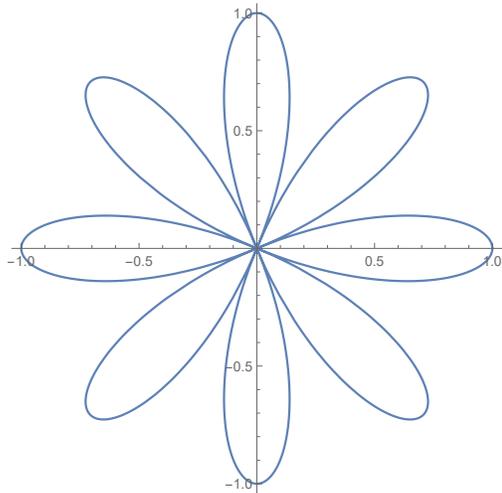
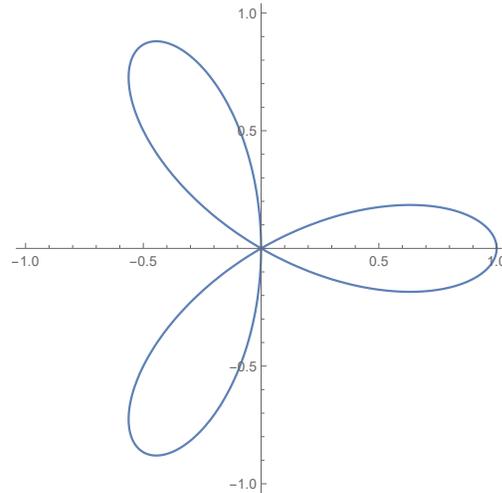


Polar Remix (feat. Shorlando Shbloom)
MATH 116-022 (Lutz)

1. Write separate integrals giving the areas of the regions bounded by the following rose curves. Then compute the perimeter of one lobe of each.

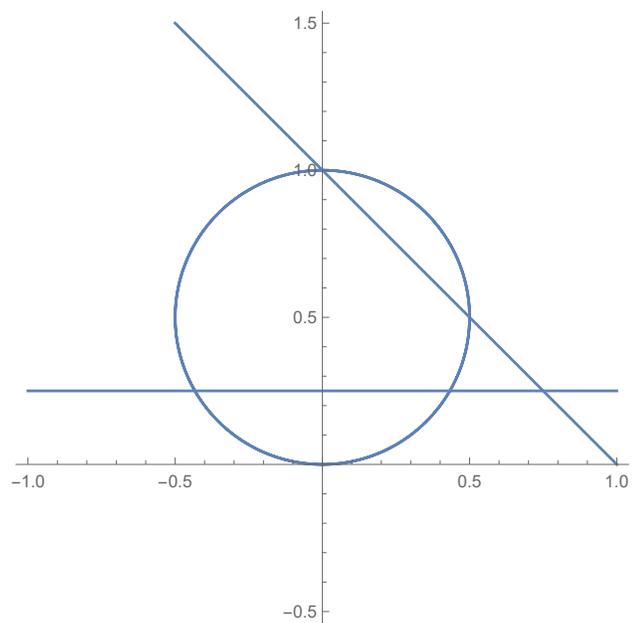


(a) $r = \cos(4\theta)$



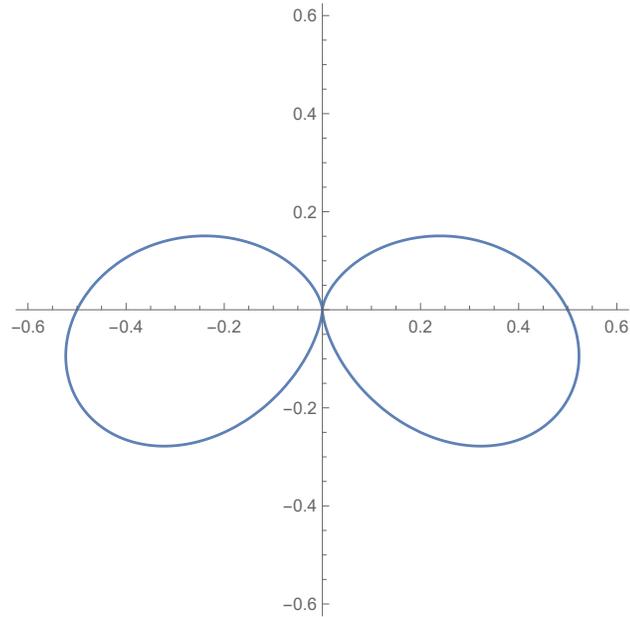
(b) $r = \cos(3\theta)$

2. Write an integral giving the area of the region bounded by the circle $r = \sin(\theta)$, the line $y = 1 - x$, and the line $y = \frac{1}{4}$, pictured below. (Hint: The going is easier if you translate down by $\frac{1}{2}$.)

