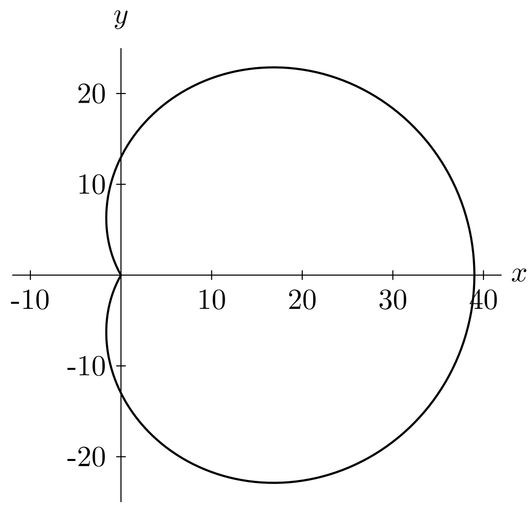
2. [6 points] Your friend the goliath frog is going to decorate the boundary of his lily pad with a string of tiny flowers. The boundary of the lily pad is given by a portion of the curve $r = 13 + 26\cos(\theta)$ where r is measured in inches and θ is measured in radians. The part of the curve that traces out the lily pad is shown below in the xy-plane.



If the goliath frog is going to decorate only the part of the boundary of the lily pad for which $x \le 0$, write an expression involving integrals for the length of the string of flowers required. Do not evaluate your integral.

Solution: The length of the string of flowers is given by

$$\int_{-\frac{2\pi}{3}}^{-\frac{\pi}{2}} \sqrt{(13+26\cos(\theta))^2 + (26\sin(\theta))^2}\,d\theta + \int_{\frac{\pi}{2}}^{\frac{2\pi}{3}} \sqrt{(13+26\cos(\theta))^2 + (26\sin(\theta))^2}\,d\theta.$$

3. [4 points] We can approximate the value of $\ln(1.5)$ by using the fact that $y = \ln(x)$ solves the differential equation

$$\frac{dy}{dx} = \frac{1}{x}$$

Approximate $\ln(1.5)$ by using Euler's method for the differential equation above with initial condition $y(1) = 0$ and with $\Delta x = 0.25$. Fill in the table with the y-values obtained at each step.

Solution: We are given that $y(1) = 0$. Using Euler's method with $\Delta x = 0.25$ we compute

$$y(1.25) \approx y(1) + y'(1)\Delta x = 0 + (1)(0.25) = 0.25,$$
$$y(1.50) \approx y(1.25) + y'(1.25)\Delta x \approx 0.25 + (0.8)(0.25) = 0.45.$$

x	y
1.00	0
1.25	0.25
1.50	0.45

Thus, $\ln(1.5) \approx$ 0.45