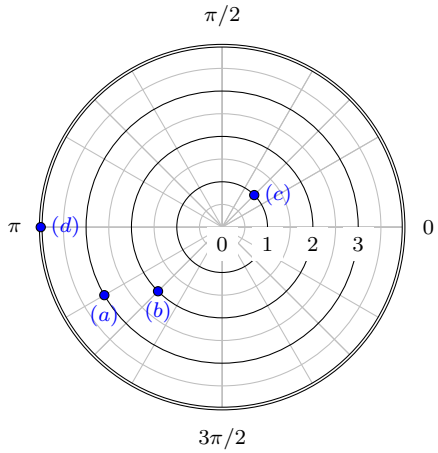
1. Plot each of the following points on the graph below:

   (a) $(r, \theta) = (3, \frac{7\pi}{6})$

   (b) $(r, \theta) = (2, -\frac{3\pi}{4})$

   (c) $(r, \theta) = (-1, \frac{5\pi}{4})$

   (d) $(r, \theta) = (4, \pi)$



2. Convert $(2, -2)$ to polar coordinates. Give two possible answers.

   Solution: $r = \sqrt{2^2 + 2^2} = 2\sqrt{2}$, and $\theta = \arctan(\frac{-2}{2}) = -\frac{\pi}{4}$. So we have $(r, \theta) = (2\sqrt{2}, -\frac{\pi}{4})$. Another possibility is $(2\sqrt{2}, \frac{7\pi}{4})$, or $(-2\sqrt{2}, \frac{3\pi}{4})$.

3. Give rectangular coordinates for these points:

   (a) $(r, \theta) = (3, \frac{5\pi}{4})$

   Solution: $(-\frac{3\sqrt{2}}{2}, -\frac{3\sqrt{2}}{2})$

   (b) $(r, \theta) = (-4, \frac{11\pi}{6})$

   Solution: $(-2\sqrt{3}, 2)$

4. Convert the following to rectangular coordinates:

   (a) $r = 8$

   Solution: $r^2 = 64$, so $x^2 + y^2 = 64$

   (b) $r = 2\sec\theta$

   Solution: $r\cos\theta = 2$, so $x = 2$, which is a vertical line.

5. Convert the following to polar coordinates:

   (a) $x^2 + y^2 = 25$

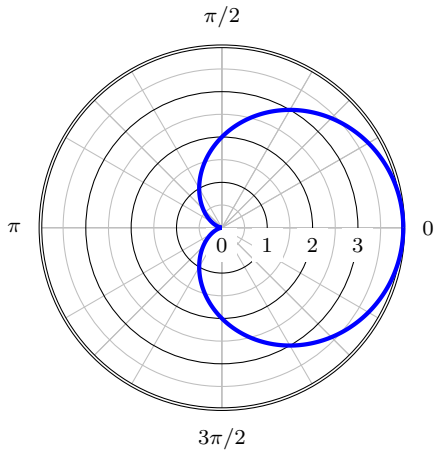
   Solution: $r = 5$

   (b) $y = 2x$

   Solution: $\frac{y}{x} = 2$, so $\theta = \arctan 2$.

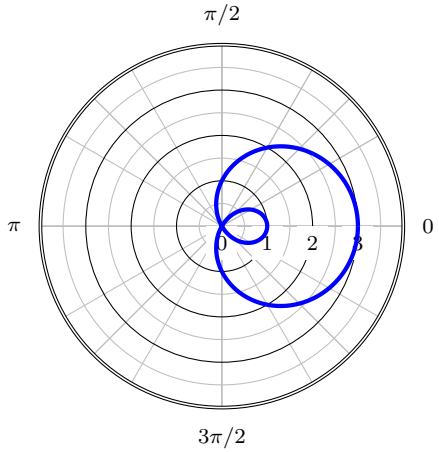
6. Graph the following polar equations. Note any values of θ where the graph hits the origin.

   (a) $r = 2 + 2\cos\theta$



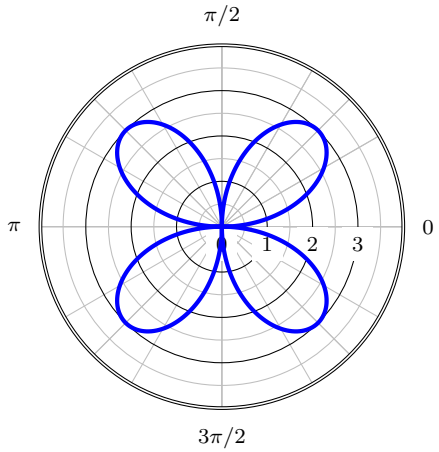
Solution: The graph hits the origin at $\theta = \pi$.

   (b) $r = 1 + 2\cos\theta$



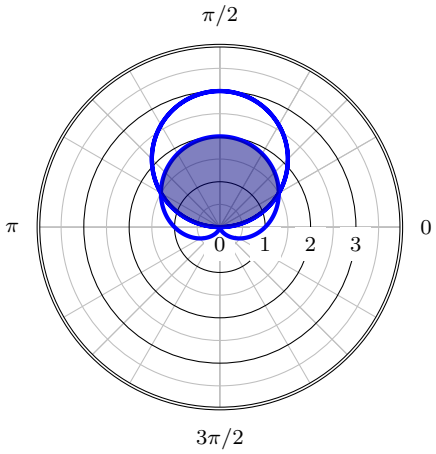
Solution: The graph hits the origin at $\theta = \frac{2\pi}{3}$ and $\theta = \frac{4\pi}{3}$.

(c) $r = 3\sin 2\theta$



Solution: The graph hits the origin at $\theta = \frac{\pi}{2}$ and $\theta = \pi$, $\theta = \frac{3\pi}{2}$, and $\theta = 2\pi$.

7. Shade the region that lies inside both of the curves $r = 1 + \sin\theta$ and $r = 3\sin\theta$. Find the intersection points.



Solution: The graphs intersect at $\theta = \frac{\pi}{6}$ and $\theta = \frac{5\pi}{6}$.