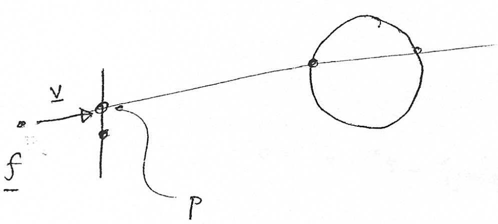
Ray Intersection

- Sphere. $(x - x_0)^2 + (y - y_0)^2 + (z - z_0)^2 - r^2 = 0$

(Implicit Surface)



- point on ray $\underline{f} + t\underline{v}$, $t \geq 0$
- this point is on the sphere if eqn above vanishes
- eqn $(\underline{x} - \underline{x}_c)\cdot(\underline{x} - \underline{x}_c) - r^2 = 0$

Substitute

$$(\underline{f} + t\underline{v} - \underline{x}_c)\cdot(\underline{f} + t\underline{v} - \underline{x}_c) - r^2 = 0$$

$$t^2(\underline{v}\cdot\underline{v}) + t\left(2\,\underline{v}\cdot(\underline{f} - \underline{x}_c)\right) + \left[(\underline{f} - \underline{x}_c)\cdot(\underline{f} - \underline{x}_c) - r^2\right] = 0$$

quadratic eqn.

Q: What is geometric meaning of

$$\text{disc} \begin{matrix} < \\ = \\ > \end{matrix} 0 \quad ?$$