Show all your work

1. Find the rectangular coordinates for the points whose polar coordinates are:

   (a) $\left(7, -\frac{\pi}{4}\right)$ (b) $(-1, \pi)$.

2. Find polar coordinates (r, θ) for the point whose rectangular coordinates is $\left(-\sqrt{3}, 1\right)$ such that:

   (a) $r \geq 0, \quad 0 \leq \theta < 2\pi,$ (b) $r \leq 0, \quad -\pi \leq \theta < \pi.$

3. Change the following polar equations into rectangular coordinates:

   (a) $r^2 \sin 2\theta = 1$ (b) $r = 4\cos\theta + 4\sin\theta.$

4. Test the following equations for symmetry with respect to the x-axis, the y-axis and the origin:

   (a) $r = \cos 2\theta,$ (b) $r = \cos\theta.$

5. Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $t = \frac{3\pi}{4}$ for the parametric curve

$$x = t\cos t, \qquad y = t\sin t$$

6. (a) Show that the two curves $r = 1 + \cos\theta$ and $r = 2\sin\theta$ intersect at $\left(\frac{8}{5}, \cos^{-1}\frac{3}{5}\right)$ and $(0, \pi)$.

   (b) Set up an integral (but do not integrate) to compute the area between the two curves in part (a).