

## Math 2415

### Homework on 15.7 and 15.8 (Coordinate systems only)

- The following points are given in cylindrical coordinates,  $(r, \theta, z)$ . Express each in rectangular and in spherical coordinates.
  - $(1, 45^\circ, 1)$
  - $(2, \pi/2, -4)$
- The following points are given in rectangular coordinates,  $(x, y, z)$ . Express each in cylindrical and in spherical coordinates.
  - $(0, 3, 4)$
  - $(\sqrt{2}, 1, 1)$
- Express the plane  $z = x$  in (a) cylindrical and (b) spherical coordinates
- A tank in the shape of a circular cylinder of radius 5 m and height 12 m is half filled with water and lying on its side. Describe the air space inside the tank using a suitably chosen cylindrical coordinate system. Justify your answer with the aid of a sketch.
- Sketch the surfaces whose equations are given as follows
  - $r = 2$  (cylindrical coordinates)
  - $r = 3z$  (cylindrical coordinates)
  - $r^2 + 4z^2 = 1$  (cylindrical coordinates)
- Convert the equations to (a) cylindrical and (b) spherical coordinates
  - $z = x^2 + y^2$
  - $x^2 + y^2 - 3z^2 = 0$
  - $x^2 + y^2 = 4$
- Sketch the solid described by the following inequalities
  - $0 \leq \rho \leq 4, \pi/2 \leq \phi \leq \pi, 0 \leq \theta \leq \pi/4$
  - $r \leq z \leq 1 - r^2$ . Hint: First sketch the curves  $z = r$  and  $z = 1 - r^2$  in  $(r, z)$ -space.