Closing Tue, Apr. 7: 12.1, 12.2, 12.3
Closing Thu, Apr. 9: 12.4(1)(2),12.5(1)

126: Calculus III - Dr. Andy Loveless

12.1 Intro to 3D

Entry Task: How can you tell if a point (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?

Observations

Basic Planes

xy-plane $\Leftrightarrow \{(x, y, z) \mid \ z = 0\} \Leftrightarrow z = 0$

yz-plane $\Leftrightarrow \{(x, y, z) \mid \ x = 0\} \Leftrightarrow x = 0$

xz-plane $\Leftrightarrow \{(x, y, z) \mid \ y = 0\} \Leftrightarrow y = 0$

Basic Lines

x-axis $\Leftrightarrow \{(x, y, z) \mid y = 0 \textbf{ and } z = 0\}$

y-axis $\Leftrightarrow \{(x, y, z) \mid x = 0 \textbf{ and } z = 0\}$

z-axis $\Leftrightarrow \{(x, y, z) \mid x = 0 \textbf{ and } y = 0\}$

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

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

How far is (1,3,4) from…

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

Homework Hints

There is a way to answer the following questions using only the distance formula:

Given three points

$A(a_1, a_2, a_3), B(b_1, b_2, b_3), C(c_1, c_2, c_3)$

1. Are the points on the same line?

2. Do the points form a right triangle?

Spheres *(HW 12.1/6-16)*

The equation of all points (x, y, z) on a sphere (*i.e.* the outer shell of a ball) centered at (h, k, l) with radius r is

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

Example: Find the equation of the sphere that has its lowest point at (0,0,1) and its highest point at (0,0,5).

Example:

Describe the intersection of the sphere $x^2 + y^2 + (z-3)^2 = 4$

and the *xz*-plane.

What if it was the *xy*-plane?

Example: Find the center and radius of the sphere

$$2x^2 + 2y^2 + 2z^2 = 26 + 12x$$

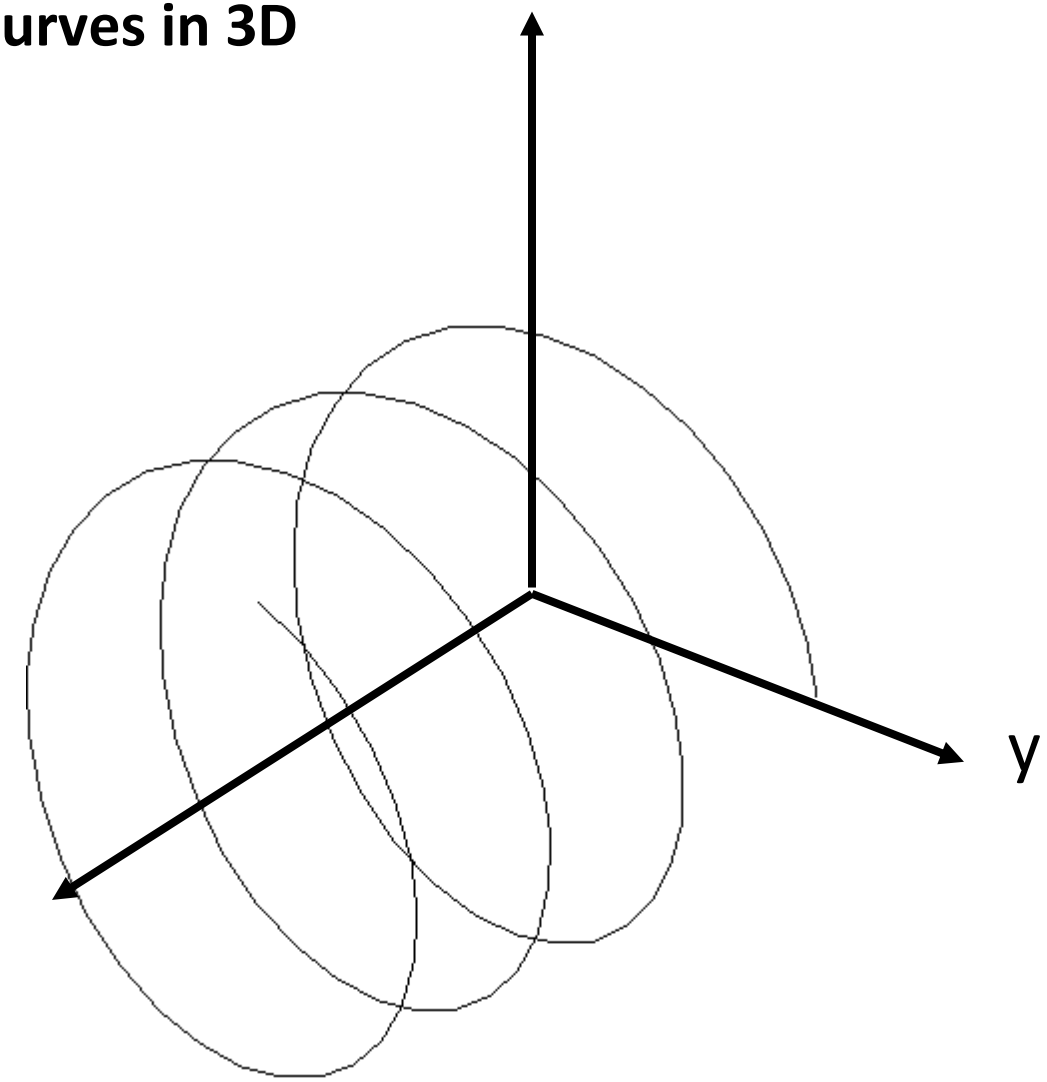
What we will do in this course:

1. Ch. 12 – Vectors and 3D Basics (vector operations, lines, planes)
2. Ch. 10/13 – 2D and 3D Curves (parametric, polar, dis/vel/acc)
3. Ch. 14 – Analyzing Surfaces (partials, tangents, max/min)
4. Ch. 15 – Volumes under Surfaces (double Integrals)
5. Taylor Notes – Taylor Polynomials and Taylor Series

How to get help: First, work ahead on homework; pretend the closing date is actually two days early.

1. Ask questions on discussion board!!!!
2. Ask questions when your TA is on Zoom or discussion board.
3. Ask questions during live-stream lectures.
4. Email your TA or me.
5. Form Zoom study groups with classmates.
6. Use my free online resources

Ch. 13 Curves in 3D



Ch. 14/15 Surfaces in 3D