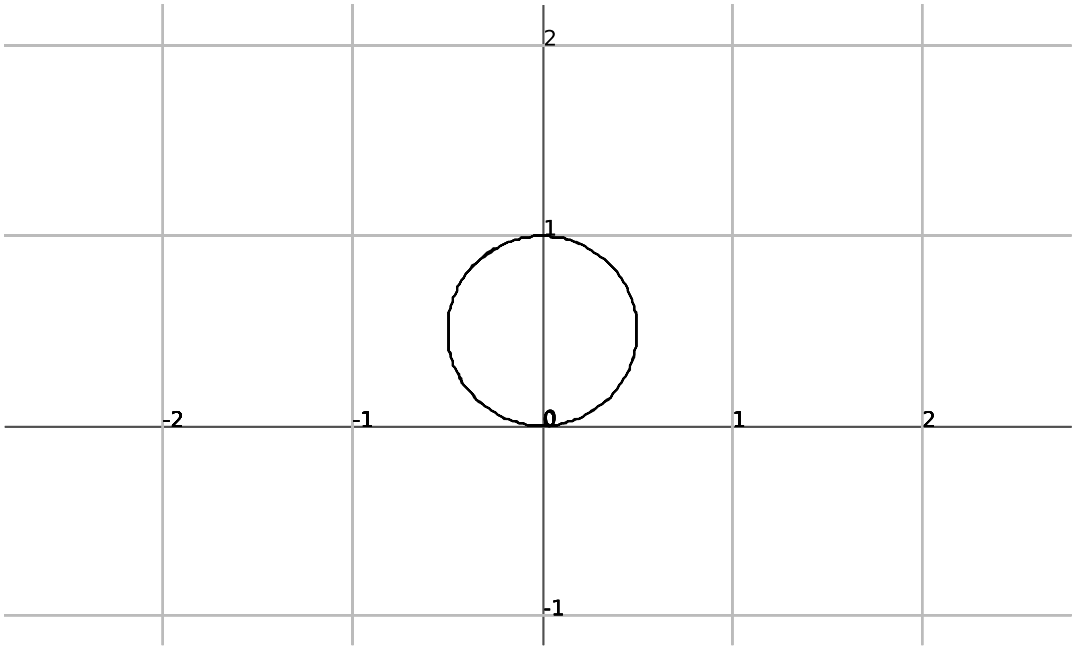
Basic Polar Curves Handout

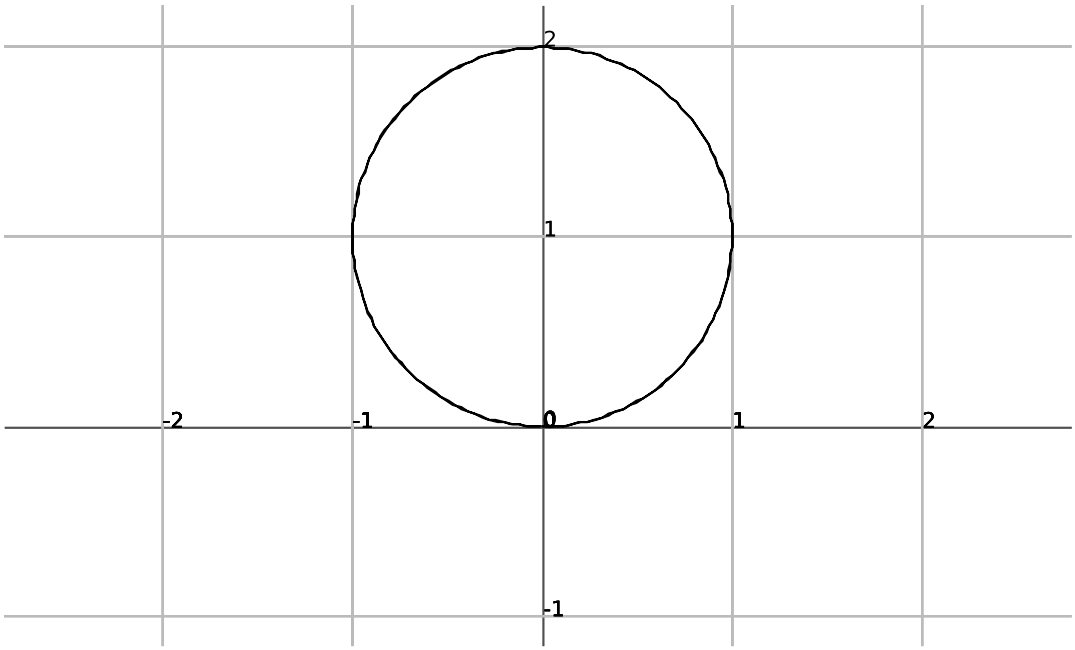
Math 12-D. Benedetto

Recognize a few of the following basic polar curves. Try and understand the sketches.

