$$r = \frac{2a}{1+\cos\theta} \quad ; \quad \frac{dr}{d\theta} = \frac{-2a}{(1+\cos\theta)^2}$$

$$r = \frac{2a}{2\cos^2\theta/2}$$

$$r = a\sec^2\theta/2$$

$$\frac{dr}{d\theta} = 2a\sec(\theta/2)\sec(\theta/2)\tan(\theta/2) \times \frac{1}{2}$$

$$\frac{dr}{d\theta} = a\sec^2(\theta/2)\tan(\theta/2)$$

So

$$ds = \sqrt{a^2\sec^4\theta/2 + a^2\sec^4(\theta/2)\tan^2(\theta/2)}\, d\theta$$

$$ds = \sqrt{a^2\sec^4(\theta/2)\left[1+\tan^2(\theta/2)\right]}\, d\theta$$

$$ds = a\sec^2(\theta/2)\sqrt{1+\tan^2(\theta/2)}\, d\theta$$

$$ds = a\sec^2(\theta/2)\cdot\sec(\theta/2)\, d\theta$$

$$ds = a\sec^3(\theta/2)\, d\theta$$

$$L = \int_{-\pi/2}^{\pi/2} ds \quad \Rightarrow \quad L = 2\int_{0}^{\pi/2} a \sec^3(\theta/2)\, d\theta$$

$$L = 2 \times \frac{a}{2}\left[\sec\frac{\theta}{2}\tan\frac{\theta}{2} + \ln\left|\sec\frac{\theta}{2} + \tan\frac{\theta}{2}\right|\right]_0^{\pi/2}$$

$$L = a\left[\sec(\pi/4)\tan(\pi/4) + \ln\left|\sec(\pi/4) + \tan(\pi/4)\right|\right]$$

$$L = a\left[\sqrt{2} + \ln\left[\sqrt{2}+1\right]\right]$$