CALCULUS III NAME _____

EXAM Rec. Instr. _____

SPRING 1998 Rec. Time _____

TO RECEIVE CREDIT YOU MUST SHOW YOUR WORK.

(25) 1. Find and classify the critical points for $f(x, y) = 2y^3 - 3x^3y + 9xy$.

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(20) 2. **Use the method of Lagrange multipliers** to find the maximum value and the minimum value for $f(x, y) = \frac{1}{3}x^3 + y^2 - 8x$ on the circle $x^2 + y^2 = 9$.

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(15) 3. Find the volume of the 3-dimensional region which is under $z = xy + x$ and above the region in the 1st quadrant of the xy-plane enclosed by the lines $y = 2x$, $y = 0$ and $x = 2$.

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(10) 4. Evaluate $\displaystyle\int_0^2 \int_{x^2}^4 x \sin(y^2)\, dy\, dx$ by **first reversing the order of integration.**

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(15) 5. Find the volume of the region enclosed by the paraboloids $z = 9 - x^2 - y^2$ and $z = 2x^2 + 2y^2$. Use polar coordinates to evaluate the double integral.

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(15) 6. A mass distribution occupies the region in the 1st octant which is enclosed by the surfaces $z = 4$, $z = y$, $x + y = 2$, $x = 0$, and $y = 0$. The mass density function is $\delta = 2x$ units of mass/unit volume. Calculate the total mass.