Math 241
Vector Calculus
Fall 2000, USC

Oct 20, 2000

MIDTERM 2

Time: 50min

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1. **(a)** Find equation of the plane through $(1,3,2)$, $(0,3,0)$, and $(2,4,3)$. **(b)** What is the area of the triangle spanned by these three points.

2. Let P be a point on a plane with normal $\mathbf{n}$ and Q be a point off the plane. **(a)** Show the distance d from Q to the plane is given by $d = \frac{|\overrightarrow{PQ}\cdot\mathbf{n}|}{|\mathbf{n}|}$. **(b)** Use this result to find the distance between $(3,0,4)$ and the plane $x+y+z=0$.

3. The motion of a particle is given by $r(t) = (\cos t, \sin t, -t^2+t-1)$. **(a)** What is the highest altitude reached by the particle? **(b)** Does the particle ever stop moving? **(c)** If the particle leaves the curve at $t=0$, where will it be 5 seconds later?

4. **(a)** Sketch the surface given by $5x^2+5y^2-4z=0$. **(b)** What is the equation of this surface in cylindrical coordinates?

5. Suppose that the temperature of a plate is given by $T(x,y)=xy$. **(a)** Sketch the isothermal curves corresponding to $T=-1$, 0, and 1. **(b)** What is the rate of change in temperature as experienced by an ant at point $(1,1)$ moving parallel to the positive direction of the x-axis? **(c)** In which direction should the ant move in order to experience the greatest decrease in temperature?

Each problem is worth 20 points