Math 3330 - Test 2

Name:____

No calculators and show all work.

1. Let $f(x, y, z) = x^2z - z^2y^2$.
   (a) Compute $D_{\mathbf{v}}f(1, 2, -1)$ where $\mathbf{v} = \langle 1, 1, 0\rangle$.
   (b) Compute $D_{\mathbf{v}}f(1, 2, -1)$ in the direction of maximum increase.
2. Compute the extremma for $f(x, y) = x^3 + 3xy + y^2 - 3$
3. Compute the extremma for $f(x, y, z) = x^2 + y^2 + z^2$ subject to $2x + y - 2z = 9$
4. $\iint_R 3y\,dA$ over the region contained below the lines $y = x$ and the line $x = -3y + 8$ and above the x-axis.
5. $\iint_R 4[\tan^{-1}(y/x)]^3\,dA$ over the region defined by inside the circle $x^2 + y^2 = 4$ and outside the circle $x^2 + y^2 = 1$ and in the third quadrant.
6. $\iint_R \frac{(5x - y)^2}{2x - y}\,dA$ over the region defined the lines $y = 5x - 7$, $y = 5x$, $y = 2x - 2$ and $y = 2x - 3$. I used $u = 5x - y$ and $v = 2x - y$.

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

(a) If $D(CP) > 0$ and $f_{xx}(CP) > 0$ then at the CP f has a minimum.
(b) If $D(CP) > 0$ and $f_{xx}(CP) < 0$ then at the CP f has a maximum.
(c) If $D(CP) < 0$ then at CP f has saddle point.
(d) If $D(CP) = 0$ then the test is inconclusive.