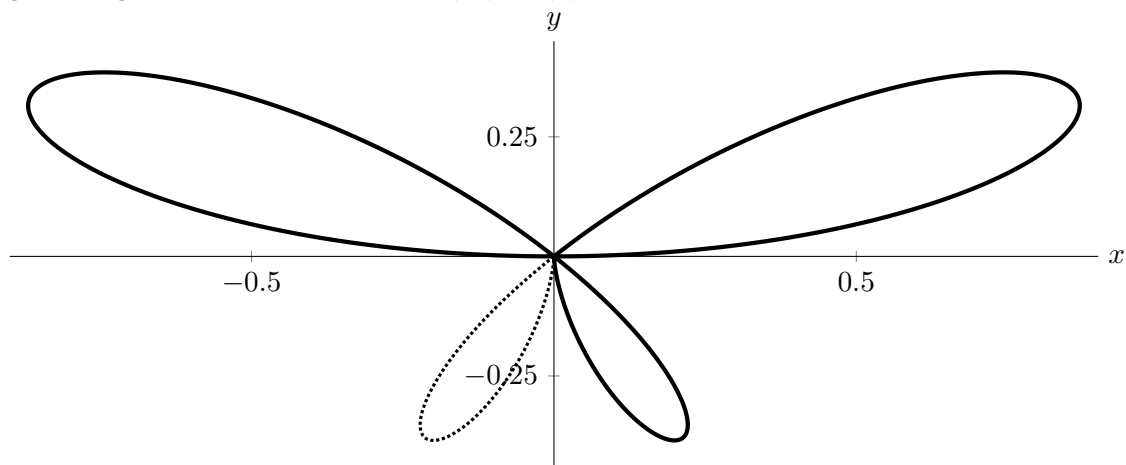


4. [9 points] The polar curve $r = \sin(4\theta) \cos(\theta)$ for $0 \leq \theta \leq \pi$ is shown below.



Note that there are two “large loops” and two “small loops”.

For reference, note that for this curve, $\frac{dr}{d\theta} = 4 \cos(\theta) \cos(4\theta) - \sin(\theta) \sin(4\theta)$

- a. [3 points] For what values of θ does the polar curve $r = \sin(4\theta) \cos(\theta)$ trace once around the “small loop” in the third quadrant? (This portion of the curve is indicated by the dotted line.) Give your answer as an interval of θ values between 0 and π .

Answer: _____

- b. [3 points] Write, but do not evaluate, an expression involving one or more integrals that gives the total arc length of the two small loops.

Answer: Arc Length = _____

- c. [3 points] Write, but do not evaluate, an expression involving one or more integrals that gives the area of the region that is enclosed by the polar curve $r = 2$ but is outside the curve $r = \sin(4\theta) \cos(\theta)$.

Answer: Area = _____