

Question 8

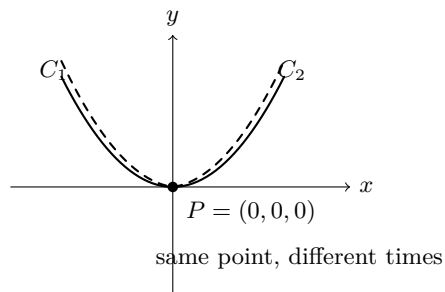
Curves C_1 and C_2 are given by

$$\vec{r}_1(t) = \langle t, t^2, t^3 \rangle, \quad \vec{r}_2(s) = \langle 1 - s, (1 - s)^2, s - 1 \rangle.$$

Determine all geometric intersection points. If particles use their displayed parameters as time, determine whether they collide.

Question 8 – Solution

Strategy Geometric intersection permits $t \neq s$; collision requires $t = s$ as well as equal positions.



Intersection From the first coordinate, set $u = 1 - s = t$. The second coordinates then agree automatically. The third coordinates require $t^3 = -u = -t$, so $t(t^2 + 1) = 0$. Thus $t = 0$ and $s = 1$, giving the sole intersection $\boxed{(0, 0, 0)}$.

Collision The required times differ, so particles using the displayed parameters do not collide.

Check At $t = 0$, $\vec{r}_1 = \vec{0}$; at $s = 1$, $\vec{r}_2 = \vec{0}$.