order to use the shared calculator. No permissions are required to view the shared calculator.
Both Graphing Calculators function identically.

**Switching between the Private and Shared Graphing Calculator**

Select Shared or Private from the drop down menu in the Graphing Calculator window.

The information on your private calculator does not change or get deleted when you switch between private and shared calculators.

**Using the Shared Graphing Calculator**

1. Select Graphing Calculator from the Window menu to open the Graphing Calculator window.

2. The calculator column appears in the Participants list. Assign calculator permissions to those participants who will be using the shared calculator. (See page Setting Permissions on page 47 for details on permissions.)

The shared calculator can be used in one of two ways: with or without the Follow Moderator option selected.

**The shared calculator without the Follow Moderator option selected**

- You and your participants can work on the shared calculator as needed.
- Participants can switch to their private calculator or close their Graphing Calculator window at any time.
- You can change the display region at any time.
- Participants can make changes on the Graphing Calculator only when they have calculator permissions. If participants do not have calculator permissions, the buttons and menus in the shared calculator are grayed out.

**The shared calculator with the Follow Moderator option selected**

To share the calculator, do one of the following:

- From the Tools menu, select Graphing Calculator > Follow Moderator.
- Select (check) the Follow Moderator option in the Graphing Calculator window.
When the Graphing Calculator window is open, the shared Graphing Calculator is displayed on everyone’s session. When *Follow moderator* is selected:

- The participants are forced to view the shared Graphing Calculator window and see all the changes that are made on your calculator.
- Participants cannot dismiss the Graphing Calculator or use their private calculator. You, however, can always use your private calculator.
- Participants can make changes on the calculator only when they have calculator permissions. If participants do not have calculator permissions, their calculator buttons and menus are grayed out.
- If you dismiss the Graphing Calculator window, then the participants’ (private and shared) calculators are dismissed as well.

**Graphing Functions using the Calculator**

You can enter only explicit functions in the Graphing Calculator. The calculator allows you to plot two functions on the same grid. If your function contains a variable, it must be represented by an x.

1. Type your function in the Function box and press Enter to graph it.

   ![Graphing Calculator Interface]

   - **y = sin(x)**
   - **y = x+2**

2. Optionally, you can enter a second function in the second function box. Your first function is graphed in blue, the second in red.
**Entering Mathematical Operators and Functions**

The following table lists the allowable mathematical operators.

<table>
<thead>
<tr>
<th>Type</th>
<th>To perform this operation…</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>Add</td>
</tr>
<tr>
<td>-</td>
<td>Subtract</td>
</tr>
<tr>
<td>*</td>
<td>Multiply</td>
</tr>
<tr>
<td>/</td>
<td>Divide</td>
</tr>
<tr>
<td>^</td>
<td>Exponent</td>
</tr>
<tr>
<td>()</td>
<td>Parenthesis (to indicate order of operation)</td>
</tr>
</tbody>
</table>

Use the following abbreviations for these functions and numbers.

<table>
<thead>
<tr>
<th>Type</th>
<th>To represent this function or number…</th>
</tr>
</thead>
<tbody>
<tr>
<td>sqrt</td>
<td>Square Root</td>
</tr>
<tr>
<td>abs</td>
<td>Absolute Value</td>
</tr>
<tr>
<td>log</td>
<td>Logarithm (base 10)</td>
</tr>
<tr>
<td>ln</td>
<td>Natural Logarithm</td>
</tr>
<tr>
<td>sin</td>
<td>Sine</td>
</tr>
<tr>
<td>cos</td>
<td>Cosine</td>
</tr>
<tr>
<td>tan</td>
<td>Tangent</td>
</tr>
<tr>
<td>csc</td>
<td>Cosecant</td>
</tr>
<tr>
<td>sec</td>
<td>Secant</td>
</tr>
<tr>
<td>cot</td>
<td>Cotangent</td>
</tr>
<tr>
<td>asin</td>
<td>Arcsine</td>
</tr>
<tr>
<td>acos</td>
<td>Arccosine</td>
</tr>
<tr>
<td>atan</td>
<td>Arctangent</td>
</tr>
<tr>
<td>pi</td>
<td>π</td>
</tr>
<tr>
<td>e</td>
<td>e</td>
</tr>
</tbody>
</table>

Trigonometric functions are graphed in radians.
Displaying the Function History

Both function entry fields maintain a history of the ten most recent functions that you graphed. When you exit the session, all the functions are erased.

Click the drop down arrow button next to the function field to display the history of graphed functions for that field.

Evaluating Functions

1. Enter a value or expression for X in the Y= text box.

2. Click the button to evaluate Y for the given value of X. The Solve Function dialog box appears.

3. Select the option Mark the resulting point on the graph if you want the coordinates of the result plotted on your graph.
4. Click **OK** to accept your changes and dismiss the dialog box. Your result is displayed in the Solve Function information box.

![Solve Function x 1 dialog box](image)

5. Click **OK** to dismiss the information box and view the coordinates on your graph. The coordinates are displayed and plotted on the graph. You can zoom out or move the display region to view the plotted coordinates on your graph.

![Graphing Calculator interface](image)

**Selecting and Displaying Points on the Graph**

Select the **+** button on the calculator and then click a point on the grid. The point is identified with a green X and the x- and y-coordinates for the point are displayed to four decimal places.

![Selecting and Displaying Points](image)
To display an x- or y-intercept or a point of intersection

1. Select the button on the calculator.

2. Drag a selection box over a region that contains an x- or y-intercept or a point of intersection of two functions to display the coordinates for a point.

If you select a region that has more than one point of interest, the point will be identified in the following order of preference:

1. Point of intersection
2. x-intercept
3. y-intercept

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3. y-intercept

If you select a region that has more than one point of equal priority, only the point with the lowest x-value will be plotted. Alternatively, you can re-select a region with only one point of interest.

The calculator displays the coordinates of only one point at a time.

Changing the Calculator Display Region

Setting the Display Region and Grid Spacing

The display region of the graph is defined by the X range and Y range values. The Grid Spacing draws visible lines that correspond to tick points on the x- and y-axis. By default, the display region is set at –5 to 5 for the X range, –5 to 5 for the Y range and the Grid Spacing is set to 1.

To display a different region of the graph, enter values for the X range and Y range and set the Grid Spacing.
**Zooming In and Out**

To zoom in, click the magnifying glass button and then click the region of the graph you want to zoom in on. You can zoom in as many times as you need until you see the level of detail that you require.

To zoom out, click the magnifying glass button and then click the display region. Click the display region again to zoom out to see more of the display.

**Moving the Graph in the Display Region**

Click the move arrow button and then click and hold the display region to move the graph with your mouse.

You can also re-position the display region by selecting the options on the Restore Defaults menu:

- **Center Graph**: This option is dependent on your current X and Y range and centers the graph in the display region based on those values. If you had changed the grid size, this option will not restore the grid defaults.

- **Default Graph Area**: Centers the graph and resets the maximum and minimum Display Region values back to the defaults (-5, 5 for both X and Y axes). If you had changed the grid size, this option will not restore the grid defaults.
Closing the Graphing Calculator

Closing the Graphing Calculator window will not affect any of the work you have already done – it just closes the window. To close the window, do one of the following:

✓ Enter Ctrl+W (⌘W on Mac).
✓ Enter ALT+F4 (no Mac equivalent).
✓ Click on the Close Window button in the title bar of the window.