Graphing Calculators (Section 1.4)

Math 111

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1 A Guide to the TI-83 Guidebook for Math 111

The TI graphing calculator guidebooks contain many, many interesting worked examples which show you how to use your calculator. Since I have a TI-83, the following references will be to that guidebook. There are analogous examples in the other TI guidebooks. Note that you may download a copy of the guidebook for your calculator from TI's website:

`http://education.ti.com/us/product/tech/83/guide/83guideus.html`

1.1 Strongly Recommended

These examples and sections in the guidebook are strongly recommended if you are not familiar with your calculator's operation.

- Getting Started on pages 1 through 16 [ignore page 8]
- Chapter 1
- Chapter 3 Getting Started: Graphing a Circle on page 3-2
- Chapter 7 Getting Started: Roots of a Function on page 7-2

1.2 Parametric Equations

We will discuss parametric equations in section 1.7 of Stewart in a couple of weeks. Look over these examples at that time.

- Chapter 4 Getting Started: Path of a Ball on page 4-2
- Chapter 17: Graphing the Unit Circle and Trigonometric Curves on page 17-10
- Chapter 17: Using Parametirc Equations: Ferris Wheel Problem on page 17-12

1.3 A Preview of Calculus

This example was mentioned in the introductory section of Stewart that I asked you to read.

- Chapter 17: Computing Areas of Regular N-sided Polygons on page 17-16

1.4 Precalculus

These are possibly worth reading.

- Chapter 9 Getting Started: Exploring the Unit Circle on page 9-2
- Chapter 17: Graphing Piecewise Functions on page 17-4

1.5 Calculus

As we cover more and more topics, these are worth taking a look at.

- Chapter 8 Getting Started: Drawing a Tangent Line on page 8-2
- Chapter 17: Demonstrating the Fundamental Theorem of Calculus on page 17-14
- Chapter 17: Finding the Area between Curves on page 17-11

1.6 Interesting But Not Necessary

If you are interested, and happen to have some spare time, these examples are interesting.

- Chapter 5 Getting Started: Polar Rose on page 5-2
- Chapter 6 Getting Started: Forest and Trees on page 6-2
- Chapter 11 Getting Started: Generating a Sequence on page 11-2
- Chapter 14 Getting Started: Financing a Car on page 14-2
- Chapter 16 Getting Started: Volume of a Cylinder on page 16-2

2 Defining Functions

Exercise 1: Enter the function $f(x) = (x+1)^{1/x}$, and evaluate it at $x = \pm 0.01$, $x = \pm 0.0001$, $x = \pm 0.000001$, and $x = \pm 0.00000001$.

To enter a function, press [Y=] and enter your function in, say, Y_1 using X as the independent variable. To evaluate Y_1 at a gvien point, return to the home screen and press [VARS] [▶] Y-VARS **1:Function 1:Y_1**. Then evaluate Y_1 at the point you want.

As x gets closer to 0, does the value of $f(x)$ appear to converge? Does it appear to converge to a number you recognize?

This problem is more easily solved by using lists.

To enter a list, press [STAT] **1: Edit**, and enter the above values in $L_1(1)$, $L_1(2)$, etc. Now you want to display in L_2 the values of Y_1 applied to each element in L_1. This is done by entering $L_2 = Y_1(L_1)$.

Exercise 2: Define the function $g(x) = 0.2x^3$ and using this defined function, define the second function

$$h(x) = \frac{g(x + 0.01) - g(x - 0.01)}{0.02}.$$

To test your work, you should have $h(0) = 0.00002$, $h(2) = 2.40002$, and $h(\pi) \approx 5.921782641$.

Plot h; you should see a parabola.

Set your viewing window to $[-3, 3] \times [0, 20]$, change your defintion of g to $g(x) = (2.71828)^x$, and plot h in this case. What do you notice about the graphs of g and h? *You should not have to alter your defintion of h since it is defined in terms of g.*

3 Graphing Functions

Exercise 3: Plot $f(x) = x^3 - 9x^2 - 48x + 52$ with horizontal and vertical ranges set to $[-10, 10]$.

Using the same horizontal range, replot the function but set the calculator to scale the vertical axis automatically. This is done by ZOOM **0:ZoomFit**.

Exercise 4: Make sure you are in radian mode and plot the function $g(x) = 2\cos(x - 1) + \sqrt{5}\sin(x - 1)$ over the interval $[-3, 4]$. Use the TRACE capability of your calculator to move the cursor along the curve and place the cursor on the local maxima (locate it by sight). Approximate its coordinates to two decimal places.

On the TI-83 press 2nd [CALC] **4:maximum** to have the maximum automatically computed.

Trace along the curve to one of the roots, and approximate its coordinates to two decimal places.

Use the built-in root finder to find the roots of g by pressing 2nd [CALC] **2:zero**.

Exercise 5: Stewart Section 1.4 #14
Determine an appropriate viewing rectangle for the function $y = x^2 + 0.02\sin 50x$ and use it to draw the graph.

Answer: Look at $[-2, 2] \times [-0.5, 4]$ then $[-0.5, 0.5] \times [-0.025, 0.25]$.

Exercise 6: Stewart Section 1.4 #17
Find all solutions of $x^3 - 9x^2 - 4 = 0$ correct to two decimal places.

Answer: $x \approx 9.05$