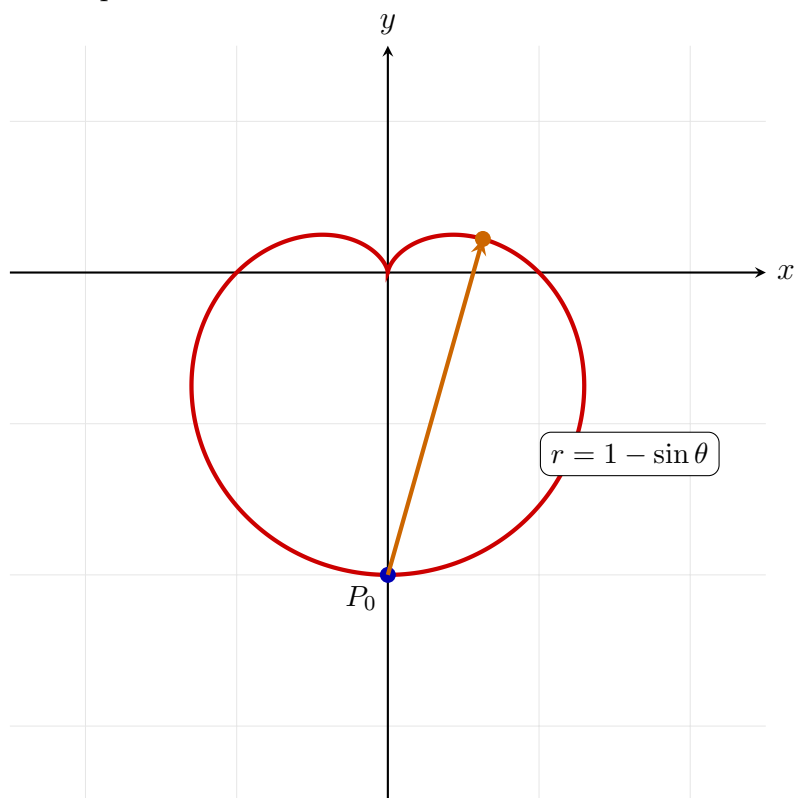


Problem 4: Valentine's Day Special: Geometry of a Heart

Consider the heart in the cartesian plane given by the polar equation $r = 1 - \sin(\theta)$ and Valentine's arrow represented by the line segment (or ray) whose base point is $(0, -2)$ and the tip is the point where the arrow intersects the heart. What is the maximum length of this arrow?



As always, show your work, fully explain and justify your answer. A solution mainly obtained by computers or calculators will not be accepted.

Posting Date 2/13/2026. Submit solutions to Noah Aydin, Mathematics Department, RBH 319 by e-mail or hard-copy by noon on Sunday, March 1, 2026. An email submission must be a single pdf file. Hard copy submissions must be dropped in the file holder at my office door (Hayes 319) and must include a time stamp.