Mth 254 Lab
Visualizing Partial Derivatives

Our goal for this activity is to visualize the partial derivatives $f_x(x, y)$ and $f_y(x, y)$ at the point $(\pi/4, \pi/3, 1/2)$ if $f(x, y) = \sin(2x - y)$ using the **2-D** graphing features on our calculators. A graph of this surface is shown below.

To find $f_x(x, y)$ we hold *y* constant, so to visualize this slope at a particular point we will graph $f(x, \pi/3) = \sin(2x - \pi/3)$. (Since this is a function of a single variable, we can easily use our graphing calculator.) So now enter $\sin(2x - \pi/3)$ into your *y* = editor. Note that the vertical axis will be the *z*-axis and the horizontal axis will be the *x*-axis. Set your window to be [-5, 5] by [-2, 2].

(1) Now graph and transfer your sketch to your paper. Using your calculator, trace to the point where $x \approx \pi/4$.
(2) Roughly sketch the tangent line at this point on your paper.
(3) Is the slope at this point positive or negative?

Note. The curve that you are seeing above is the curve of intersection of the surface with the plane $y = \pi/3$.

Now, to find $f_y(x, y)$ we hold *x* constant, so to visualize this slope at a point we will graph $f(\pi/4, y) = \sin(2(\pi/4) - y)$. So now enter $\sin(\pi/2 - x)$ into your *y* = editor. Note that the vertical axis will be the *z*-axis and the horizontal axis will be the *y*-axis. Set your window to be [-5, 5] by [-2, 2].

(4) Now graph and transfer your sketch to your paper. Using your calculator, trace to the point where $y = \pi/3$.
(5) Roughly sketch the tangent line at this point on your paper.
(6) Is the slope at this point positive or negative?

Note. The curve that you are seeing above is the curve of intersection of the surface with the plane $x = \pi/4$.

Now find:

(7) $f_x(x, y)$, $f_x(\pi/4, \pi/3)$, $f_y(x, y)$, $f_y(\pi/4, \pi/3)$ symbolically by hand.
(8) Explain how these calculations support what you are seeing graphically.
(9) Now roughly sketch both tangent lines above on the 3-D graph shown below.