MA 114 Worksheet #23: Polar coordinates

1. Convert from rectangular to polar coordinates:
   (a) $(1, \sqrt{3})$
   (b) $(-1, 0)$
   (c) $(2, -2)$
2. Convert from polar to rectangular coordinates:
   (a) $\left(2, \frac{\pi}{6}\right)$
   (b) $\left(-1, \frac{\pi}{2}\right)$
   (c) $\left(1, -\frac{\pi}{4}\right)$
3. List all the possible polar coordinates for the point whose polar coordinates are $(-2, \pi/2)$.
4. Sketch the graph of the polar curves:
   (a) $\theta = \frac{3\pi}{4}$
   (b) $r = \pi$
   (c) $r = \cos\theta$
   (d) $r = \cos(2\theta)$
   (e) $r = 1 + \cos\theta$
   (f) $r = 2 - 5\sin\theta$
5. Find the equation in polar coordinates of the line through the origin with slope $\frac{1}{3}$.
6. Find the polar equation for:
   (a) $x^2 + y^2 = 9$
   (b) $x = 4$
   (c) $y = 4$
   (d) $xy = 4$
7. Convert the equation of the circle $r = 2\sin\theta$ to rectangular coordinates and find the center and radius of the circle.
8. Find the distance between the polar points $(3, \pi/3)$ and $(6, 7\pi/6)$.

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1. What is the slope of the line $\theta = \dfrac{2\pi}{3}$?

2. Match each equation in Cartesian coordinates with its equation in polar coordinates:

   - $x^2 + y^2 = 4$
   - $(x-1)^2 + y^2 = 1$
   - $x^2 - y^2 = 4$
   - $x + y = 4$
   - $r^2(1 - 2\sin^2\theta) = 4$
   - $r(\cos\theta + \sin\theta) = 4$
   - $r = 2\cos\theta$
   - $r = 2$

3. Find an equation in polar coordinates of the line $\mathscr{L}$ with point closest to the origin having polar coordinates $(2, \frac{\pi}{9})$.

4. Using the equations $x = r\cos(\theta)$ and $y = r\sin(\theta)$ and the formula for finding dy/dx of a parametric curve, derive the formula for dy/dx of the curve $r = f(\theta)$.