1 Use of the *subfigure* Package

As can be seen in Figure 1(c) of Figure 1 on page 2 of Section 1, some polar plots are very pretty.[1] However, the polar coordinate system is useful for much more than simply creating visually stimulating images.

Polar coordinates can be used to simplify some integration problems. For example, the circumference and area of a circle of radius x may be computed as

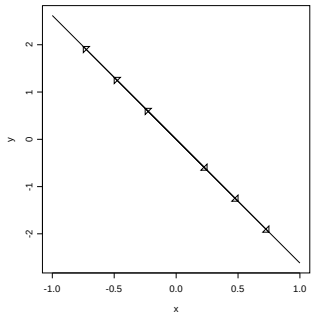
$$\begin{aligned} C &= \int_0^{2\pi} \int_0^x dr\ d\theta && (1) \\ &= \int_0^{2\pi} x\ d\theta \\ &= 2\pi x && (2) \end{aligned}$$

and

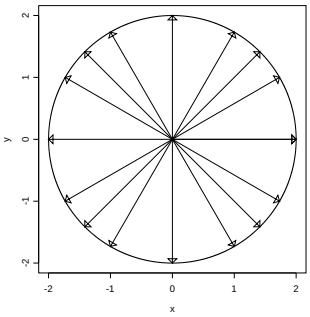
$$\begin{aligned} A &= \int_0^{2\pi} \int_0^x r\ dr\ d\theta && (3) \\ &= \int_0^{2\pi} \frac{x^2}{2}\ d\theta \\ &= \pi x^2 && (4) \end{aligned}$$

respectively. The final results (Eqs. 2 and 4) are well known.

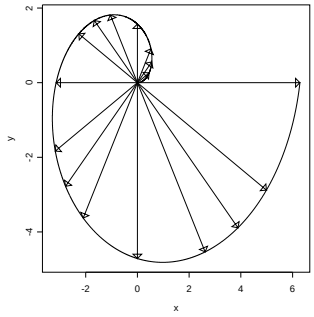
[1] Of course, beauty is in the eye of the beholder.



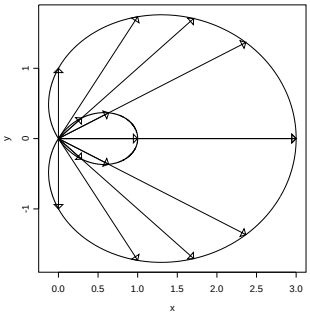
(a) Line with $\theta = \frac{5\pi}{6}$.



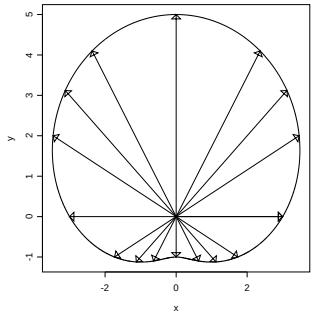
(b) Circle with $r = 2$.



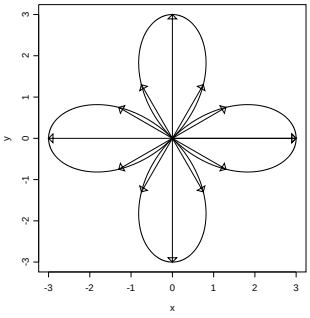
(c) Archimedian Spiral with $r = \theta$.



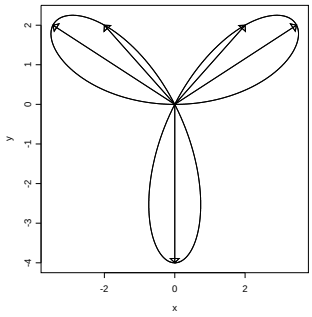
(d) Limacon with $r = 1 + 2\cos(\theta)$.



(e) Limacon with $r = 3 + 2\sin(\theta)$.



(f) Rose with $r = 3\cos(2\theta)$.



(g) Rose with $r = 4\sin(3\theta)$.

Figure 1: Plots of various shapes showing how polar coordinates can be used to simplify graphing.