

Name: _____

Score: _____

Instructions: You must show supporting work to receive full and partial credits. No books or class notes.

- 1(15 pts)** Find the critical points of the function f and use the 2nd derivative test to classify the critical points into local maxima, minima, and saddles.

$$f(x, y) = xy + \ln x + 2y^2 - 4, \quad (x > 0).$$

- 2(15 pts)** Find the constraint minimum and maximum of the function $z = f(x, y) = x^2 + y^3 - y + 5$ on the ellipse $x^2 + y^2 = 1$.

- 3(10 pts)** Use a regular partition with $\Delta x = 0.5, \Delta y = 0.5$ for the region $R: 0 \leq x \leq 1, 1 \leq y \leq 1.5$ to find an lower estimate of the integral $\int_R \frac{1}{x^3 + y} dA$.

- 4(15 pts)** Sketch the region of $\int_0^3 \int_{y^2}^9 f(x, y) dx dy$ and change the order of integration to $dy dx$.

- 5(15 pts)** Use polar coordinate to evaluate the integral $\int \int_R \sqrt{x^2 + y^2} dA$ where the region R is bounded by these curves in the first quadrant: the x -axis, the line $y = x$, and the circle $x^2 + y^2 = 1$.

- 6(15 pts)** Let G be the solid bounded by the three coordinate planes $x = 0, y = 0, z = 0$ and a sphere $x^2 + y^2 + z^2 = 4$. Set up an iterated triple integral for $\int \int \int_G x dV$

(a) in the order of $dx dy dz$ (b) in the spherical coordinate.

(Do not evaluate the integrals.)

- 7(15 pts)** Find the mass of the part of a spherical shell with density $\delta(x, y, z) = z$, that is between $x^2 + y^2 + z^2 = 1, x^2 + y^2 + z^2 = 4$, and in the first octant $x \geq 0, y \geq 0, z \geq 0$.

Bonus(3 pts) The score of last Saturday's football game between Nebraska and Oklahoma is ____.

The End