

MA166 Recitation Notes and Exercises

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1 Notes: Vectors and the Geometry of Spaces

Material found in Stewart §12.

1.1 Three-Dimensional Coordinate Systems

Here are some of the most important concepts, equations, and theorems from this section.

The distance between two points $P_1(x, y, z)$ and $P_2(x, y, z)$ in \mathbb{R}^3 is given by the formula

$$|P_1P_2| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}. \quad (1)$$

This is also called the *Euclidean norm* and generalizes to all dimensions. Note that equation (1) is equivalent to

$$\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2} = |P_2P_1|$$

so that the distance between point does not depend on your point-of-view, i.e, whether you think of the line starting connecting P_1 and P_2 as starting at P_1 and ending at P_2 or vice-a-versa.

The equation of a sphere with $C(h, k, l)$ and radius r is

$$(x - h)^2 + (y - k)^2 + (z - l)^2 = r^2. \quad (2)$$

In particular, if the center is the origin O , then the equation (??) reduces to

$$x^2 + y^2 + z^2 = r^2.$$

2 Exercises Week 2