Math 12, Fall 2007

Lecture 3

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10/01/07

Outline

1. Recap and overview
   - Last class
   - Quick review of reading topics
2. Further discussion
   - Group Work
3. Summary
4. Next class

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Dot Poduct

- dot product measures angle: $\vec{u} \cdot \vec{v} = |\vec{u}||\vec{v}| \cos(\theta)$
- Projections, components
- Work: $W = \vec{F} \cdot \vec{D}$

Cross product

- measures volume/area
- torque: $\vec{\tau} = \vec{r} \times \vec{F}$
- cross product is perpendicular to components
- $|\vec{u} \times \vec{v}| = |\vec{u}||\vec{v}| \sin(\theta)$

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Concepts from reading
Lines

- Lines:

$$\vec{r} = \vec{r}_0 + t\vec{v}$$

- Lines are determined by a point and a direction
- Parametric form: $\vec{r} =< x, y, z >$, $\vec{r}_0 =< x_0, y_0, z_0 >$, $\vec{v} =< a, b, c >$

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

- Symmetric form:

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

Concepts from reading

Planes

- A plane is determined by a point and a normal vector:

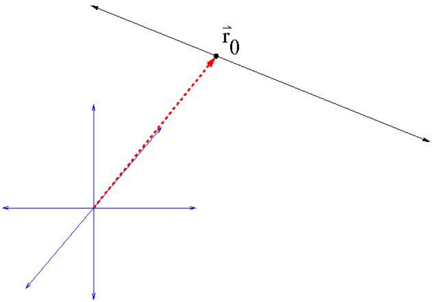
$$\vec{n} \cdot (\vec{r} - \vec{r}_0) = 0$$

- Letting $\vec{n} =< a, b, c >$, $\vec{r} =< x, y, z >$, $\vec{r}_0 =< a_0, y_0, z_0 >$, we can reduce this to the scalar equation of the plane:

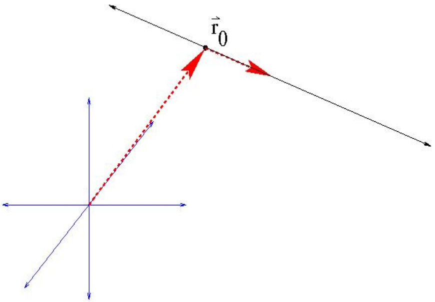
$$ax + by + cz + d = 0$$

where $d = -(ax_0 + by_0 + cz_0)$

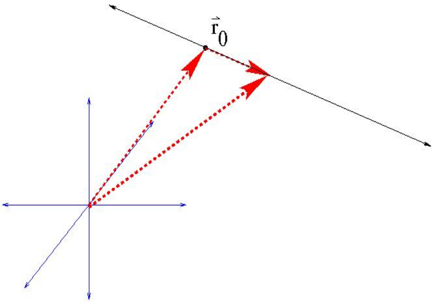
Geometric derivation of the line



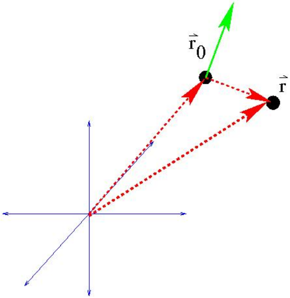
Geometric derivation of the line



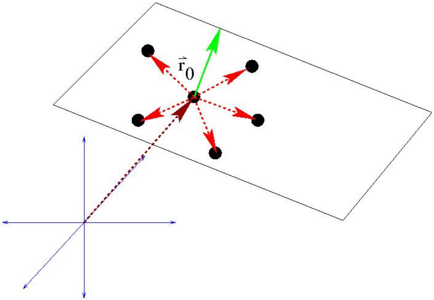
Geometric derivation of the line



Geometric derivation of a plane



Geometric derivation of a plane



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Problems to work on

From elementary geometry, there are many ways to characterize lines and planes. Generate an algorithm for each case to determine the vector equation of the line/plane using the given data.

- Lines
  1. Two points determine a line
  2. Two intersecting planes determine a line
- Planes
  1. Three non-colinear points determine a plane
  2. Two parallel lines determine a plane
  3. Two intersecting lines determine a plane
  4. A point and a line determine a plane

Summary

Lines and Planes!

Work for next class

- Reading: 14.1,14.2
- Practice Problems: 14.1 #1,10,15; 14.2 #3,9
- f07hw4