Indian Institute of Information Technology, Vadodara

Course - Curves & Surfaces for Computer Graphics
Course Code - SC303
Prof. P Shah

EndSem

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1. Have a careful look at paper model of a cone provided on the next page. Assume that the cone tip is origin in R^3 and the base rests on a plane parallel to $x - y$ plane. Give a C^3 parametrization[1] $S(u, v), (u, v) \in U \subset R^2$ of this cone, i.e. a function $S : U \to R^3$.

2. How do you describe curves γ and c on the surface of cone?[2]

3. With identified parametrization $S(u, v)$, calculate Riemannian metric g_{ij}, where $E = g_{11} = \langle S_u, S_u \rangle, G = g_{22} = \langle S_v, S_v \rangle, F = g_{12} = g_{21} = \langle S_u, S_v \rangle$ and S_u and S_v are partial derivatives $\frac{\partial S}{\partial u}$ and $\frac{\partial S}{\partial v}$ respectively.

4. What is the expression off length of a curve on cone?

5. Is γ a geodesic on S? What is the length of γ? Find out the geodesic and normal curvature at every point of $\gamma \subset S$.

6. Is c a geodesic on S? What is the length of c? Find out the geodesic and normal curvature at every point of c on cone.

7. Use Euler-Lagrange minimization to minimize length functional and find corresponding ODEs.

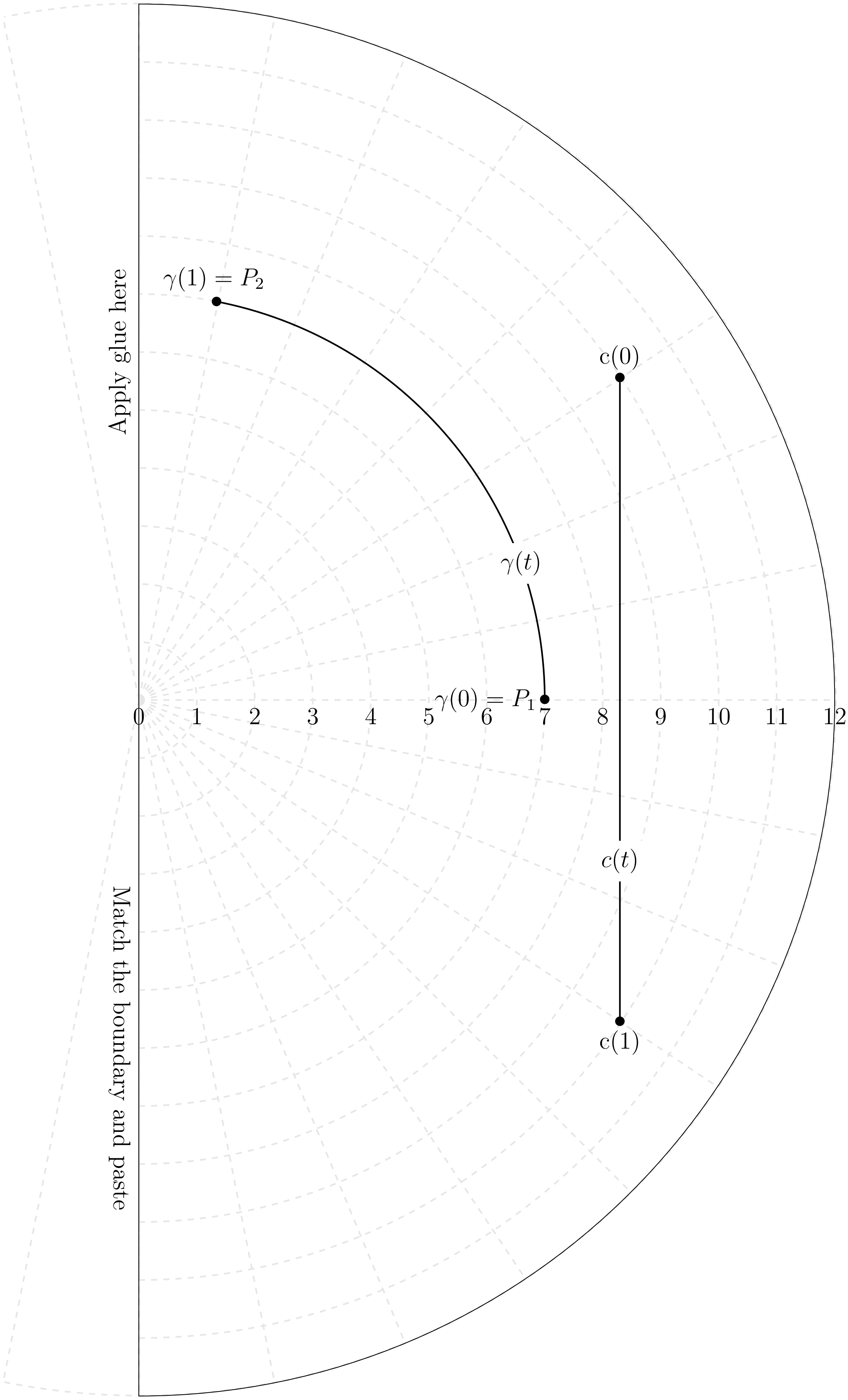
8. Use **bvp4c** and compute minimum length curve between P_1 and P_2. What is the length of this curve? Is it same as γ?

`“The goal is to turn data into information, and information into insight.”`

Carly Fiorina

[1]Discount cone tip from the parametrization.

[2]For $\gamma : [0, 1] \to S$ and $c : [0, 1] \to S$, find $u^\gamma(t)$ and v^γ such that $\gamma(t) = S(u^\gamma(t), v^\gamma(t))$, similarly find $u^c(t)$ and $v^c(t)$ such that $c(t) = S(u^c(t), v^c(t))$.


Apply glue here
$\gamma(1) = P_2$
c(0)
$\gamma(t)$
$\gamma(0) = P_1$
0 1 2 3 4 5 6 7 8 9 10 11 12
$c(t)$
c(1)
Match the boundary and paste

Answers