CALCULUS II – EXAM 3 – SPRING 2000
NO CALCULATORS

NAME ____________________________
Rec. Instr. ____________________________
Rec. Time. ____________________________

1.(20pts) Integrate (show all the steps):

a. $\int \frac{x+10}{x^2+2x+3}dx =$

b. $\int \arctan x dx =$ **(Recall** $(\arctan x)' = 1/(1+x^2)$**).**

2.(20pts) Sketch the area under the curve that the integrals below represent and then compute it.

a. $\int_0^1 \ln x dx$

b. $\int_2^\infty \frac{dx}{x}$

c. $\int_1^\infty \frac{dx}{x^2}$

d. $\int_0^2 \frac{dx}{\sqrt{x}}$

3. (16pts) Compute the area in the first quadrant between the circle of radius 1 and the spiral $r = e^{-\theta}$ $(0 \leq \theta \leq \pi/2)$.

4. (20pts) A wheel of radius 2 ft rolls down the x-axis from left to right without slipping, with a constant angular speed of one revolution every two seconds. As it passes over the origin at time t=0 a pebble get stuck on the rim.

a. Write equations for the motion of the pebble.

b. Suppose that the ground ends after one revolution (at $x = 4\pi$ feet). The wheel starts to free fall. Write the new equations for the motion of the pebble, i.e., for $t \geq 2$. (Neglect air resistance).

5. (20pts) An airplane is traveling at a speed of 360 mph (528 ft/sec) at an altitude of 3000ft. At $t = 0$, it passes directly above a target T, and drops a box of supplies. Assume the force due to air resistance to be equal to half the velocity of the box. Write parametric equations for the trajectory of the box. What is the farthest from the target that the box can land?

6. (14pts) Kansas law states that it is illegal to operate a motor vehicle if your blood alcohol concentration (BAC) exceeds .08%. Suppose that you ingest a drink every 2 hours, and that each such drink adds an initial concentration of .05% to your BAC, which then decays exponentially with a half-life of 2 hours.

a. What is your BAC after 4 drinks?

b. Compute the limiting BAC and decide if you are allowed to drive.