Answer all the questions, justify your answers and show your work.

1. Prove one of the following two propositions:
   A. The semicircles that are centered on the $x$-axis are geodesics of the upper half-plane geometry.
   B. In the context of neutral geometry, the assumption that the sum of the angles of every triangle is $180^\circ$ implies Euclid’s 5th postulate.

2. Identify the following two rigid motions relative to the square $ABCD$ below.
   a. $R_{A,90^\circ} \circ \gamma_{AC}$
   b. $\gamma_{BD} \circ \gamma_{CD}$

3. Find the inversion, if one there be, that performs the following transformation (if it exists specify $C$ and $k$; otherwise, explain clearly why not):
   a. The circle $x^2 + y^2 = 4$ into the straight line $x = 25$;
   b. The circle $x^2 + y^2 = 100$ into the circle $x^2 + (y - 11)^2 = 25$.

4. Let $k, m, n$ be the perpendicular bisectors to a triangle’s three sides. Identify $\rho_n \circ \rho_m \circ \rho_k$. (Hint: Recall that any triangle’s perpendicular bisectors are concurrent.)

5. Find the hyperbolic distance between the points (-3, 4) and (3, 4).