My favorite function of two variables is called the monkey saddle. It is given by the following function:

$$f(x, y) = x(x^2 - 3y^2)$$

Find the $f(x, y) = 0$. From this information, start to make a contour plot: Which areas of the contour are bigger than 0? Which areas of the contour are smaller?

Once you have finished this, consult with your teammates on why this surface is called the Monkey Saddle.

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Find the intersection of the surface given by this graph with the xz plane.

Once you have finished this, consult with your teammates on why this surface is called the Monkey Saddle.

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Show that this has 3-way symmetry about the origin. Show that if $x = r\cos\theta$ and $y = r\sin\theta$, then $f(x, y) = r^3\cos(3\theta)$. Conclude that the Monkey Saddle graph has 3 fold symmetry around the origin by rotation.

Once you have finished this, consult with your teammates on why this surface is called the Monkey Saddle.