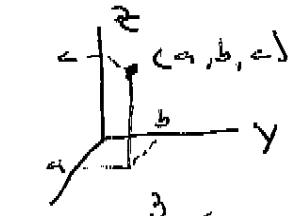
12.1: 3D CooRD SYSTEMS

Where we are: Calc III is about broadening our derivative & integral skills to

- parametric fcts. ✓
- polar fcts. ✓
- 3D fcts
- Discrete "fcts"
- vector functions.

Chapter 12 provides a background to talk about vector fcts in ch 13 & 3D fcts in ch 14.

$\mathbb{R}^3$: The axes & the right hand rule

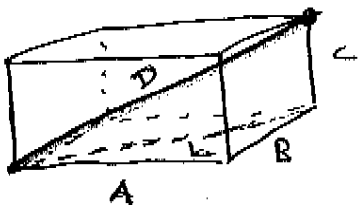


$$\mathbb{R}^3 = \{(x,y,z) \mid x,y,z \in \mathbb{R}\}$$

Ex1: Plot $x=4$ and $z=-2$ (planes)

Ex2: Plot $z=y+1$ and $y=x^2+1$ (surfaces)

The Distance Formula in $\mathbb{R}^3$



$$L^2 = A^2 + B^2$$

$$D^2 = L^2 + C^2$$

$$= A^2 + B^2 + C^2$$

$$\Rightarrow D = \sqrt{A^2 + B^2 + C^2}$$

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And if $A = \Delta x = (x_2 - x_1)$

$B = (y_2 - y_1)$

$C = (z_2 - z_1)$ then the distance from (x_1, y_1, z_1) to (x_2, y_2, z_2) is given by D where $D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$

Ex3: Find the distance from $P_1(1, 2, 3)$ to $P_2(2, -5, 8)$

Find the eqt of a sphere w/radius r centered at (a, b, c)

Ex4: What is $x^2 + y^2 + z^2 = 4x - 2y$ (a sphere)

Hint: complete the square twice

Ex5: Describe $1 \leq x^2 + y^2 + z^2 \leq 25$

Ex6: Describe $x^2 + y^2 = 9$