CALCULUS III NAME _____

EXAM I Rec. Instr. _____

FALL 1999 Rec. Time _____

TO RECEIVE CREDIT YOU MUST SHOW YOUR WORK.

(25) 1. Given the three points $P(1,0,2)$, $Q(2,2,1)$ and $R(0,1,4)$, let ΔPQR denote the triangle having P, Q and R as vertices. Find

a) the area of ΔPQR.

b) the angle of ΔPQR at the vertex P.

c) the equation of the plane containing the points P, Q and R.

d) equations for the line through point P which is perpendicular to the plane containing ΔPQR.

NAME _____

Rec. Instr. _____

(10) 2. An object is moving around the ellipse $x^2+2y^2 = 100$ in the xy-plane. It is moving at a constant speed of 3 ft/sec. Specify whether each of the following statements is true or false and explain why.

a) The acceleration vector is zero.

b) The velocity vector is zero.

c) At each instant the acceleration vector is perpendicular to the velocity vector.

d) At each instant the acceleration vector is parallel to the velocity vector.

NAME _____

Rec. Instr. _____

(15) 3. An object is moving in 3-space in such a way that its acceleration vector as a function of time is $\vec{a} = 2\vec{j} - (\sin t)\vec{k}$. Suppose that at time $t = 0$ we know that $\vec{v}(0) = \vec{i} + \vec{j}$ and $\vec{r}(0) = \vec{i}$. Find the velocity vector and the position vector as functions of the time t and then give the parametric equations for the motion.

NAME _____

Rec. Instr. _____

(30) 4. An object is moving in 3-space according to the parametric equations $x = \sin t\,,\ y = \cos t\,,\ z = \sin 2t\,.$

Find as functions of the time t,

a) position vector $\vec{r} =$

b) velocity vector $\vec{v} =$

c) acceleration vector $\vec{a} =$

d) speed $\frac{ds}{dt} =$

e) tangential component of acceleration $a_T =$

Now at time $t = 0$ find

f) curvature $\kappa =$

g) normal component of acceleration $a_N =$

NAME _____

Rec. Instr. _____

(20) 5. Let $f(x,y) = 3x^2y - 4x^3 - 2y^3 + 7y + 1$.

a) Calculate all 1st and 2nd partial derivatives of $f(x,y)$.

b) Find the equation for the tangent plane to the graph of $f(x,y)$ at the point $(1,1,5)$.

c) Find all points (x,y) which give points on the graph of $f(x,y)$ at which the tangent plane is horizontal.