Math 208, Section 3

Practice problems for Exam 2

5. Use Lagrange multipliers to find the point on the graph of

$$g(x,y,z) = x^2 - 2xz + y^2 - 4yz + 14z^2 = 1$$

(it happens to be an ellipsoid, but that doesn't matter) which has the largest z-value. (Hint: What function are you trying to maximize?)

1. Find the integral of the function $f(x,y) = x$ over the region R lying between the graphs of the curves

$$y = x - x^2 \text{ and } y = x - 1 \text{ (see figure).}$$

2. Find the integral of the function $f(x,y,z) = z$ over the region S bounded by the planes

$$x = 0,\ x = y,\ y = 1,\ z = 0 \text{ and}$$
$$\text{the surface } z = x^2 + 1 \text{ (see figure).}$$

4. Find the critical points of the function

$$f(x,y) = x^2 - y^3 + 6xy$$

Describe what the Second Derivative Test says about each critical point.

5. (15 pts.) Calculate the first and second partial derivatives of the function

$$\frac{\sin(x+y)}{y}$$

1. (25 pts.) Find the critical points of the function

$$f(x,y) = x^2 - xy^2 - 4x$$

and determine which of *rel max*, *rel min*, or *saddle point*, each is.

2. (20 pts.) Find the maximum value of the function

$$f(x,y) = x + 2y$$

subject to the constraint $\quad g(x,y) = x^2 + 2y^2 = 5$.

5. Evaluate the following double integrals (10 pts. each):

(a): $\displaystyle\int_0^1 \int_1^2 x^2y - y^2x \, \mathrm{d}x \, \mathrm{d}y$

(b): $\displaystyle\int_0^1 \int_{\sqrt{x}}^1 x\sqrt{y} \, \mathrm{d}y \, \mathrm{d}x$

5. (20 pts.) Evaluate the integral

$$\int_0^1 \int_0^{(1-y^3)^{1/3}} y(1-x^3)^{1/3} \, \mathrm{d}x\mathrm{d}y$$

by changing the order of integration. (Trust me, you **can't** evaluate it in the order in which it is given!)