

First Examination
Tuesday, February 19, 2013

Instructions: This exam should be done on your own paper. Your name should be on each sheet and on the back of the last sheet; the answers should appear written carefully and in order. If in doubt, show intermediate steps: Full credit may not be given, even for correct answers, unless work is arranged clearly and explained. This exam is closed book. You may leave after handing in your exam paper, but be sure to check your answers carefully. You may keep this exam sheet. Each entire problem is worth 20 points.

1. Draw the $c = 1$, $c = 4$, and $c = 9$ contours of the function

$$f(x, y) = \frac{x^2}{4} + y^2,$$

labeling the contours and their intersection points with the x -axis and y -axis. What geometric figures do these contours represent?

2. Consider the plane through the points $(-1, 0, 0)$, $(0, -1, 0)$, and $(0, 0, -1)$.

- (a) Write down an equation for the plane.
(b) Sketch the plane.

3. Write down a vector perpendicular to the plane corresponding to the equation

$$x - 2y + 3z = 4.$$

4. Does

$$f(x, y) = \frac{x^3 + 3x^2y + 3xy^2 + y^3}{x^2 + 2xy + y^2}$$

have a limit at $(x, y) = (0, 0)$? Why or why not?

5. A boat is headed due south at a speed of 25 kilometers per hour in a current that is flowing from west to east at a speed of 4 kilometers per hour.

- (a) Draw a diagram of the boat's heading velocity, the velocity of the current, and the velocity of the boat's travel.
(b) Write down the net speed at which the boat is traveling.
(c) Write down the angle of the boat's path. (Assume the positive x -axis is east, the positive y -axis is north, and angles are measured counterclockwise from the positive x -axis.)