Turn in the following problems at the start of your Thursday recitation section. To receive full credit, please staple your work, and put your name, your section number, and the homework number at the top.

1. (a) Find a Cartesian equation for the polar curve

$$r = 3\sin\theta + 4\cos\theta.$$

   (b) Use the Cartesian equation you found in part (a) to graph the curve. What is its geometric shape?

2. Carefully sketch the curve whose polar equation is $r = 7\cos(6\theta)$. Include work that shows how you drew the graph.

3. Carefully sketch the curve whose polar equation is $r = 2 + \sin\theta$. Include work that shows how you drew the graph.

4. (a) Sketch the graph of the polar curve $r = e^{\theta}$.

   (b) Find the polar coordinates (r, θ) of all points on this curve where the tangent line to the graph is horizontal or vertical.

5. Find the area of the region enclosed by one loop of the curve whose polar equation is

$$r = 4\sin 3\theta.$$

6. Find the area of the region that lies inside the curve whose polar equation is $r = 3\sin\theta$ and outside the curve whose polar equation is $r = 2 - \sin\theta$. (Hint: First, sketch the two curves on the same axes and shade the region of interest.)

7. Find the area of the region that lies inside both polar curves

$$r = 1 + \cos(\theta) \quad \text{and} \quad r = 1 - \cos(\theta).$$

8. Find the exact length of the polar curve $r = e^{2\theta}$, $0 \le \theta \le 2\pi$.