- $\boxed{r = \sin\theta}$ circle of radius $\frac{1}{2}$ centered at $\left(0, \frac{1}{2}\right)$

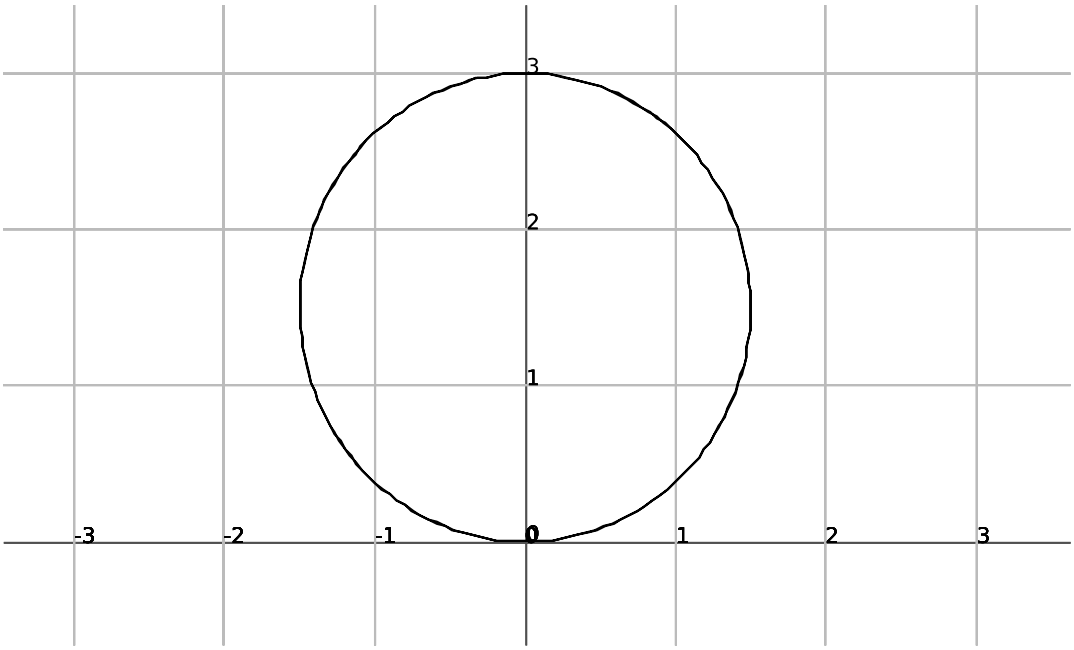


- $\boxed{r = 2\sin\theta}$ circle of radius 1 centered at $(0, 1)$



Note: These circles cycle through and close one full loop as θ ranges from say $\theta = 0$ to just $\theta = \pi$.

- $\boxed{r = 3\sin\theta}$ circle of radius $\frac{3}{2}$ centered at $(0, \frac{3}{2})$



