

HW 1 (40 points) - To be handed by Tuesday, Aug 13  
in the class or by email

1. (10 points) Prove the congruence theorem for plane curves.
2. (10 points) How does  $G$  (the inner product matrix on the tangent space) change under reparametrisation?
3. (20 points) Let  $E = \|\vec{r}_u\|^2$ ,  $F = \langle \vec{r}_u, \vec{r}_v \rangle$ , and  $D = \|\vec{r}_v\|^2$ . Prove that the Gaussian curvature

$$K(u, v) = \frac{\begin{vmatrix} -E_{vv}/2 + F_{uv} - D_{uu}/2 & E_u/2 & F_u - E_v/2 \\ F_v - D_u/2 & E & F \\ D_v/2 & F & D \end{vmatrix} - \begin{vmatrix} 0 & E_v/2 & D_u/2 \\ E_v/2 & E & F \\ D_u/2 & F & D \end{vmatrix}}{(ED - F^2)^2}$$

and that it is invariant under reparametrisation.