

Lab 5 for Math 215

Monday - February 18th, 2008

Student's Name: _____

Instructions: Show all your work for full credit. Indicate your answers clearly.

Problem 1. Find the sum of the first 100 odd natural numbers.

Problem 2. Find the product of the first 15 even natural numbers.

Problem 3. Plot on the same graph $f(x) = x^2 - \sin(x)$ and $g(x) = \pi^2 - (x - \pi)e^x$ for $x \in [0, 6]$. Approximate all the points x such that $f(x) = g(x)$.

Problem 4. The astronomer Giovanni Cassini (1625-1712) studied the family of curves with polar equations

$$r^4 - 2c^2r^2 \cos(2\theta) + c^4 - a^4 = 0$$

where a and c are positive real numbers. These curves are called the **ovals of Cassini** even though they are oval shaped only for certain values of a and c . (Cassini thought that these curves might represent planetary orbits better than Kepler's ellipses.) Investigate the variety of shapes that these curves might have. In particular, how are a and c related to each other when the curve splits in two parts?

Problem 5. Graph the following polar curves. Choose the parameter interval to make sure that you produce the entire curve:

- (a) $r = 1 + 2 \sin(\theta/2)$ (nephroid of Freeth)
- (b) $r = \sqrt{1 - 0.8 \sin^2(\theta)}$ (hippopede)
- (c) $r = e^{\sin \theta} - \cos(4\theta)$ (butterfly curve)