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i___ii___iii___iv___v___vi___vii___viii___ix___x___xi___xii___xiii___ TOTAL _________

December 12, 2003	Mathematics 206a Multivariable Calculus Final Examination	Mr. Haines

(3) I. Let **a** = (1, 3, 7) , **b** = (0, 3, 6), and C be the straight line segment connecting **a** to **b**. Give a parametrization for C.

(9) II. Let **x**(t) = (t, t^2, t^3) from t = 0 to t = 3 be the parametrization of a curve in $\Re^3$.

A. Give an equation of the tangent line to this curve at the point where t = 2.

B. Give the cosine of the angle between **x**(t) and this tangent line at t = 2.

C. Set up but **do not evaluate** an integral whose value is the length of this curve.

(12) III. Give examples of:

A. Equations of two distinct parallel planes in $\Re^3$.

B. Parametric equations of two distinct parallel lines in $\Re^4$.

C. A non-constant vector field defined on $\Re^3$ that is path independent.

D. A quadratic form.

(15) IV. Let M be the triangular surface in the plane $\frac{x}{2}+\frac{y}{3}+z=1$ that is cut off by the three coordinate planes. (M lies in the first octant, where $x \geq 0, y \geq 0, \text{and } z \geq 0$.)

A. Give a parametrization for the surface M.

B. Set up and evaluate an iterated integral that gives the area of M.

C. Set up and evaluate an iterated integral that gives the surface integral of the vector field **F** (x, y, z) = (y, 0, 0) over the surface M.

(5) V. Explain why you cannot use The Fundamental Theorem of Line Integrals to evaluate the line integral of $\mathbf{F}(x, y, z) = (x, x^2, x^3)$ over a path connecting (0, 0, 0) to (1, 1, 1).

(7) VI. Evaluate the line integral $\oint_C -xy\,dx + x^2\,dy$, where C is the boundary of the triangle cut from the first quadrant by the lines x = 2, y = x, the x-axis, and the y-axis.

(7) VII. Calculate the value of the double integral $\iint_R dA$, where R is the region whose boundary is the circle parametrized by $\mathbf{x}(t) = (2 + 3\cos t, 5 + 3\sin t)$ for $0 \le t \le 2\pi$.

(7) VIII. Set up but **do not evaluate** an iterated integral to compute the volume of the solid below the surface $x^2 + y^2 + z = 3$ which lies above the region R which is the right triangle with vertices (0, 0), (0, 2), and (1, 0)

(7) IX. Suppose $f(x, y, z) = x^2 y^3 + xy - z - 3y$. Compute the line integral of ∇f, the gradient of f along the straight line path connecting (0, 0, 0) to (1, 1, 1).

(7) X. Find the equation (either parametric or rectangular) of the tangent plane to the surface whose equation is $x^2 + y^2 + z = 3$ at the point $(1, 1, 1)$.

(7) XI. Give a parametrization of the curve in $\Re^3$ that is the intersection of the surface

$x^2 + y^2 + z = 3$ with the plane $z = 2$.

(7) XII. Evaluate $\oiint_{\partial S} \mathbf{F} \bullet \mathbf{n}\, d\sigma$, where $\mathbf{F} = x\mathbf{i} + z^2\mathbf{j} + y^3\mathbf{k}$ and S is the solid box determined by the three coordinate planes, the plane $x = 2$, the plane $y = 3$, and the plane $z = 4$.

(7) XIII. State Stokes's Theorem.