

Math 2415
Paper Homework #3

1. **[12.5B: Planes]** Let $A = (2, 0, 1)$, $B = (3, 1, 0)$ and $C = (4, 3, 5)$.
- Find the level set equation of the plane, \mathcal{P} , containing the points A , B , and C .
 - Check that A , B , and C each satisfy the equation you derived in (a).
 - Find a parametrization, $(x, y, z) = \mathbf{r}(s, t)$, of the plane, \mathcal{P} , containing A , B , and C .
 - For each of the three points, A , B , and C , find values of the parameters (s, t) in the parameterization you found in (c).
 - Let \mathcal{L} be the line passing through the point $(-1, 0, 2)$ that is parallel to the vector $(1, 2, 3)$. Find the point of intersection of this line with the plane, \mathcal{P} .
 - Let \mathcal{Q} be the plane that contains the point $(3, 1, 2)$ and that is perpendicular to the line \mathcal{L} in (e). Find the level set equation of the plane that passes through the point $D = (1, 2, 1)$ and contains the line of intersection of the planes \mathcal{P} and \mathcal{Q} .
2. **[15.7A: Cylindrical Coordinates]** Sketch the following solids, surfaces, curves, and points, *altogether in one plot, with labels*. For each surface, convert the equation to rectangular and to spherical coordinates. For each point, find the rectangular and spherical coordinates of that point.
- The surface $r = 2$.
 - The curve where $r = 2$ and $z = 3$.
 - The curve where $r = 2$ and $\theta = \pi/4$.
 - The point $(r, \theta, z) = (2, \pi/4, 3)$.
 - The solid where $r \leq 2$, $0 \leq \theta \leq \pi/4$ and $0 \leq z \leq 3$.
3. **[15.8A: Spherical Coordinates]** Sketch the following solids, surfaces, curves, and points, *altogether in one plot, with labels*. For each surface, convert the equation to rectangular and to cylindrical coordinates. For each point, find the cylindrical and rectangular coordinates of that point.
- The surface $\rho = 4$.
 - The curve where $\rho = 4$ and $\theta = \pi/2$.
 - The curve where $\rho = 4$ and $\phi = \pi/3$.
 - The point $(\rho, \theta, \phi) = (4, \pi/2, \pi/3)$.
 - The solid where $\rho \leq 4$, $0 \leq \theta \leq \pi/2$ and $\pi/3 \leq \phi \leq 2\pi/3$.