Section 3 Math 2202
Distances between Points, Lines and Planes

1. Find the distance from the point $Q = (2, -3, 1)$ to the line $L : x = 3 - t, y = 1 + 4t, z = 6$. (By 'distance', remember we mean the shortest distance between Q and any point on L.)

   Can you find the coordinates of the point on L closest to Q?

2. For each case, how could you find the distance between two lines L_1 and L_2, using what we know about distance from a point to a line or to a plane?

   - L_1 and L_2 intersect
   - L_1 and L_2 are parallel
   - L_1 and L_2 are skew

3. Find the distance between the given lines.

$$\begin{aligned} L_1 : &\quad x = 1 + 2t, \quad y = 3t, \quad z = 2 - t \\ L_2 : &\quad x = -1 + s, \quad y = 4 + s, \quad z = 1 + 3s. \end{aligned}$$

4. For each, determine the $x = k$ traces, the $y = k$ traces and the $z = k$ traces. Identify the quadric surface as a hyperboloid, cone, paraboloid, or ellipsoid, and give a rough sketch. If appropriate, describe any axes of symmetry.

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