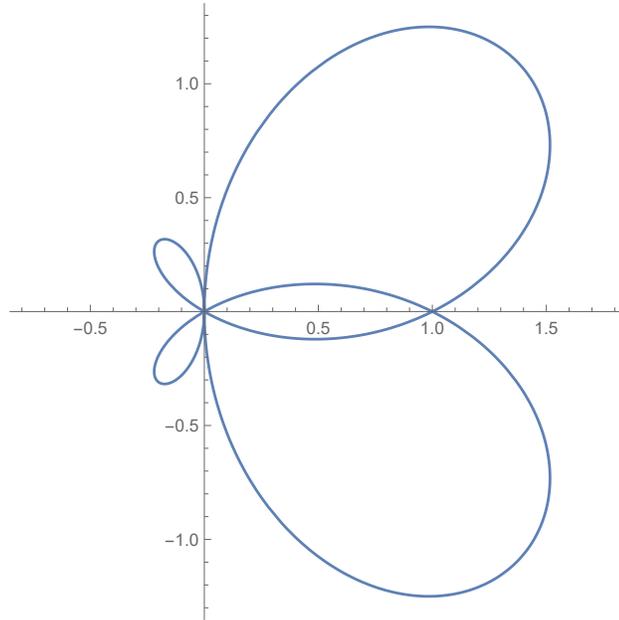


3. Shorlando Shbloom is customizing his new sunglasses online. He's decided on lenses outlined by the polar curve $r = \cos^2(\theta)/(2 + \sin(\theta))$, plotted below. Answer the following questions about his dope new shades.

- (a) For which $\theta \in [0, 2\pi)$ is the curve farthest from the origin?
- (b) What is the perimeter of one lens?

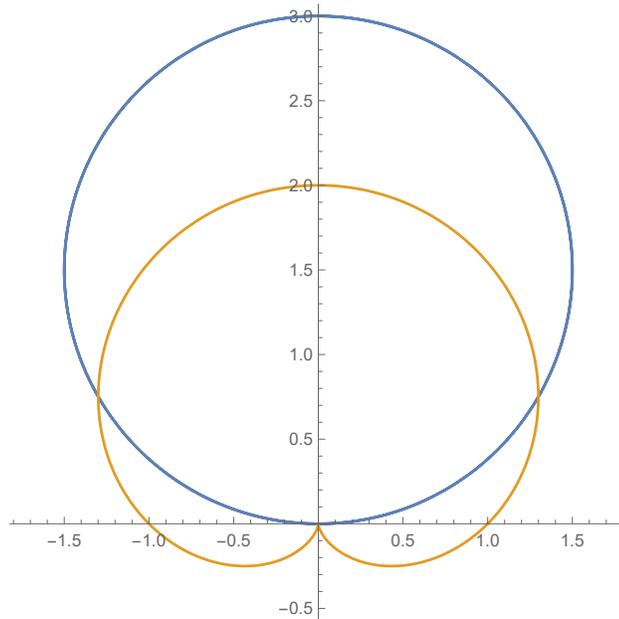


4. Shorlando has been turned into a horrible bean creature whose shape is the polar curve $r = \sin(2\theta) + \cos(\theta)$, pictured below. Answer the following questions about his hot new look.
- What is the lowest point on the curve?
 - What are the rightmost points on the curve?
 - What is the tangent line at the points you found in (b)?
 - Shorlando's new liver is the football-shaped region between his horrible bean lobes. What is the area of his new liver?



5. Shorlando's new bean rump is stuck.

- (a) He implores you to compute the total area of stuck rump, which is outside the circle $r = 3 \sin(\theta)$ and inside the limaçon $r = 1 + \sin(\theta)$, as pictured below.
- (b) After wiggling his bean body spiritedly, he has freed some precious rump. Compute the new area of stuck rump, which is now the region inside the limaçon and below the x -axis.



6. In the transformation, Shorlando's heart turned into the Arby's logo. The transformation is captured by the family of polar curves $r = \cos(5t) + \mu \cos(t)$, where μ varies in some interval $[a, b]$. Answer the following questions to help out poor Shorlando.
- Assuming the extreme cases (i.e., $\mu = a$ and $\mu = b$) are among those pictured below, what are the values of a and b ?
 - For which value of μ is the tangent line to the curve at $\theta = \frac{\pi}{20}$ horizontal? Give your answer in exact form.

