Lines and Plots

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Overview

There are two objectives in this lab:

- Review our ability the work with the equations of lines.
- Use Maple 10 to produce report-quality figures.

Maple Essentials

- The *Lines* tutor is started from the Maple 10 user interface under the **Tools** menu:

  Tools → Tutors → Precalculus → Lines ...

- 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 $f(x) = ax + b$

Preparation

- Review parallel and perpendicular lines.
- Read Section 1.2: *Graphing Functions Using Calculators and Computer Algebra Systems* in Anton. Specifically, review choosing a viewing window and compression.

Assignment

This week's Mastery Quiz asks you to use Maple to generate a report-quality figure. The Activities in this lab will help prepare you to answer the Mastery Quiz questions. The deadline for turning in Mastery Quiz 1 will be announced in lab.

Activities

1. Launch the *Lines* tutor. Notice the four options for inputting data about your line. Use the appropriate line definitions to quickly solve the following problems.
   Note: *You may want to use the tutor more than once.*
   (a) Find the *slope-intercept* form of the equation of the line passing through the points (2,4) and (1,-7).
   (b) Find the *slope-intercept* form of the equation of the line that is parallel to $y = 4x - 2$ and passes through the point (2,5).
   (c) Find the *slope-intercept* form of the equation of the line that is perpendicular to $x - 4y = 7$ and passes through the point (3,-4).

2. Create one plot that displays the graph of both $f(x) = \sqrt{x}$ and $g(x) = |x|$. 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 beautiful plot to a **Microsoft Word** document.
3. Repeat Activity 2 using $f(x) = 2\sin(4x)$, $g(x) = 2 + \cos(\frac{x}{2})$, and $h(x) = \sin(x)$ on the viewing window $[-\pi, \pi]$×[-5,5].

Example: Activity 2

- 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 window for x to be -3 to 3.
- Click **Options**. Under **Line**, change the style to **dot**. 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(x^(1/2), x=-3..3, linestyle=DOT, 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 range.
- Say we want $f(x)$ red with a solid line and $g(x)$ blue with a dotted line, and we want to change the window to [-3,3]×[-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);`
- 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, DOT], color=[red, blue], title="My New Graph");
- To create the Legend, follow these steps:
  1. Position the cursor over the plot and press the right mouse button to see the context menu.
  2. Under the option **Legend**, select **Edit Legend**.
  3. Enter an appropriate label for each of the functions.
- Finally, transfer your figure to a Word document as follows:
  1. Position the cursor over the plot and press the right mouse button to see the context menu. Select **Copy**.
  2. Open **Microsoft Word** from the **Start** menu at the bottom left of the screen. On the blank document, press the right mouse button to see the context menu. Select **Paste**.