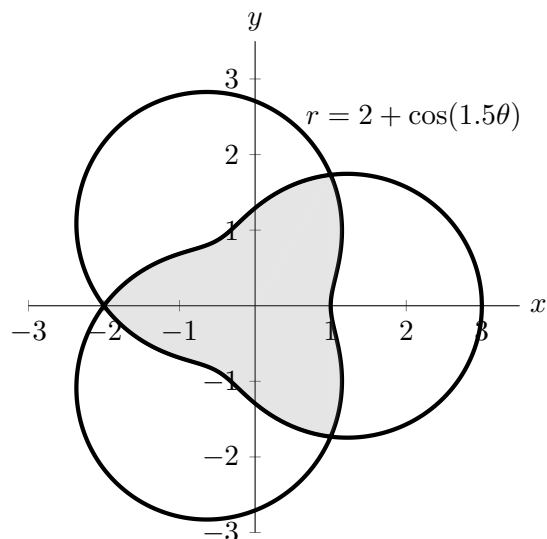


## 6. [11 points]

Leight Vloss has instructed his Star Children to run laps on the Trail of Atonement. The Trail of Atonement is best described as the polar curve  $r = 2 + \cos(1.5\theta)$  where  $r$  is measured in kilometers. An aerial view of the trail is illustrated below.



- a. [4 points] Leight stands on a pedestal in the center of the trail (at the origin). What is the furthest distance, in km, a Star Child gets from Leight on the Trail of Atonement? List all angles  $\theta$  in  $[0, 4\pi)$  where this distance  $r$  is achieved.

**Answer:** Greatest distance: \_\_\_\_\_

**Answer:**  $\theta =$  \_\_\_\_\_

- b. [3 points] Write an integral in terms of  $\theta$  which represents the total length, in km, of the Trail of Atonement.

- c. [4 points] The shaded innermost region of the trail is called the Sacred Heart. Write an expression involving one or more integrals which represents the area, in  $\text{km}^2$ , of the Sacred Heart.