3.7 Functions of Several Variables

To enter and graph functions of more than one independent variable, we need to change the MODE settings. As shown in Figure 148, change the option for the `Graph` setting to option `5:3D`.

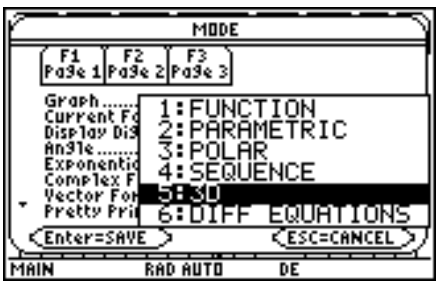

Figure 148: Setting the `Graph` mode for 3D

3.7.1 Graphing Multivariable Functions

We begin with graphing the function $z(x, y) = \sin x + 2 \sin y$. Enter the function as shown in Figure 149. There are several different formats for 3D graphing, so press ◊ | to pull up the `GRAPH FORMATS` dialog box. The `Style WIRE FRAME` will usually graph the fastest. Press ENTER. See Figure 150.

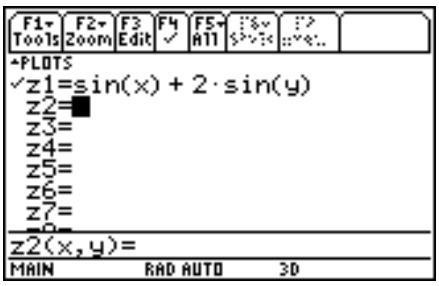

Figure 149: Entering the multivariable function

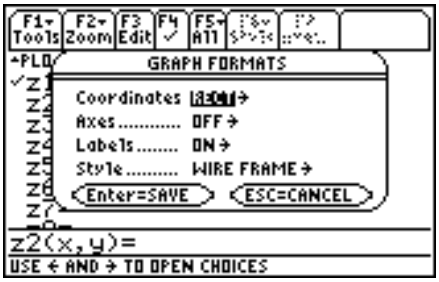

Figure 150: `GRAPH FORMATS` dialog box for 3D graphing

Begin by selecting the option `ZoomStd` from the F2 `Zoom` menu. This will automatically graph the function, but it will take some time. After the function graphs, you can modify the default viewing window by changing the settings manually. From the `[WINDOW]` screen change the following: `xmin=-5, xmax=5, ymin=-5, ymax=5, zmin=-3, zmax=3`. Leave all other settings the same. Regraph the function (see Figure 151). Once you have graphed the function, you can change your viewpoint by pressing the arrow keys multiple times to rotate the graph.

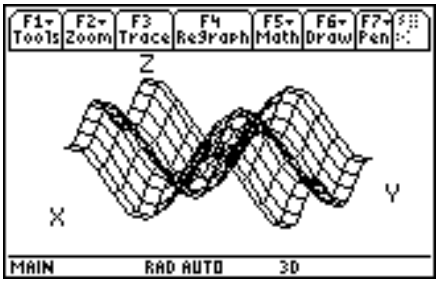

Figure 151: Graph of $z = \sin x + 2\sin y$

3.7.2 Partial Derivatives

Taking partial derivatives involves the same derivative commands as used in Section 3.5.3. Enter the function $z = \sin x + 2x^2 \sin y$ into the `Y= Editor`. (Be sure you are still using the mode for 3D graphing.) See Figure 152. To take the derivative with respect to x, say, use any of the analytic derivative commands. For example, we can use the $[d]$ command by pressing 2nd 8. `d(` requires the function (you could type it in directly) followed by the variable the derivative is taken with respect to. See Figure 153.

To compute second partial derivatives, mixed partials, or any combination, you can simply embed the

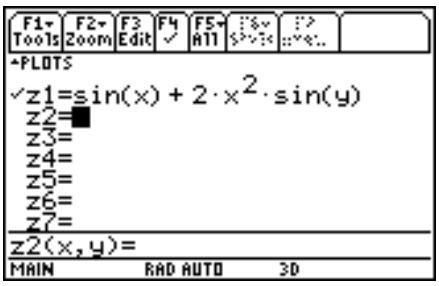

Figure 152: Entering a multivariable function

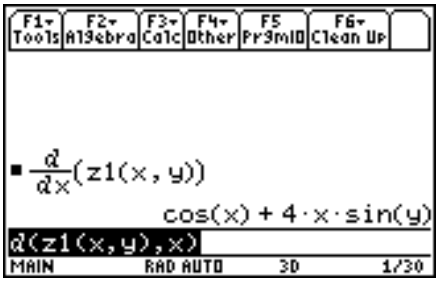

Figure 153: Computing the partial derivative dz/dx

derivative computation into another derivative. For example, to compute $\frac{d}{dy}(\frac{d}{dx}z(x,y))$, you can enter `d(d(z1(x, y), x), y)`. See Figure 154.

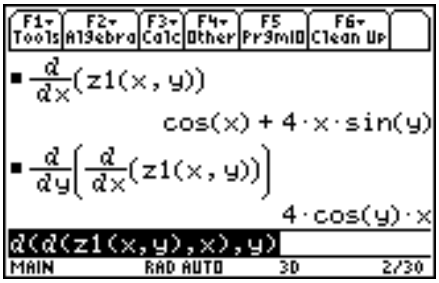

Figure 154: Computing a mixed partial derivative

3.7.3 Multiple Integration

To do multiple integration on the TI-89 we use the same commands as in Section 3.5.4. The integrals are embedded within each other. The $\int($ command requires the function, the variable you are integrating with respect to, the lower integration bound, and the upper bound. For example, to compute

$$\int_{-2}^{2}\int_{-2}^{1} x^3(x-y)^2 dx\, dy$$

we enter $\int(\int(\mathtt{x}^3 * (\mathtt{x}-\mathtt{y})^2, \mathtt{x}, -2, 1), \mathtt{y}, -2, 2)$. See Figure 155.

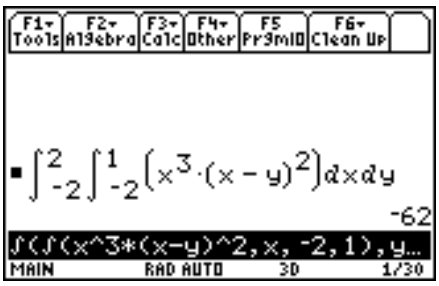

Figure 155: Multiple integration