MATH 249

Today

1. Questions from last time
2. 12.5 and 10.1: Parametric curves, lines, and planes. (Understand how to represent curves parametrically in 3D and how to represent lines and planes algebraically.)
3. WeBWorK

10.1 Parametric Curves

1. x and y depend on a third variable, the **parameter**: $x = x(t), y = y(t)$.
2. This allows graphs even when y isn't a function of x.
3. It is sometimes possible to eliminate the parameter (algebraically) to express y as a function of x.

12.5 Lines and Planes

Used for:

- Physics (paths of particles, linear approximation)
- Computer graphics (linear approximation)
- Linear approximations all over: economics, chemistry, physics, ...

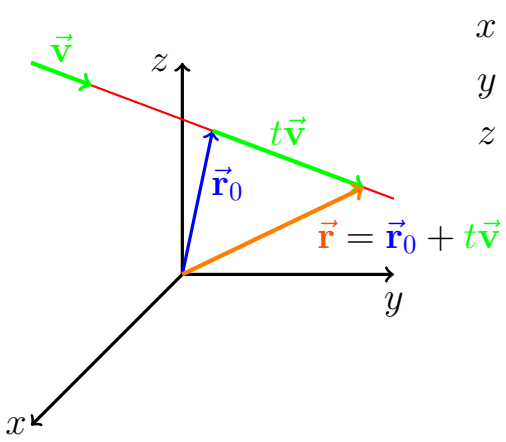
1. For both lines and planes, we need a point and a direction.

   Lines

   Let $\vec{r}_0 =< x_0, y_0, z_0 >$ and $\vec{v} =< a, b, c >$. Take $\vec{v}$ to be the direction of the line.

2. Vector equation of a line: $\vec{r} = \vec{r}_0 + t\vec{v}$
3. Line segment from $\vec{r}_0$ to $\vec{r}_1$: $\vec{r} = (1-t)\vec{r}_0 + t\vec{r}_1$

4. Parametric equations of a line:

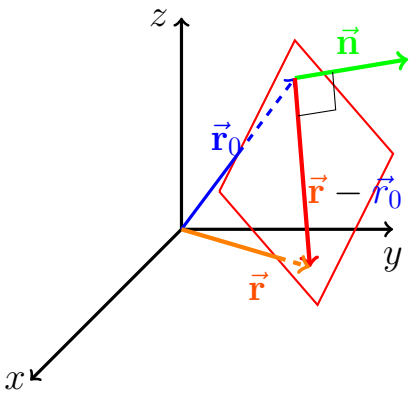


$$x = x_0 + at$$
$$y = y_0 + bt$$
$$z = z_0 + ct$$

Planes

Let P be a plane. Let $\vec{r}_0 =< x_0, y_0, z_0 >\in P$, and let $\vec{n} =< a, b, c >$ be orthogonal to P.

5. Vector equation of plane: $\vec{n} \cdot (\vec{r} - \vec{r}_0) = 0$
6. Vector equation of plane: $\vec{n} \cdot \vec{r} = \vec{n} \cdot \vec{r}_0$
7. Scalar equation of plane:
   $a(x - x_0) + b(y - y_0) + c(z - z_0) = 0$



8. The angle between two planes is defined to be the angle between their normals.
9. Examples: p. 802: 6-12, 13, 19, 23-38 [29], (possible: 39-42, 55-56, 69-70)
10. WeBWorK: 2, 3 (implicit), 5, 6, 10 (wants the cosine!)

Next Time

1. Watch 12.6 [$\sim$ 31 minutes]
2. Homefun 3 (CalcPlot, Python).