

Discussion Problems 9 (Thu., Dec. 7)

1. A particle moves on a curve $x = t + \cos t$, $y = 2t - \sin t$.
 - (a) Find the particle's velocity (which is the derivative ds/dt of the arc length s) at time $t = \pi/2$.
 - (b) Find the tangent to the curve at time $t = 0$.
 - (c) Sketch the curve roughly using first derivatives.
 - (d) Find the area under the curve for $0 \leq t \leq \pi/2$.
 - (e) Rotate the region in (d) around the y -axis. Set up the integral for the volume of the resulting solid.
 - (f) Set up the integral for the arc length of this curve for $0 \leq t \leq \pi/2$.
 - (g) Rotate the curve for $0 \leq t \leq \pi/2$ around the x -axis. Set up the integral for the area of the resulting surface.

2. Consider the equation $r = 1 + 2\sin\theta$ in polar coordinates. Restrict yourself to θ for which $1 + 2\sin\theta \geq 0$.
 - (a) Sketch the graph of the resulting curve.
 - (b) Compute the point on this curve with maximal distance from the origin.
 - (c) Compute the point on this curve with maximal distance from the y -axis.
 - (d) Compute the area enclosed by the curve.
 - (e) Compute the area of the intersection between the region enclosed by the curve and the interior of the circle $r = 3/2$.
 - (f) Set up the integral for the arc length of this curve.