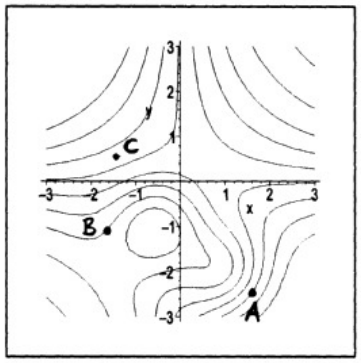
Exam 2 Name:__________________

Math 202 F01 11/11/05

1. (10 pts.) A plot of level curves of a function $z = f(x, y)$ is given:



   (a) At the points A, B, C, draw the gradient for f. You should be able to indicate the correct direction, and correct *relative* lengths of the three.

   (b) Mark with an 'X' all points where the gradient is $\vec{0}$

2. (16 pts.) A metal plate is shaped like the region between the three lines $y = \pm 2x$ and $x = 5$, where x and y are measured in m. The density of the plate is given by $\rho(x, y) = 1+x \; kg/m^2$. Give an expression involving integrals for the center of mass of the plate. (Do NOT evaluate any integrals, but leave your answer in a form where that is all that remains to be done.)

3. (14 pts.) Give an equation of the tangent plane to the surface

$$xy + yz^2 + zx = -1$$

at the point $(1, 0, -1)$.

4. The temperature at a point (x, y) is given by

$$T = \frac{y}{1 + x^2} + z^2.$$

(a) (10 pts.) Compute the directional derivative of temperature at the point $(2, 1, 1)$ in the direction towards (3,2,1).

(b) (6 pts.) At the point $(2, 1, 1)$, in what direction should you travel in order to get the fastest *increase* in temperature?

5. (28 pts. – 14 pts. each) Evaluate the following integrals by first following the suggestions.

(a) $\displaystyle\int_0^3 \int_{x^2}^9 x\cos(y^2)\,dy\,dx$ (Reverse the order of integration.)

(b) $\displaystyle\int_0^3 \int_0^{\sqrt{9-x^2}} \sqrt{(10-x^2-y^2)}\,dy\,dx$ (Use a different coordinate system.)

6. (16 pts.) Find the maximum of the function $f(x, y, z) = 8x - 4z$, subject to the constraint that $x^2 + 10y^2 + z^2 = 5$