pattern continues here

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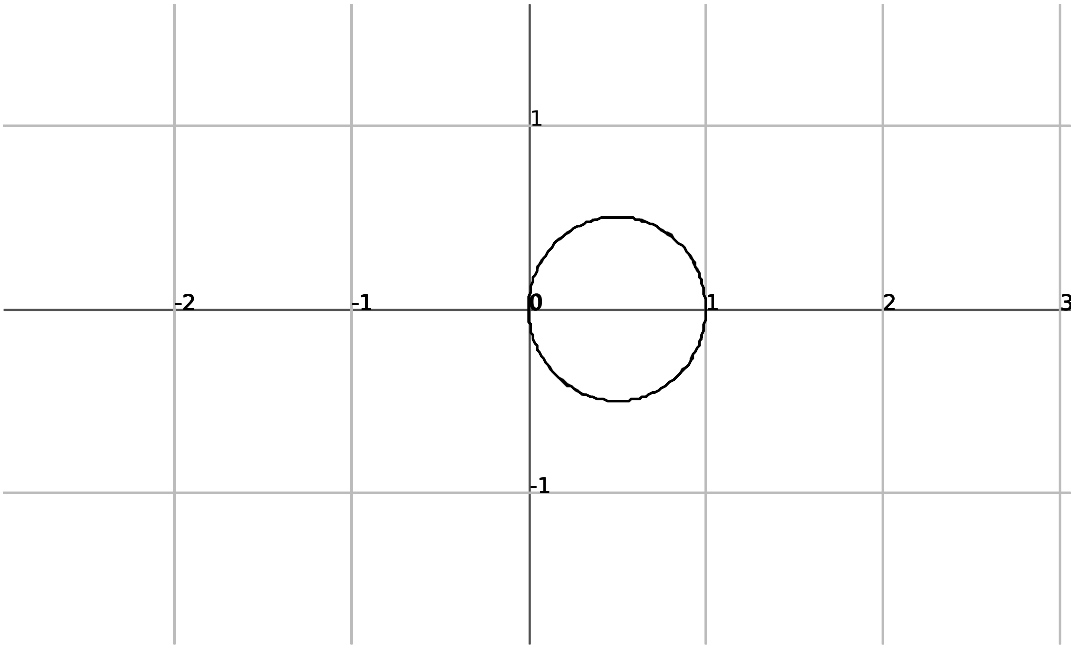
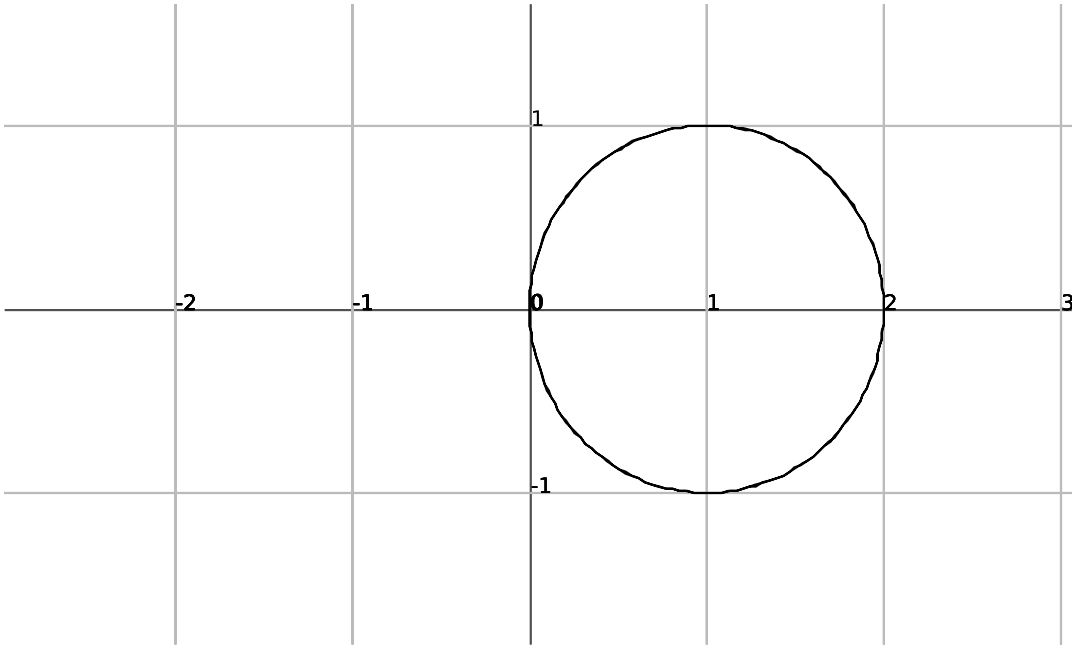
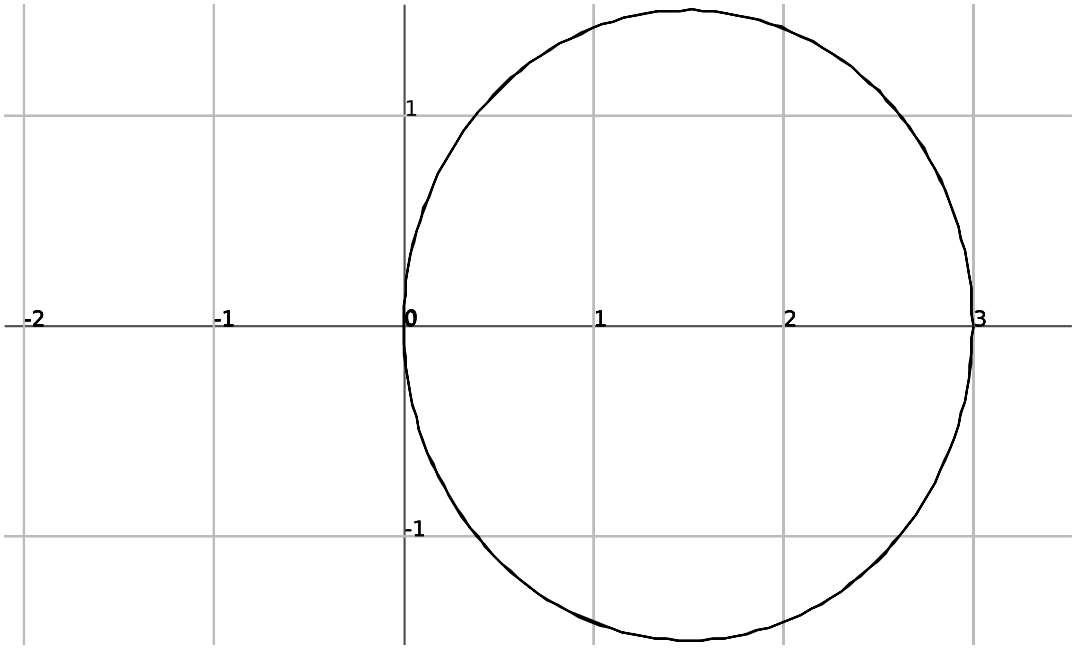
- $\boxed{r = \cos\theta}$ circle of radius $\frac{1}{2}$ centered at $\left(\frac{1}{2}, 0\right)$



