Groupwork I: Exploring the Monkey Saddle

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

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

Describe the curve $f(x, y) = 0$. 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?

Groupwork II: Exploring the Monkey Saddle

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 intersection of the graph of the Monkey saddle with the xz plane.

Groupwork III: Exploring the Monkey Saddle

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

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

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.