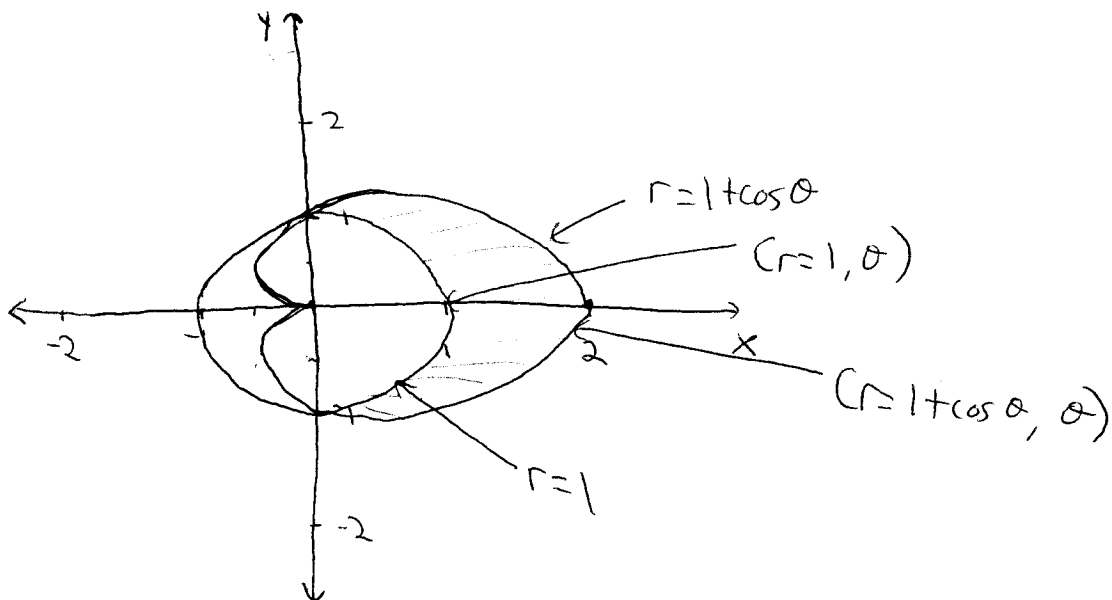
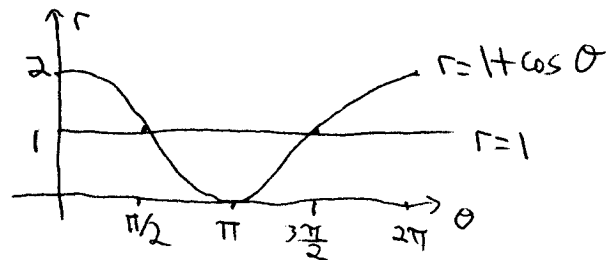


Quiz 1: Solution

Find the area of the region that lies inside the cardioid $r=1+\cos\theta$ and outside the circle $r=1$.

First, draw the graphs:



$$\text{Area} = \int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \int_1^{1+\cos\theta} r \, dr \, d\theta$$

$$= 2 \cdot \int_0^{\frac{\pi}{2}} \int_1^{1+\cos\theta} r \, dr \, d\theta$$

$$= 2 \cdot \int_0^{\frac{\pi}{2}} \left[\frac{r^2}{2} \right]_1^{1+\cos\theta} d\theta$$

$$= \int_0^{\frac{\pi}{2}} r^2 \Big|_1^{1+\cos\theta} d\theta$$

$$= \int_0^{\frac{\pi}{2}} [(1+\cos\theta)^2 - 1] d\theta$$

$$= \int_0^{\frac{\pi}{2}} (1 + 2\cos\theta + \cos^2\theta - 1) d\theta$$

$$= \int_0^{\frac{\pi}{2}} (2\cos\theta + \cos^2\theta) d\theta = \int_0^{\frac{\pi}{2}} \left(2\cos\theta + \frac{1}{2}(1+\cos 2\theta) \right) d\theta$$

$$= 2\sin\theta + \frac{\theta}{2} + \frac{1}{4}\sin 2\theta \Big|_0^{\frac{\pi}{2}}$$

$$= 2 + \frac{\pi}{4}$$

$$= \boxed{\frac{8+\pi}{4} : \text{Final Answer}}$$