Name: _____

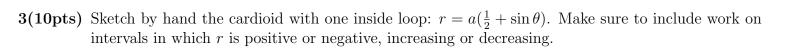
TA's Name: _____

Instructions: You must show supporting work to receive full and partial credits. No text book, notes, formula sheets allowed.

1(10pts) (a) A curve is given in polar coordinate $r = 4 \tan \theta \sec \theta$. Transform it in the Cartesian coordinate.

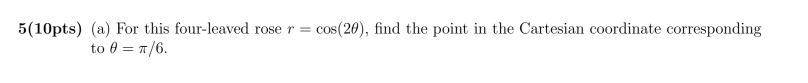
(b) Express the hyperbola xy = 1 in polar coordinate.

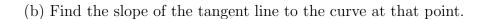
2(10pts) Find the exact value for the length of the curve: $r = \sqrt{1 + \cos(2\theta)}$, $-\pi/2 < \theta < \pi/2$.



4(10pts) Find the solution to the differential equation $\frac{d\vec{r}}{dt} = 3(t+1)^{1/2}\vec{i} + \frac{1}{t+1}\vec{k}$ with the initial condition $\vec{r}(0) = \vec{j}$.

 $(Continue\ on\ Next\ Page\ \dots\)$





6(10pts) (a) Find the intersection of the circle
$$r = 3\sin\theta$$
 and the cardioid $r = 1 + \sin\theta$.

(b) Set up an integral for the area of the region inside the circle and outside the cardioid. Give a rough sketch of the region. (Do not evaluate the integral.)

7((10pts)	Given t	the	vectors	$\vec{u} = <$	1, 2	, 3 >	$\vec{v} = <$	3, 2,	1 > .

(a) Find the angle between \vec{u} and \vec{v} .

(b) Find the unit vector of \vec{v} .

(c) Find the projection vector of \vec{u} along \vec{v} .

8(10pts) The trajectory of a particle moving in space is given as $\vec{r}(t) = \sin(t^2)\vec{i} + \ln(t^2 + 1)\vec{j} + t\vec{k}$. Find (i) its position, (ii) velocity, and (iii) acceleration at the point $\vec{r}(0)$.

