

First Examination
Monday, February 23, 2015

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 problem is worth 16 points, and 4 points are free.

1. Draw the $c = 0$, $c = 1$, and $c = 2$ contours of the function

$$f(x, y) = \frac{x^2}{4} + \frac{y^2}{9}.$$

Put 6 tic-marks on each axis and label the intersection points of the contours with the axes.

2. Find the center and radius of the sphere with equation

$$x^2 - 4x + y^2 + 2y + z^2 - 6z = 0.$$

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

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

4. Compute $\vec{u} \times \vec{v}$, where $\vec{u} = (1, 0, -1)$ and $\vec{v} = (0, 1, 0)$. Show all steps in your computation.
5. Find an equation for the plane through the points $(1, 0, 0)$, $(1, 1, 0)$, and $(1, 1, 1)$.
6. A plane flying 500 kilometers per hour is headed due west and flying at a constant altitude. If there is a wind of 100 kilometers per hour blowing from the southwest (a 45 degree angle), what is the ground speed of the plane? Give your answer to the nearest kilometer per hour. (Draw a picture of all vectors used in your computation, and show your work.)