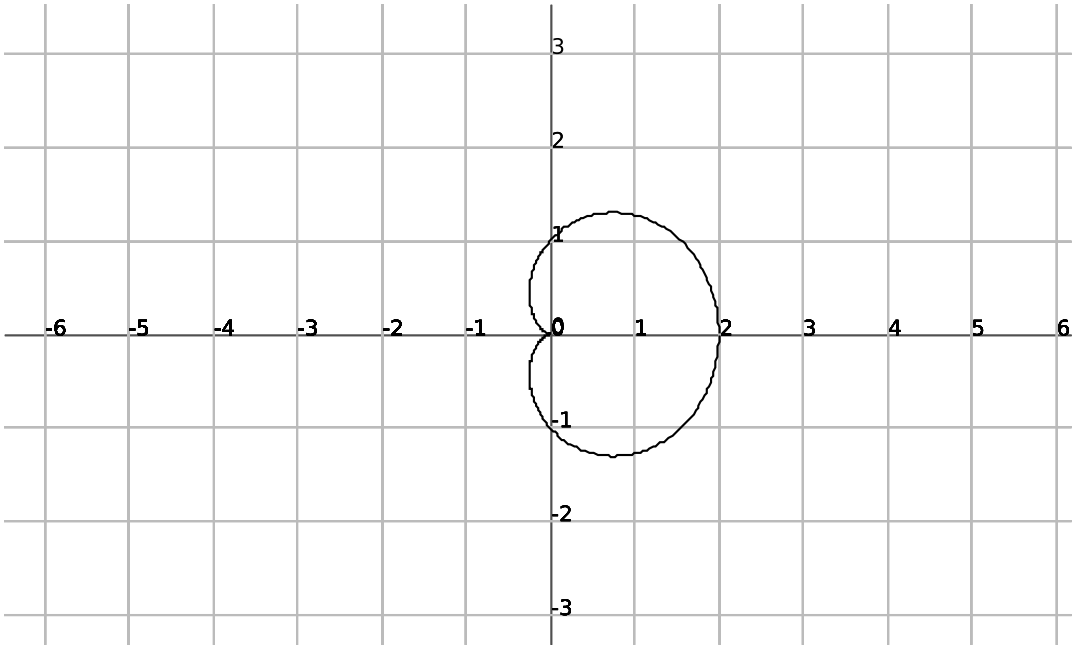
- $\boxed{r = 2\cos\theta}$ circle of radius 1 centered at $(1, 0)$



