Functions and Plots

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Overview

You will likely have to deal with graphs on a daily basis in your study of Calculus and beyond. The main objective of this lab is to learn to use Maple to produce report-quality graphs of functions. This important topic was introduced briefly in the New User's Tour, but we will explore it in more detail here.

Maple Essentials

- New Maple commands introduced in this lab include:

Command	Description
`plot`	plot one or more functions on a specified window
	`plot(f(x), x=a..b);` plots the graph of $f(x)$ for $a < x < b$;
	`plot([f(x), g(x)], x=a..b);` graphs two functions in a single plot
`:=`	assign a name to a quantity
`->`	`f:=x->a*x+b;` assigns f to be the function $f(x) = ax + b$

- As introduced in the New User's Tour, the best way to start the **Plot Builder** assistant is right-clicking over an expression, but it can also be started from the Maple 11 user interface under the **Tools** menu:

<p align="center">Tools → Assistants → Plot Builder . . .</p>

Related Course Material

§1.1 and §1.2. Specifically, you should review Examples 3-5 (pages 18-21) in §1.2 for choosing an appropriate viewing window for graphing.

Activities

1. Create one plot that displays the graph of both $f(x) = \sqrt{x}$ and $g(x) = |x|/2$. Use the viewing window [-3,3]×[-3,3] for your plot. Change the line style for each expression so the curves can be distinguished from one another on a black and white copy. Give your plot a title and legend. Finally, transfer your plot to a **Microsoft Word** document. (Detailed steps for this activity are given on the next page.)

2. Create three plots of the function $f(x) = x^3 - x$ using the following different x-ranges: $-0.1 \le x \le 0.1$, $-10 \le x \le 10$, and $-2 \le x \le 2$. This example will demonstrate that your choice of viewing window can greatly affect your perception of the graph.

3. Repeat Activity 1 using $f(x) = 2\sin(4x)$, $g(x) = 2 + \cos(\frac{x}{2})$, and $h(x) = \sin(x)$ on the viewing window $[-\pi, \pi]$×[-4,4].

Example: Activity 1

- We will start with graphing $f(x) = \sqrt{x}$. Input the expression using proper Maple notation as shown. Remember, you can use the Expression palette if you wish.
  $>$ sqrt(x);
- Next, launch the **Interactive Plot Builder** by right-clicking over $\sqrt{x}$. From the context menu, choose **Plots** and then **Plot Builder**.
- Change the range for x to be -3 to 3.
- Click **Options**. Under **Line**, change the style to **dash**. Under **Color**, change the color to **Blue**. Under **Title**, give your graph a title, say **My Graph**. Click **Plot**.
- Maple will return your plot with the following command:
  $>$ `plot(`$\sqrt{x}$`, x=-3..3, linestyle=dash, color=``Blue'', title=``My Graph'');`
  Notice that each change we made using the Plot Builder corresponds to a different Maple command.
- We can add other functions and choices using square brackets, and we can change the window vertically by adding a command for the y-range.
- Say we want $f(x)$ red with a solid line and $g(x)$ blue with a dashed line, and we want to change the window to [-3,3]$\times$[-3,3].
- First, assign $f(x)$ and $g(x)$ as functions as follows. This will make the functions easier to call and change in the future.
  $>$ `f:= x -> sqrt(x);`
  $>$ `g:= x -> abs(x)/2;`
- Next, mimic the plot command to reflect our new choices. Remember to use square brackets for more than one choice. You should come up with something like this:
  $>$ `plot([f(x),g(x)], x=-3..3, y=-3..3, linestyle=[solid, dash], color=[``Red'', ``Blue''], title=``My New Graph'');`
- To create the Legend, follow these steps:
  1. Position the cursor over the plot and right-click to see the context menu.
  2. Under the option **Legend**, select **Show Legend**.
  3. Right-click once more and select **Edit Legend**. Enter an appropriate label for the first curve. Repeat this step until you have a completed legend.
- Finally, transfer your figure to a Microsoft Word document. If you have time, check out the other options in the context menu. For example, under **Title** choose to **Add Caption**, or under **Legend** choose to change the **Position**.

Assignment

Use Maple to complete Exercises 12, 14, and 19 in §1.2(page 25). **Make sure each graph has a title and legend**. Turn in your Maple worksheet to be graded. Attach any additional papers to the Maple worksheet. (This assignment is due at the beginning of next week's lab.)

Remarks

You should always save your lab worksheets in your **Z:** drive. This way, you can view them later for help with projects, quizzes, etc. Please do not forget to logout.