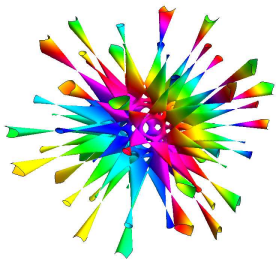
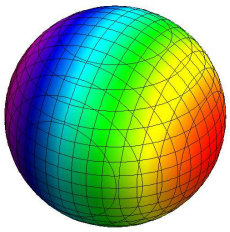
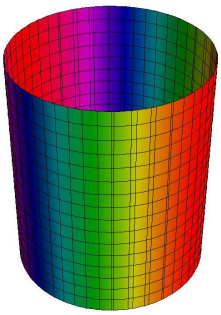
Lecture 5: Quadrics

Functions $f(x, y, z)$ can be visualized by **contour surfaces** $f(x, y, z) = c$. To analyze and distinguish surfaces, it is important to look at **traces**, the intersections with the coordinate planes. To the right we have a level surface called decic. If $f(x, y, z)$ is a polynomial which is not linear and quadratic at most, then the surface is called a **quadric**. There are three generic classes ellipsoids, hyperboloids, paraboloids and then there are cylinders, cones or even more singular ones like cylindrical cones $x^2 = y^2$.

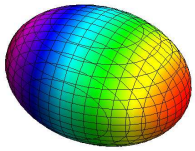




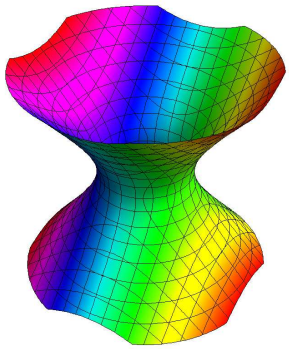
$x^2 + y^2 + z^2 = 1$
Sphere



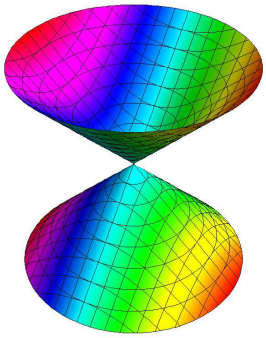
$x^2 + y^2 = 1$
Cylinder



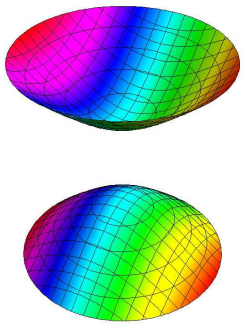
$3x^2 + 4y^2 + 2z^2 = 1$
Ellipsoid



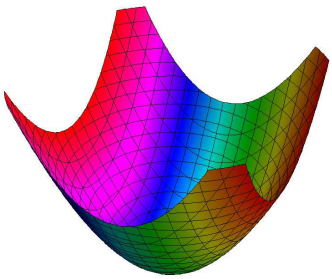
$x^2 + y^2 - z^2 = 1$
One sheeted Hyperboloid



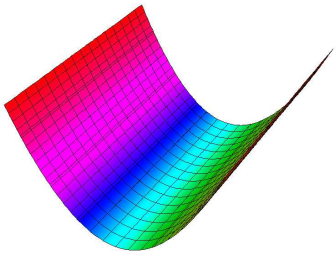
$x^2 + y^2 - z^2 = 0$
Cone



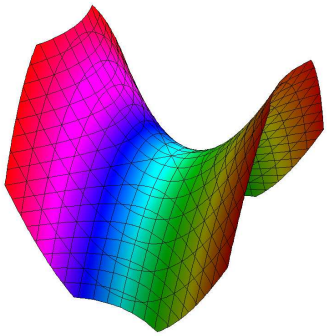
$x^2 + y^2 - z^2 = -1$
Two sheeted Hyperboloid



$x^2 + y^2 - z = 0$
Elliptic Paraboloid



$x^2 - z = 0$
Cylindrical Paraboloid



$x^2 - y^2 - z = 0$
Hyperbolic Paraboloid