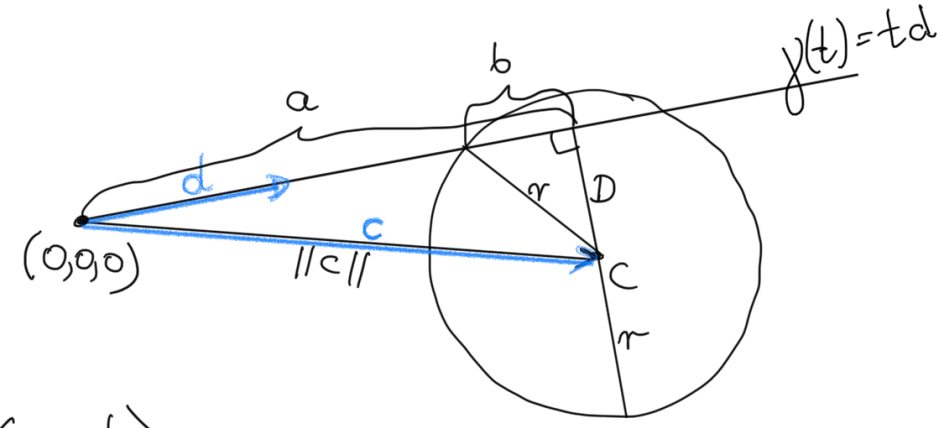

$$a = \langle c, d \rangle$$

$$D^2 = \|c\|^2 - a^2 = \|c\|^2 - \langle c, d \rangle^2$$

$$D = \sqrt{\|c\|^2 - \langle c, d \rangle^2}$$

Cases: $D < r \Rightarrow$ two solution

$D = r \Rightarrow$ one

$D > r \Rightarrow$ no solution

$$t_{1,2} = a \pm b$$

$$b^2 = r^2 - D^2$$

$$t_{1,2} = \langle c, d \rangle \pm \sqrt{r^2 - D^2}$$

The intersections are given by substituting $t_{1,2}$ into ray equation.