

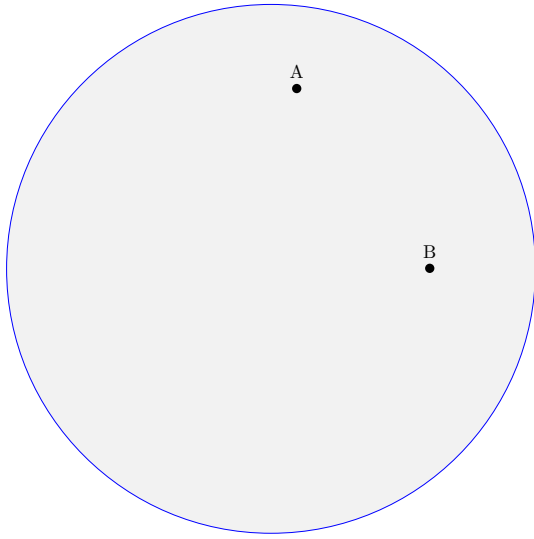
Name: \_\_\_\_\_

**MA495 Exam 2** April 25, 2020

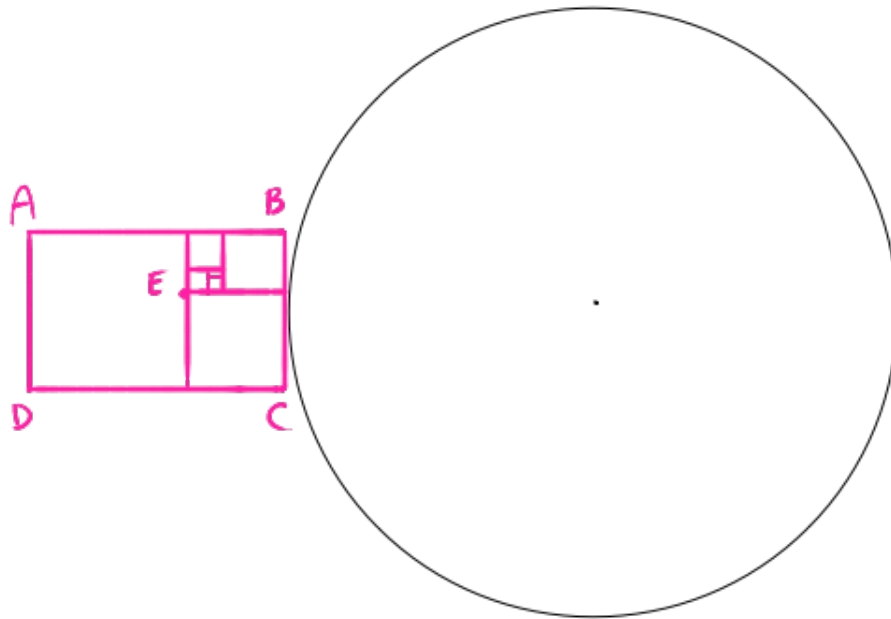
1. In the Poincare' model, draw a sketch that shows that the converse to the Alternate Interior Angle Theorem does not hold in hyperbolic geometry.

2. Describe in words and pictures how one constructs the P-center of a circle in the Poincare' model.

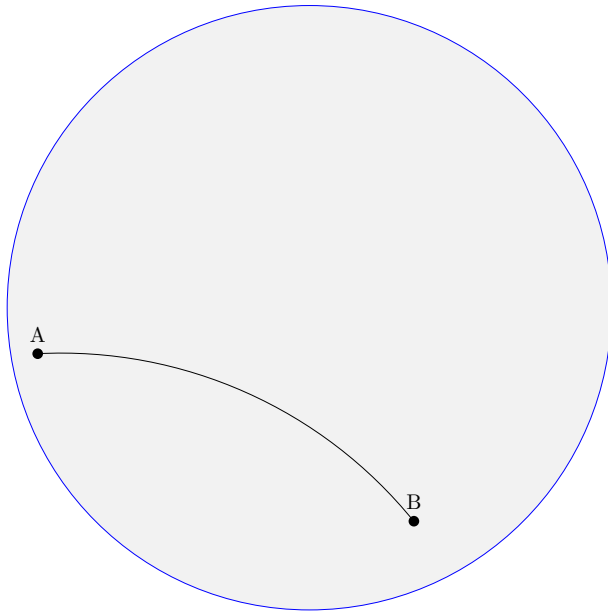
3. Describe how to find the P-line through points A and B in the P-model.



