GROUP WORK 1, SECTION 11.4

Calculus by the Light of the Moon

Ah, the crescent moon. It shines bright in the night sky, causing people all over the world to experience it in their own personal way. Long-time married couples remember all the evenings spent in love, and kiss gently. Thieves and murderers curse its revealing light as they go about their horrid business. Astronomers, kind and scholarly, foray into observations of its dark shadow, subconsciously hoping to learn more about their own. And mathematicians think of ways to model it and find its area.

1. Describe and graph the polar curves $r = 2\cos\theta$ and $r = \sqrt{2}$.

2. Compute the area of the region inside $r = 2\cos\theta$ and outside $r = \sqrt{2}$.

3. Compute the area of the region inside $r = \sqrt{2}$ and outside $r = 2\cos\theta$.

GROUP WORK 2, SECTION 11.4

On and On... (Part 2)

1. Graph the polar curve $r = 3e^{-\theta}$ for $0 \le \theta \le 2\pi$, and compute its exact length.

2. Now compute the exact length of the polar curve $r = 3e^{-\theta}$ for $0 \le \theta \le 4\pi$.

3. Finally, consider the "infinite" polar curve $r = 3e^{-\theta}$ for $\theta \ge 0$. Based on your results in Problems 1 and 2, what do you think its "length" should be?

4. Does your answer to Problem 3 make sense to you? Why or why not?

Polar Propellers

Consider the polar curve $r = 2 + \cos 4\theta$ for $0 \le \theta \le 2\pi$.

1. Graph this curve and determine the points farthest from the origin. What values of θ give these points?

2. Determine the points closest to the origin. What values of θ give these points?

3. Find the area bounded by this polar curve.

4. Set up the integral for the length of this polar curve.