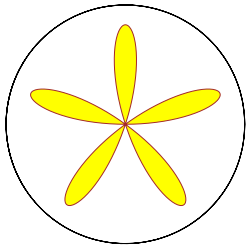
MAT126, Paper Homework "Wax"

1. In addition to the star-shaped candles Zhulong makes for his candle store (as in problem 4 of the second midterm), he also makes "sand-dollar candles". These have an inner area filled with colored beeswax, with regular wax on the outside. The beeswax area can be described as the interior of the polar curve $r = sin(5\theta)$ (r is measured in inches); the outside is a circle. A cross-section of the candle is shown at right.



   - Find the area of the beeswax part of a candle cross-section. (Be careful about the range of θ.)
   - Then, calculate how much beeswax is needed for a 5 inch tall candle (the candle is not tapered— all cross sections are the same).

2. The average (mean) height of an American male is about 176 cm (5'9"), with a standard deviation of about 9 cm. Variations in height are well-modeled by a normal distribution, with the density function $\frac{1}{\sqrt{2\sigma^2\pi}}\, e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ where μ is the mean and σ is the standard deviation.

   Write an integral which represents the probability of an American man being more than 200 cm (about 6'$6\frac{3}{4}$") tall, and then use a computer program like Wolfram Alpha to calculate the probability to at least 3 significant figures. (Symbolab will give you an answer involving *erf* or *erfc*, but you need to evaluate this as a number; the calculator on Google knows those functions if you type them in the search bar.)