Lines
Using Beamer

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Definition of a line

- Lines are defined as a set of points
- Lines can be defined in 2D or 3D
- To describe a line, you need to know a point and a direction
- Vectors are helpful to define a line

Vector basics

- Vectors are identified as bolded text, or a line or arrow over the variable
- Vectors can be defined by a triple of numbers, for each basis direction
- Vectors are added by connecting tails to heads
- A point can be represented by a vector going from the origin to that point

Vector equation of a line

- If we know one point and the direction, we can describe the whole line
- The vector equation for a line is given by:
- $\vec{r} = \vec{r_0} + t * \vec{d}$

Parametric equation of a line

If we have the coordinates for each of the vectors, we can define:

- $\vec{r} = \ <x, y, z>$
- $\vec{d} = \ <a, b, c>$
- $\vec{r_0} = \ <x_0, y_0, z_0>$

This leads to the parametric equations:

- $x = x_0 + at$
- $y = y_0 + bt$
- $z = z_0 + ct$

Symmetric equations of a line

We can solve for t, to get the symmetric equations:

- $t = \frac{x-x_0}{a} = \frac{y-y_0}{b} = \frac{z-z_0}{c}$

Skew lines

Unlike in 2D, in 3D, lines can be not and yet still not intersect. These are called skew lines. In order to prove, you need to:

- show not parallel by showing that there is no C such that $\vec{d_1} = C\vec{d_2}$
- show no intersection by looking at the system of equations for both lines, assuming that there is some $< x, y, z >$ that is on both lines