Polar Coordinates

Solutions should show all of your work, not just a single final answer.

1. Here are three points P in polar coordinates:

$$\text{(a)}\ \ P = \left(2, \frac{\pi}{4}\right), \qquad \text{(b)}\ \ P = \left(-3, \frac{3\pi}{4}\right), \qquad \text{(c)}\ \ P = \left(-1, -\frac{\pi}{3}\right).$$

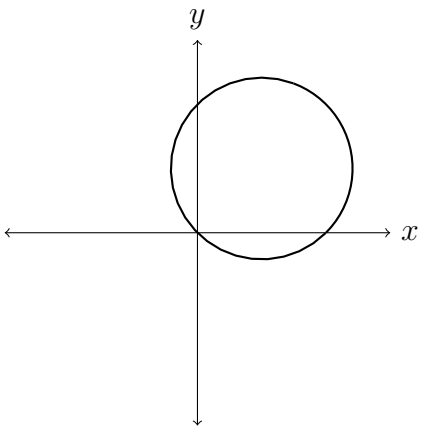
   For each of these do the following.

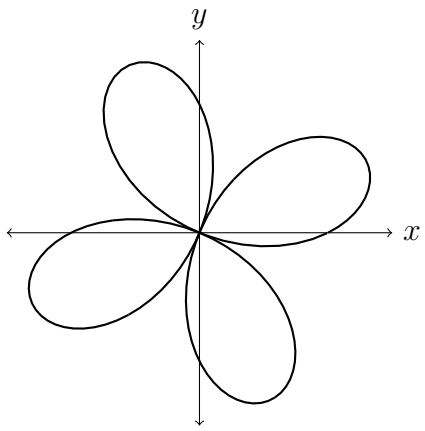
   (i) Convert P to Cartesian coordinates (give exact values, not approximations).

   (ii) Plot P in the xy-plane.

   (iii) Give two additional representations of P in polar coordinates.

2. Here are plots of the polar equations $r = \sin\theta + \cos\theta$ and $r = \sin(2\theta) + \cos(2\theta)$.





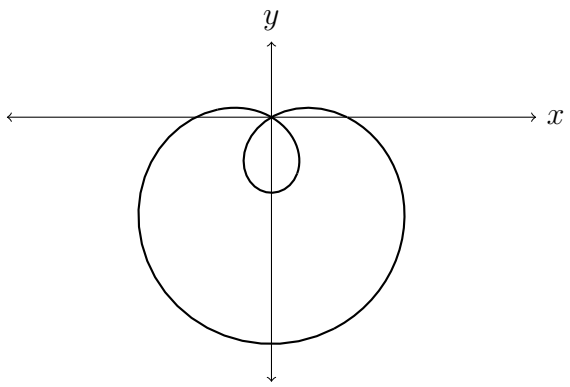
   Fill in the table below for each polar graph.

θ	$\sin\theta + \cos\theta$	(r, θ)	(x, y)
0			
$\pi/2$			
π			
$3\pi/2$			

θ	$\sin(2\theta) + \cos(2\theta)$	(r, θ)	(x, y)
0			
$\pi/2$			
π			
$3\pi/2$			

   Based on this table, and additional data if it seems needed, draw arrows on the curves (including on each loop of the second curve) to indicate the direction of increasing θ.

3. Here is a plot of the polar equation $r = 1 - 2\sin\theta$.



   (a) Mark the points on the curve for $\theta = 0, \pi/4, \pi/2$, and π, and then draw arrows on the curve (including on both the big and small loops) to indicate the direction of increasing θ.

   (b) Find the equation of the tangent line to the curve $r = 1 - 2\sin\theta$ at $(x, y) = (1, 0)$.

4. T/F (with justification)

   Every point in the plane besides the origin can be written in polar coordinates (r, θ) with $r < 0$.