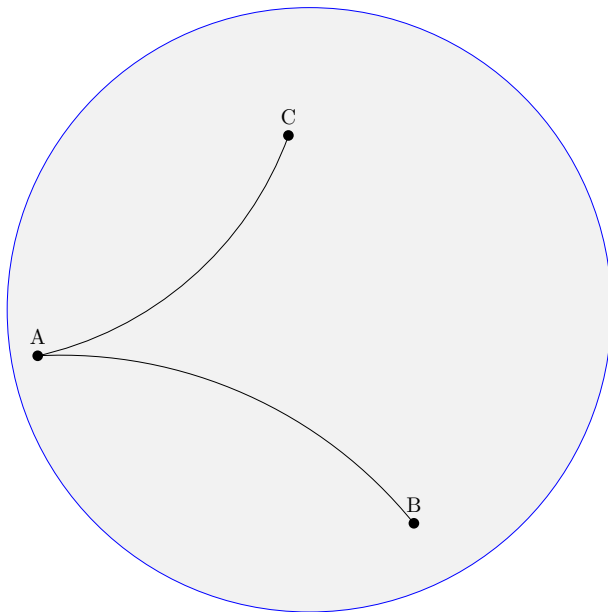
4. Sketch the inversion of the image below about the circle.



5. Let  $AB$  be the segment below in the Poincaré model of hyperbolic geometry. Construct the midpoint  $AB$ . Justify your reasoning.



6. Show how to find the angle bisector of the angle below in the Poincaré model of hyperbolic geometry.



7. The main goal of this problem is to show explicitly that the Pythagorean Theorem does not hold in hyperbolic geometry. Let  $\widehat{OA}$  denote the Poincare lengths of the hyperbolic segment OA. Compute Poincare lengths of OB and AB and determine which of the following is true:

$$(\widehat{OA})^2 + (\widehat{OB})^2 < (\widehat{AB})^2 \text{ or } (\widehat{OA})^2 + (\widehat{OB})^2 > (\widehat{AB})^2$$

$$\widehat{OA} = \underline{\hspace{2cm}}$$

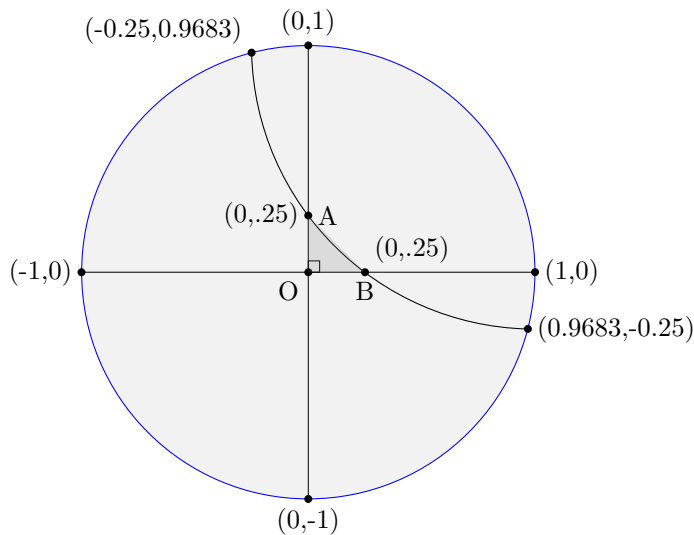
$$(\widehat{OA})^2 = \underline{\hspace{2cm}}$$

$$\widehat{OB} = \underline{\hspace{2cm}}$$

$$(\widehat{OB})^2 = \underline{\hspace{2cm}}$$

$$\widehat{AB} = \underline{\hspace{2cm}}$$

$$(\widehat{AB})^2 = \underline{\hspace{2cm}}$$



8. (a) Find the Euclidean distance between  $(0, .99)$  and  $(0, .999)$ . \_\_\_\_\_

(b) Find the Poincaré distance between  $(0, .99)$  and  $(0, .999)$ . \_\_\_\_\_