

## Math 1A Worksheet 12

October 1st, 2007

1. Without graphing the entire curve  $\sin x$ , graph the points on the curve  $y = \sin x$  corresponding to  $x = 0, \pi/2, \pi, 3\pi/2$ , and  $2\pi$ . Now find the slopes of the tangent lines to  $y = \sin x$  at these four points, and sketch these tangent lines. What do you notice?
2. Write down the equation for the area  $A$  of a circle in terms of its radius  $r$ . Then:
  - a) Use this to compute  $dA$  in terms of  $dr$ .
  - b) Draw two concentric circles, one with radius  $r$  and the second with radius  $r + \Delta r$  where  $\Delta r$  is reasonably small.
  - c) Shade the area on your drawing which represents  $\Delta A$ . Calculate  $\Delta A$  in terms of  $r$  and  $\Delta r$ .
  - d) Explain why  $dA$  is a good approximation to  $\Delta A$ .
3. How many solutions are there to  $x = \sin x$ ? [Hint: to prove your answer, try a derivative argument!]
4. On July 4th, 2007, Joey Chestnut, from San Jose, CA, won a hot dog eating contest by eating 66 hot dogs with buns in 12 minutes. Let's assume that Joey's stomach is roughly spherical, that it starts completely empty, and that a hot dog with bun has volume approximately 6 cubic inches. Let's assume moreover that Joey was eating these hot dogs at a pretty constant rate over those 12 minutes. About how quickly was the radius of his stomach growing as he finished the last dog? (Recall the volume of a sphere is given by  $V = \frac{4}{3}\pi r^3$ .)