MATH F111- MATHEMATICS I
Tutorial sheet 1

1. Which polar coordinate pairs label the same point?
   A. $(-2, \pi/3)$ B. $(2, -\pi/3)$ C. (r, θ) D. $(r, \theta + \pi)$ E. $(-r, \theta)$ F. $(2, -\frac{2}{3}\pi)$

2. Find the Cartesian coordinates of the points $(\sqrt{2}, \frac{\pi}{4})$,$(-\sqrt{2}, \frac{\pi}{4})$

3. Find the polar coordinates $0 \leq \theta < 2\pi$ and $r \geq 0$ of the points $(1, 1)$,$(\sqrt{3}, -1), (-3, 4)$.

4. Find the polar coordinates $0 \leq \theta < 2\pi$ and $r \leq 0$ of the points $(1, 1)$,$(\sqrt{3}, -1), (-3, 4)$.

5. Find the polar coordinates $-\pi \leq \theta < \pi$ and $r \geq 0$ of the points $(-2, -2)$,$(-\sqrt{3}, 1), (0, 3)$.

6. Graph the sets of points whose polar coordinates satisfy the equations and inequalities
   A. $-\pi/2 \leq \theta \leq \pi/2, 1 \leq r \leq 2$ B. $0 \leq \theta \leq \pi/2, 1 \leq |r| \leq 2$

7. Replace the following polar equations with equivalent Cartesian equations.
   A. $r \cos \theta = 2$ B. $r \sin \theta + r \cos \theta = 1$ C. $r^2 = 4r \sin \theta$

8. Replace the following Cartesian equations with equivalent polar equations.
   A. $x = 7$ B. $y^2 = 4x$ C. $x^2 + (y - 2)^2 = 4$

9. Identify the symmetries of the curves and sketch them.
   A. $r = 2 + \sin \theta$ B. $r = 2 - 2\cos \theta$ C. $r^2 = \sin \theta$ D. $r = \cos(\theta/2)$ E. $r = \frac{1}{2} + \sin \theta$
   F. $r^2 = \sin \theta$ G. $r = 1 - 2\sin(2\theta)$

10. Which of the following has the same graph as $r = \cos 2\theta$?
    A. $r = -\sin(2\theta + \frac{\pi}{2})$ B. $r = -\cos(\theta/2)$

11. Graph the equation $r = 1 - 2\sin 3\theta$.

12. Graph the nephroid of Freeth:
    $r = 1 + 2\sin \frac{\theta}{2}$

13. Graph the following spirals:
    A. $r = \theta$ B. $r = -\theta$ C. $r = e^{\theta/10}$ D. $r = 8/\theta$