Practice Exam 3 Calculus 2 4/15/2003

Each problem is worth 10 points, show all work and give adequate explanations for full credit. Please keep your work as legible as possible.

1. Convert the point with rectangular coordinates (5, -5) to polar coordinates.

2. *Set up* an integral for the area inside one loop of the curve $r = 3\cos 5\theta$.

3. *Set up* an integral for the length of one loop of the curve $r = 3\cos 5\theta$.

4. (a) Determine whether $y = e^{-3t}$ is a solution to the differential equation $y'' - 3y' - 4y = 0$.
(b) Determine whether $y = e^{4t}$ is a solution to the differential equation $y'' - 3y' - 4y = 0$.

5. A moose walks along a path given by the parametric equations $x=t^2+t$, $y=t^2-t$ (where $t=0$ of course represents the moment when the moose sees Officer Rebel). Set up an integral for the distance traveled by the moose (i.e., the arc length) between $t=-1$ and $t=1$.

Moose on campus scares Dartmouth students

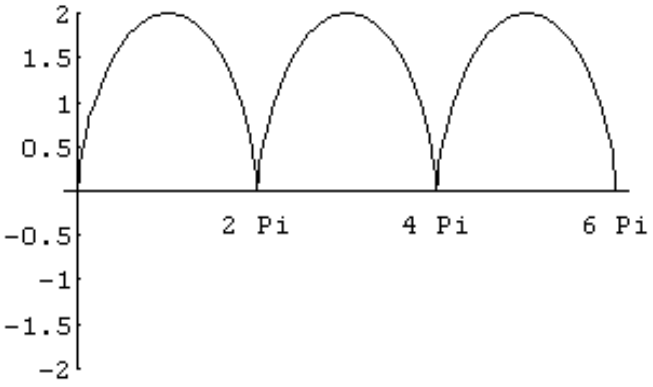
HANOVER, N.H. -- Amid the normal flurry of activity on the Dartmouth College Green Thursday morning, students were surprised to find a special visitor running through campus -- a moose.

The moose ran through the West side of campus Thursday morning.

Although no one was hurt in the incident, there are some safety concerns when moose are running through populated areas, according to Safety and Security Officer Rebel Roberts, who responded to the call.

(taken from the Oklahoma Daily)

6. *Write* an integral for the area under *one arch* of the cycloid with parametric equations $x = t - \sin t$, $y = 1 - \cos t$. The plot below shows the curve for $0 \le t \le 6\pi$.



7. Suppose it has been determined that the general solution for the temperature of a cup of coffee placed in a 20° C room after t minutes is of the form $T(t) = Ke^{-t/50} + 20$, for some value of the constant K. If the coffee starts out at a temperature of 85° C, when will it reach a temperature of 70° C?

8. Find the slope of the line tangent to $r = \cos\theta$ when $\theta = \pi/3$.

9. Find a general solution to the differential equation $\frac{dy}{dt} = 0.5y + 2$, which can be used to represent the depth of pine needles piled up under a tree after *t* years as old needles decompose and new needles fall.

10. Find the coordinates of the lowest point on the curve $x=t^3-3t$, $y=t^2+t+1$.