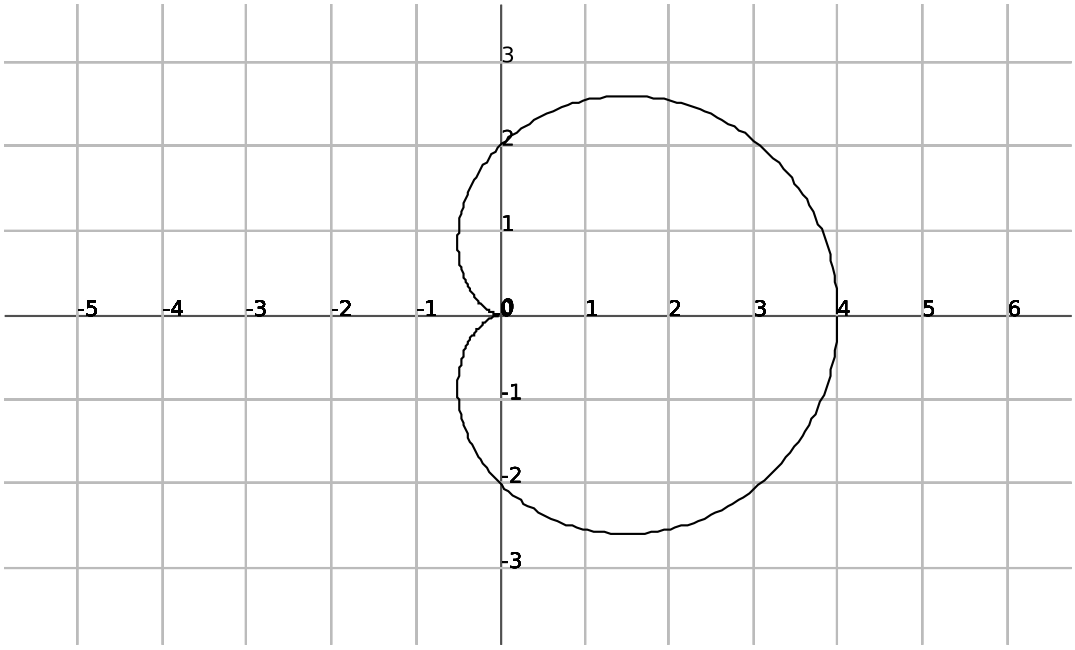
- $\boxed{r = 3\cos\theta}$ circle of radius $\frac{3}{2}$ centered at $(\frac{3}{2}, 0)$



- $\boxed{r = 1 + \cos\theta}$ cardioid (think about $r = 1 - \cos\theta$)

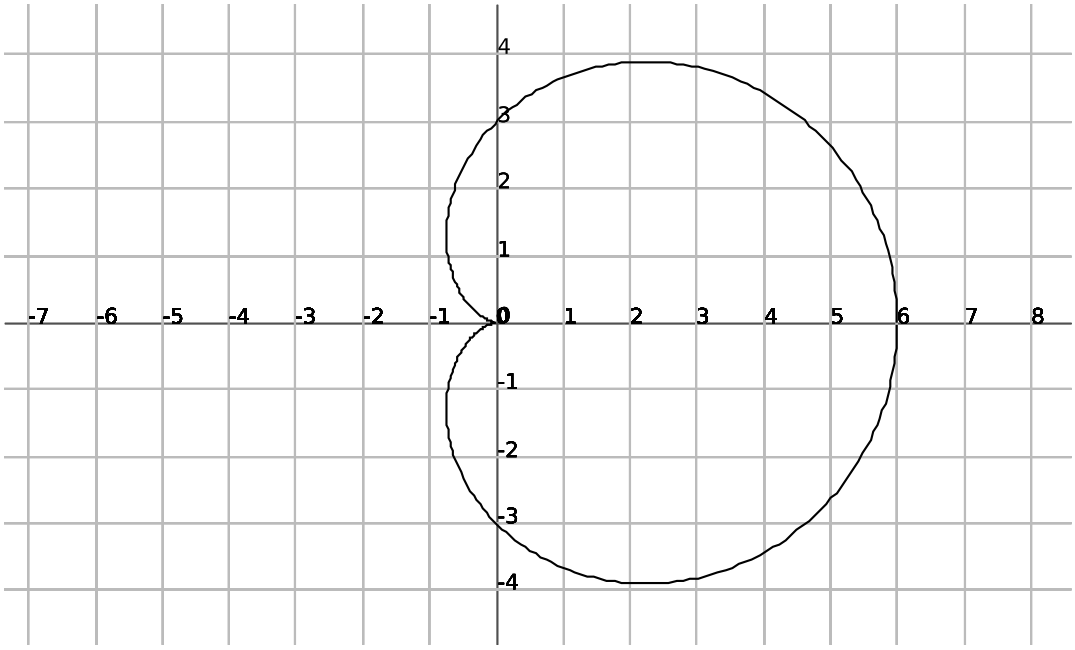


- $\boxed{r = 2 + 2\cos\theta}$ cardioid (think about $r = 2 - 2\cos\theta$)



