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Final for Calculus III(Fall 2002)
December 18, 2002

100 minutes total; PICK AND MARK CLEARLY 6 out of 7 problems; all the problems are of equal value. *Problems NOT ordered according to difficu

1.a) Find the equation for the plane going through three points $A(0,1,1)$, $B(1,0,1)$ and $C(1,1,0)$; b) Find the angle between AC and AB.

2. With the constraint $x^2+y^2+z^2=1$, find the maximum value of $f(x,y,z)=x^3+y^3+2z^3$.

3. Find the volume of the solid inside both the cylinder $x^2+y^2=4$ and the ellipsoid $4x^2+4y^2+z^2=64$.

4. a) For a vector field $\mathbf{F}=x\mathbf{i}+y\mathbf{j}+z\mathbf{k}$, and Ω a 3-dimensional region, prove

$$Vol(\Omega)=\frac{1}{3}\int\int_{\partial\Omega}\mathbf{F}\cdot\mathbf{dS},$$

where $\partial\Omega$ is the boundary of Ω with the compatible orientation; b) Using a), find the volume of a 3-dimensional ball of radius 1.

5. For $\mathbf{F}=e^x\mathbf{i}+e^{-x}\mathbf{j}+e^z\mathbf{k}$, compute the following line integral

$$\int_C \mathbf{F}\cdot\mathbf{dr},$$

where C is the boundary curve of the part of the plane $x+y+z=1$ in the first octant, with counterclockwise orientation as viewed from above. (Hint: Stokes' Theorem).

6. Compute the suraface area of the part of the cylinder $x^2+z^2=a^2$ that lies inside of the cylinder $x^2+y^2=a^2$.

7. Compute $\int_C yzdx+xzdy+xydz$, where C consists of line segments from $(0,0,0)$ to $(100,100,200)$, from $(100,100,200)$ to $(2002,2003,0)$. (Hint: fundamental theorem of line integrals)

GOOD LUCK!