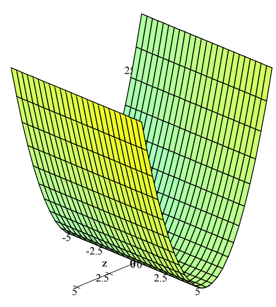
Section 12.6 Cylinders and Quadric surfaces

Quadric surface:
General form: $Ax^2 + By^2 + Cz^2 + Dxy + Exz + Fyz + Hx + Iy + Jz + K = 0$
By suitable translations and rotations, it falls into nine distinct types:
1. The parabolic cylinder
2. The elliptic cylinder
3. The hyperbolic cylinder
4. The ellipsoid
5. The elliptic parabolid
6. The hyperbolic parabolid
7. The (elliptic) cone
8. The hyperboloid of one sheet
9. The hyperboloid of two sheet

Cylinders : When one of x, y, z is missing, the surfacs is a cylinder. That means it can take on all the values for the missing variable.
Example 1 (parabolic cylinder)
a. $z = x^2$



b. $y = x^2$

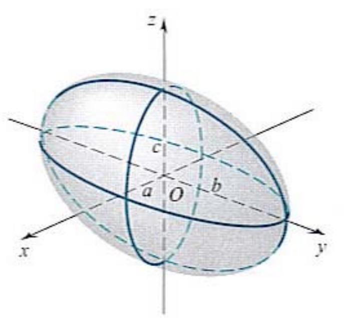
Example 2 (elliptic cylinder)
a. $x^2 + y^2 = 4$

b. $y^2 + \frac{z^2}{4} = 1$

Example 3 (hyperbolic cylinder) $x^2 - y^2 = 1$

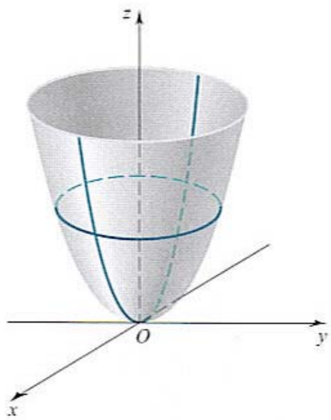
Definition: The traces (or cross sections) are the intersections of the surface with planes parallel to the coordinate planes.

Example 4 (ellipsoid) $\frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{16} = 1$



Example 5 (elliptic paraboloid)

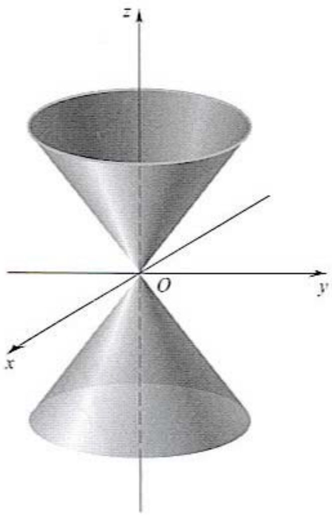
a. $z = x^2 + 4y^2$



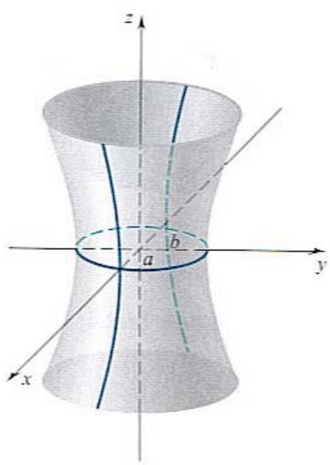
b. $z = x^2 + y^2 - 2x + 4y + 5$

Example 6 (hyperbolic parabolid) $z = y^2 - x^2$

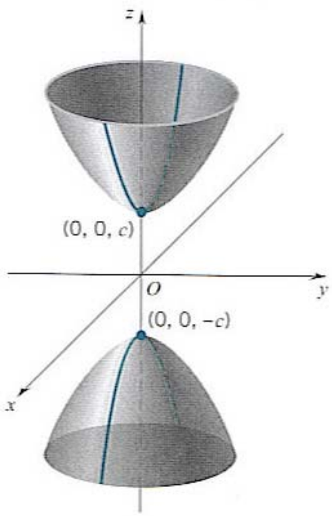
Example 7 (cone) $z^2 = x^2 + \frac{y^2}{9}$



Example 8 (hyperboloid of one sheet) $\frac{x^2}{4} + y^2 - z^2 = 1$



Example 9 (hyperboloid of two sheet) $\frac{x^2}{4} + y^2 - z^2 = -1$



HW: 1, 3, 4, 21, 23, 25, 27, 31, 33, 42