Math 3330 - Test 2

Name:_____

1. Let $\mathbf{r}(t) = \langle t^2 - t, 3t^2 + t + 1 \rangle$. Compute the velocity and acceleration at the points $t = 0$ and $t = 1$. Graph the acceleration and velocity coming from the point.

2. Compute the limit if it exists. If not show why.

$$\lim_{(x,y)\to(0,0)} \frac{x^2+3xy+y^2}{x^2+y^2}$$

3. Let $f(x, y, z) = e^{x^2-4y} - xyz$. Find the tangent planes at $P(2, 1, -1)$. Use the tangent plane to approximate $f(1.9, 1.1, -1)$.

4. Use the second derivative test to find and classify the extremma for:

$$f(x, y) = x^3 + x^2y + y^3 - 9y - 3$$

(a) If $D(P) > 0$ and $f_{xx}(P) > 0$ then f has a local minimum at P.

(b) If $D(P) > 0$ and $f_{xx}(P) < 0$ then f has a local maximum at P.

(c) If $D(P) < 0$ then f has a saddle point at P.

(d) If $D(P) = 0$ then the second derivative test is inconclusive.

where $D(x, y) = f_{xx}(x, y)f_{yy}(x, y) - (f_{xy}(x, y))^2$.

5. Find max/min of $f(x, y, z) = xy + z^2$ subject to $2x + y - 2z = 1$

6. $\iint_R e^{x^2}\, dA$ over the region defined by $y = -x$, $y = x$ and the vertical line $x = 4$.

7. $\iint_R \sin(x^2+y^2)\,dA$ over the region defined by the portion of the circle $x^2+y^2=1$ in the second quadrant.

8. $\iint_R \frac{x-y}{x+y}\,dA$ over the region defined the lines $y = x + 2$, $y = x + 4$, $y = -x + 2$ and $y = -x + 3$.