EXERCISES #1

OVERVIEW, COORDINATE SYSTEMS

Exercise 1. Find the rectangular coordinates (in 2D) of the point $(r, \theta) = (2, \frac{\pi}{4})$ in polar coordinates.

Exercise 2. Find the polar coordinates of the point $(x, y) = (1, -1)$ in rectangular coordinates (in 2D).

Exercise 3. Find the rectangular coordinates (in 3D) of the point $(r, \theta, z) = (4, \frac{4\pi}{3}, 1)$ in cylindrical coordinates.

Exercise 4. Find the cylindrical coordinates of the point $(x, y, z) = (0, -1, 3)$ in rectangular coordinates (in 3D).

Exercise 5. Explain why $\rho = \sqrt{r^2 + z^2}$ (in the context of expressing spherical coordinates in terms of cylindrical coordinates).

Exercise 6. Convert the point $(x, y, z) = (0, -2, 0)$ in rectangular coordinates (in 3D) to spherical coordinates.

Exercise 7. Identify the surface whose equation in spherical coordinates is $\rho \cos(\phi) = 3$.

Exercise 8. Convert the point $(\rho, \theta, \phi) = (2, \frac{\pi}{4}, \frac{\pi}{4})$ to rectangular coordinates (in 3D).

Exercise 9. Express the equation $\phi = \frac{\pi}{4}$, in spherical coordinates, of the cone in terms of cylindrical coordinates.

Exercise 10. Consider a vertical line (in 2D) through the point $(3, 3)$ (expressed in rectangular coordinates). Decide if the line would be more easily expressed in polar coordinates or in rectangular coordinates. Then write an equation for it.

Exercise 11. Find an equation in polar coordinates for the curve represented by the given equation in rectangular coordinates (in 2D).

- $x^2 + y^2 = 7$.
- $x = -1$.
- $y = \sqrt{3}x$.
- $x^2 + y^2 = 4y$.