These models can be used to visualize the volume between an elliptical paraboloid and a saddle surface. The elliptical paraboloid is the graph of the function
\[ z = f(x, y) = 2 - x^2 - 3y^2 \]
and the saddle surface is the graph of the function
\[ z = g(x, y) = x^2 - y^2. \]
The volume can be filled with vertical French fries. The French fries are labelled by their position \((x, y)\) in the \(xy\)-plane. The French fry at \((x, y)\) has the range of \(z\)-values given by
\[ g(x, y) \leq z \leq f(x, y). \]
The two surfaces meet on the curve in space consisting of all points \((x, y, z)\) so that
\[ g(x, y) = z = f(x, y). \]
If we convert the equation \(g(x, y) = f(x, y)\) to polar coordinates we obtain the equation \(r = 1\). Consequently, the curve lies over the circle \(r = 1\) in the \(xy\)-plane. Therefore, this curve is the intersection of a cylinder and a saddle surface. So it is parametrized by
\[ (x, y, z) = r(t) = (\cos t, \sin t, \cos^2 t - \sin^2 t). \]
The volume is then given
\[ V = \int_{\theta=0}^{2\pi} \int_{r=0}^{1} [f(r \cos \theta, r \sin \theta) - g(r \cos \theta, r \sin \theta)] \, r \, dr \, d\theta. \]