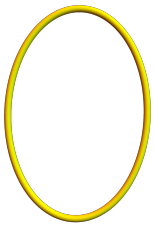
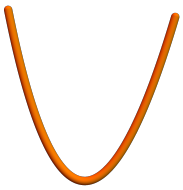
Conic sections

Ellipse



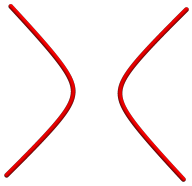
$x^2 + y^2 = 1$

Parabola



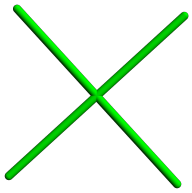
$y = x^2$

Hyperbola



$x^2 - y^2 = 1$

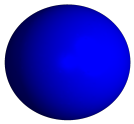
Specials



$x^2 = y^2$

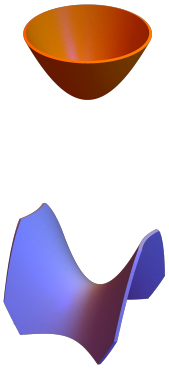
Quadrics

Ellipsoid



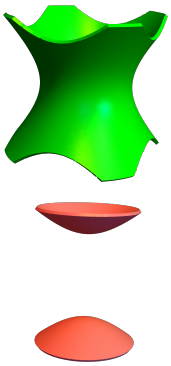
$x^2 + y^2 + z^2 = 1$

Paraboloid



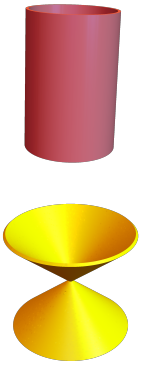
$z = x^2 + y^2$
$z = x^2 - y^2$

Hyperboloid



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

Specials



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

Advise

You will have to know the quadrics in the exam. Here are some pointers:

- There is no need to memorize the quadrics. You can derive them: look at the traces (put one of the variables to zero) to see what conic section you get.
- The name usually reveals what the surface is: elliptic paraboloids contain ellipses and parabola, hyperbolic paraboloids contain hyperbola and parabola as traces.
- The paraboloids can be written as graphs $z = f(x, y)$. This is not possible for ellipsoids or hyperboloids.
- The special surfaces are non-generic but useful and important. The cone or cylinder appear a lot in applications.
- Make sure to recognize the surfaces also if the variables are turned, scaled shifted or signs switched. $2x^2 - (y - 5)^2 - 4z^2 = -1$ for example is a one-sheeted hyperboloid.