Note: These cardioids cycle through and close one full loop as θ ranges from say $\theta = 0$ to $\theta = 2\pi$.

- $\boxed{r = 3 + 3\cos\theta}$ cardioid (think about $r = 3 - 3\cos\theta$)



pattern continues here

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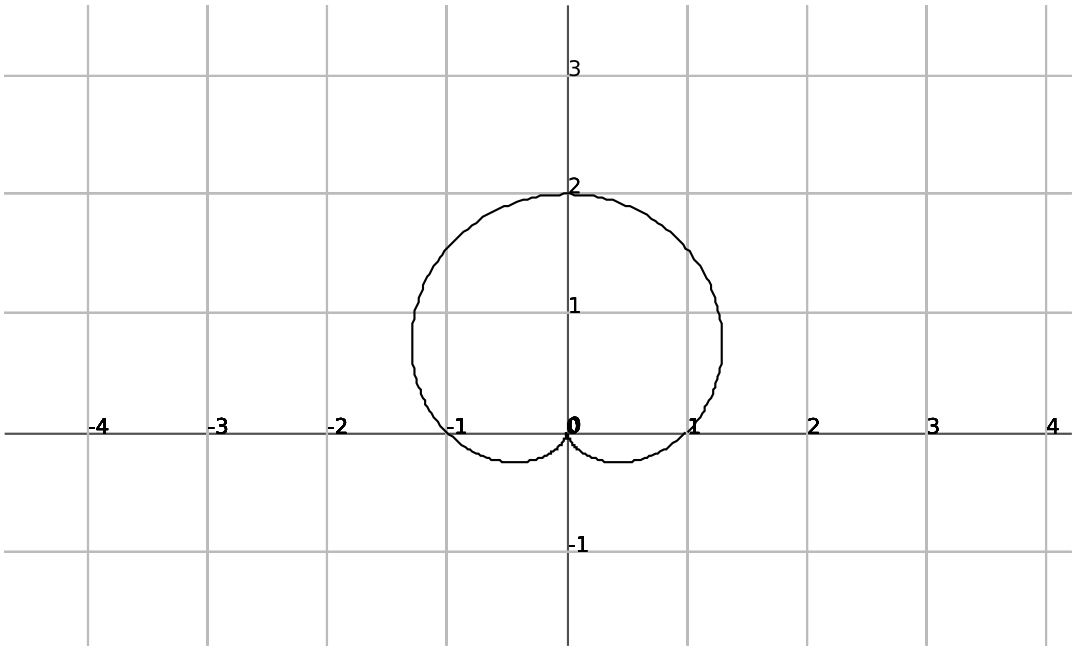
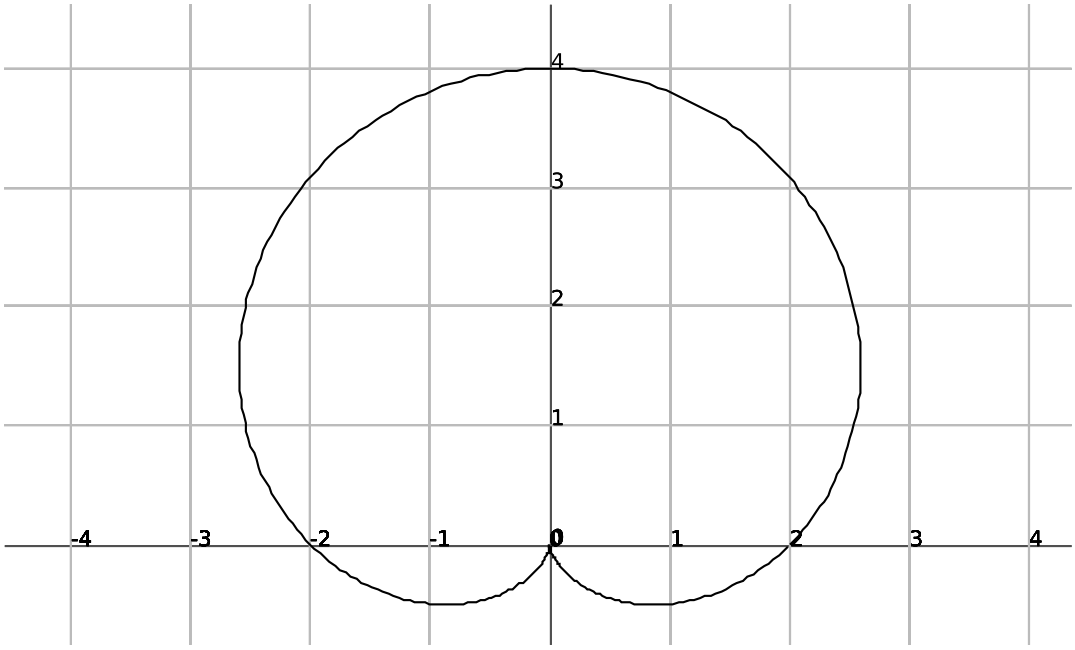
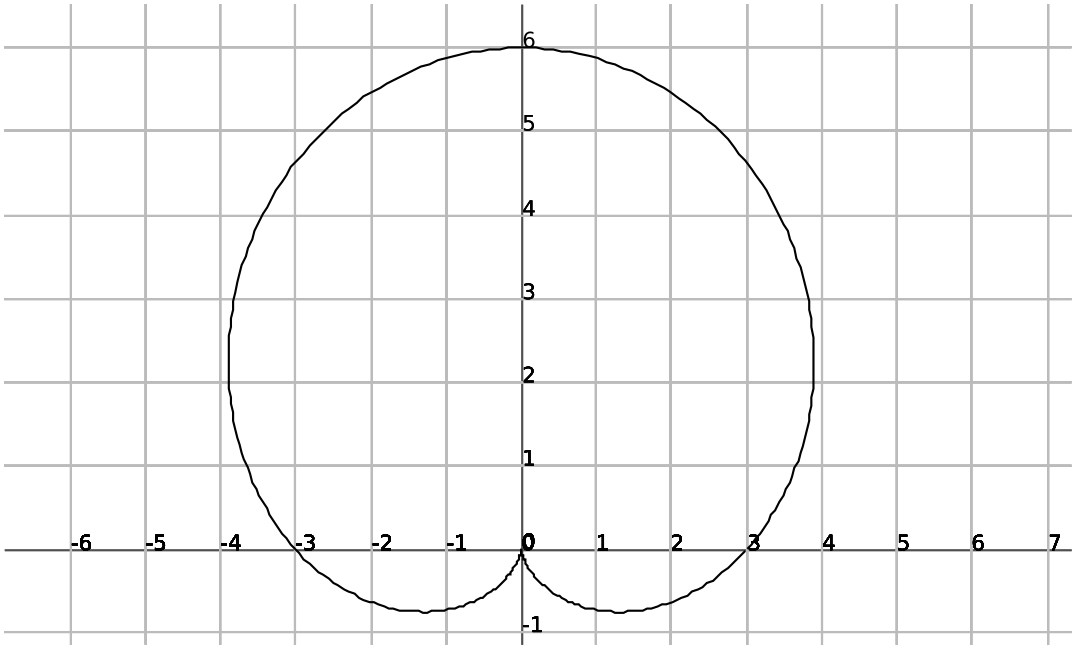
- $\boxed{r = 1 + \sin\theta}$ cardioid (think about $r = 1 - \sin\theta$)



- $\boxed{r = 2 + 2\sin\theta}$ cardioid (think about $r = 2 - 2\sin\theta$)



- $\boxed{r = 3 + 3\sin\theta}$ cardioid (think about $r = 3 - 3\sin\theta$)



You should also know how to sketch say $r = 3$ or $r = 1$. Recall the area formula for polar curves or intersections of 2 curves. The area is given by

$$A = \int_{\theta=\alpha}^{\theta=\beta} \frac{1}{2} r^2 \, d\theta \quad \text{or} \quad A = \int_{\theta=\alpha}^{\theta=\beta} \frac{1}{2} \left((\text{outer polar curve})^2 - (\text{inner polar curve})^2 \right) \, d\theta \, .$$