# PRACTICE FINAL

Total possible number of points: 160. Time : 1 hour 50 minutes.
The exam is closed book; calculators are not allowed.
(Note: most problems on this practice exam are from the book).
PLEASE WRITE YOUR NAME ON YOUR EXAM!

1. [20 points] Calculate the equation of the plane which passes through the points $(1, 4, 2)$ and $(3, 4, 3)$ and is perpendicular to the plane $x + y + z = 1$.

2. [20 points] Let $f(x, y, z) = e^{x+y+z}$ and $x = s/t$, $y = t/s$, $z = st$. Find the value of $\frac{\partial f}{\partial s}$ at the point where $s = t = 1$.

3. [20 points] Find the direction in which the function $f(x, y) = x^2 - 5xy + 2y^2$ has the maximum rate of change at the point $x = y = 1$ and find the value of this maximum rate of change.

4. [20 points] Find all critical points of the function $f(x, y) = x^3 - 12xy + 8y^3$ and for each critical point determine if it is a local maximum, a local minium, or a saddle point.

5. [20 points] Find the maximum and minimum values of the function $f(x, y, z) = yz + xy$ subject ot the constraints $xy = 1$, $y^2 + z^2 = 1$.

6. [20 points] Evaluate the integral $\int \int_D xy \, dA$ where $D$ is enclosed by the curves $y = x^2$ and $y = 3x$.

7. [20 points] Calculate the double integral $\int_0^2 \int_0^{\sqrt{2x-x^2}} \sqrt{x^2 + y^2} \, dy \, dx$ by switching to polar coordinates.

8. [20 pointrs] Calculate the volume of the solid enclosed by the two surfaces $y = x^2 + z^2$ and $y = 8 - x^2 - z^2$.