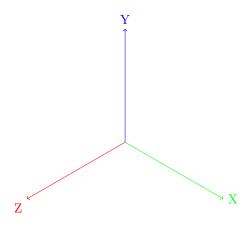
Vectors and 3-Dimensional Space

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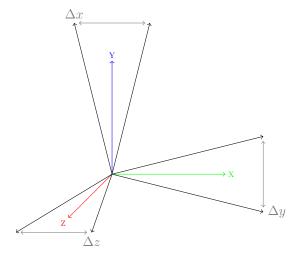
1/30/2023

1 Visualizing a 3D Space

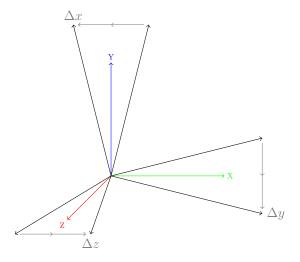
Objects can move in 3 ways with respect to a position, and **vectors** are used to represent this. Vectors include both a direction and a distance.



If we take the gray lines in the figure below:



and assign each of them a direction:



We now have vectors!

2 Vectors

Mathematically, vectors are represented as a variable with an arrow on-top of it:

 $\vec{\mathbf{a}}$

Above, we have a vector named ${\bf a}$. This vector has various components:

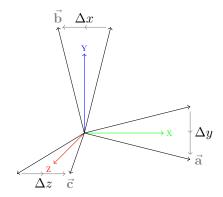
 $\mathbf{a} = \text{magnitude (distance)}$

 $\mathbf{a}_x = \mathbf{x}$ distance

 $\mathbf{a}_y = \mathbf{y}$ distance

 $\mathbf{a}_z = \mathbf{z}$ distance

Lets label our figure from before with vectors:



We can say that:

$$\vec{\mathbf{a}} = \Delta y$$

$$\vec{\mathbf{b}} = \Delta x$$

$$\vec{\mathbf{c}} = \Delta z$$

These vectors would be known as **displacement vectors**, which are the simplest type of vectors and thus make for a good introductary example.