LECTURE OUTLINE

Planes

Professor Leibon

Math 8

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Goals

Equations for planes
Distances between various objects

Planes

A plane containing a point $\vec{r}_0 =< x_0, y_0, z_0 >$ can be described as the positions determined by all of the vectors at $\vec{r}_0$ that are perpendicular to a fixed vector, the plane's *normal*. In other words all the $\vec{r}$ that satisfy

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

As an equation, a plane is all (x, y, z) such that

$$a(x - x_0) + b(y - y_0) + c(z - z_0) = 0,$$

where $\vec{n} =< a, b, c >$. This is called the *scalar equation of the plane*. (While $ax + by + cz = d$, is called the plane's *linear equation*.)

Examples

1. Find an equation of plane perpendicular to $< 1, 2, -5 >$ that contains the point $(-1, 0, 3)$.

2. Find an equation of a plane that contains the points $(1, 1, -3)$, $(2, 3, 4)$ and $(0, -7, 8)$.

3. Find the point on the line $< 1, 1, 2 > t + < 2, -3, 4 >$ that intersects the plane in part 2.

4. Find an equation of the line of intersection of the planes in parts 1 and 2.

5. Find the distance between the plane in part 1 and the point $(2, 1, 9)$.