

Welcome to Math 126!

Resources

- Canvas: canvas.uw.edu
- Dr. Loveless Materials Page
math.washington.edu/~aloveles
- Free 3D grapher: desmos.com/3d

To do over next two days

- Syllabus / Welcome Quiz
- Start 12.1 HW
- Go to quiz section

Plan for Today

1. About me & about you.
2. Tour of resources.
3. Discuss 12.1 (3D intro).

12.1 Intro to 3D ([12.1 Lecture Desmos Graphs](#))

Entry Task:

How can you tell if (x,y,z) in $\mathbb{R}^3$ is on...

1. ...the xy-plane?
2. ...the yz-plane?
3. ...the z-axis?
4. ...the x-axis?
5. ...the origin?

Sketch here:

Observations and Notation

Think in terms of “conditions”

Horizontal & Vertical Planes

xy-plane $\Leftrightarrow z = 0$

yz-plane $\Leftrightarrow x = 0$

xz-plane $\Leftrightarrow y = 0$

Horizontal & Vertical Lines

x-axis $\Leftrightarrow y = 0$ and $z = 0$

y-axis $\Leftrightarrow x = 0$ and $z = 0$

z-axis $\Leftrightarrow x = 0$ and $y = 0$

You do:

What do these conditions describe in $\mathbb{R}^3$?

1. $x = 3$

2. $z = 5$

3. $x = 3$ and $y = 4$

Sketch here:

Distances

The distance (in a straight line) between two points in $\mathbb{R}^3$ is

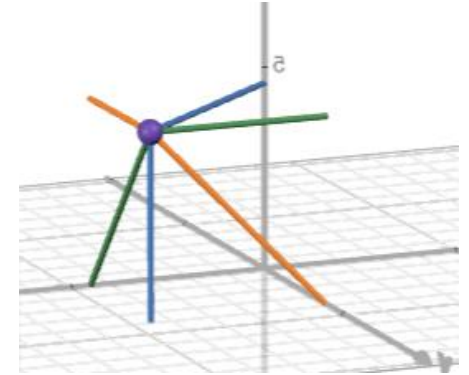
$$\text{Dist} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

You do: How far is (1,3,4) from...

1. ...the origin?
2. ...the xy-plane?
3. ...the x-axis?

“Corresponding Point” concept

Before computing a distance to a plane or axis, identify the nearest point on that plane or axis.



[Open interactive visual](#)

HW Hints: Given Three Points (HW 2–3)

Compute the three pairwise distances. Then ask:

1. Are the points on the same line?
2. Do the points form a right triangle?
3. Do the points form an isosceles triangle?

What must be true about the distances in each case?

Spheres (HW 5–10)

A sphere is the set of all points a fixed distance r from a center (h, k, l) .

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

Example 1 (HW 8)

The points $A(1, -2, 8)$ and $B(5, 4, 10)$ are endpoints of a diameter of a sphere.

Find the equation of the sphere.

Given:

Want:

Example 2 (HW 10)

Find the equation for the largest sphere completely in the first octant with center at (2,3,5).

Given:

Want:

Example 3 (HW 5)

Describe the intersection of

$$x^2 + y^2 + (z + 3)^2 = 4$$

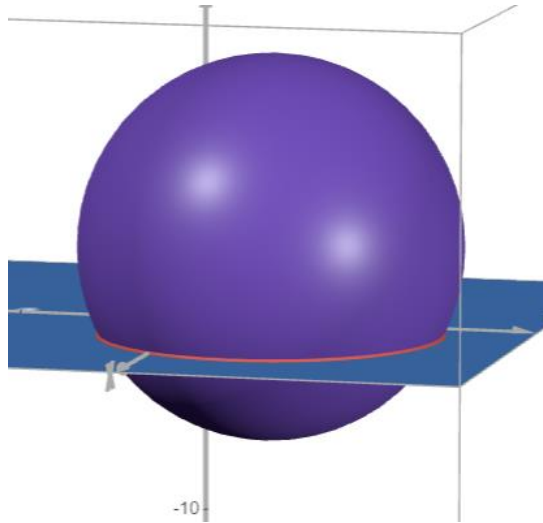
and the xz-plane.

What if it was the xy-plane?

12.1 Summary

I hope you've gained some comfort with...

- Horizontal and Vertical Planes and Lines
- Distance Formula
- Spheres
- Intersections with horiz. and vert. planes



Formulas:

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

Sphere Equation

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