ADDED PROBLEM 4 ON TUESDAY 11/15.

See also: recent quizzes, the actual quiz and the samples, esp. quiz 3 (on parametrizing surfaces); MT 2 review assignment on WebAssign; and two more, if you need more: p. 1107, #5 & 13 (answers in back of book).

I'll try to post some final answers or solutions for these 4 problems no later than noon on Thursday.

1. Let $f(x, y, z) = x\cos(\pi y) + ye^z$.
   (a) Compute ∇f at $(2, 3, 1)$.
   (b) A curve $\mathbf{r}(t)$ passes through $(2, 3, 1)$ at $t = 0$, so $\mathbf{r}(0) = (2, 3, 1)$. The velocity vector $\mathbf{r}'(0)$ points from $(2, 3, 1)$ towards $(5, 3, 5)$, and the speed there is $|\mathbf{r}'(0)| = 2$. Find $\mathbf{r}'(0)$ and use it to compute $\frac{d}{dt} f(\mathbf{r}(t))$ at $t = 0$. (Hint if you are stuck: use the chain rule.)
2. Let C be the curve consisting of the line segments from $(0, 0, 0)$ to $(1, 1, 1)$ and from $(1, 1, 1)$ to $(1, 0, 1)$. Compute the mass of a thin wire bent in the shape of the curve C if the density at any point is equal to $\rho(x, y, z) = 2 - z$.
3. Let $\mathbf{F}(x, y) = (x^3 - 2xy^3)\mathbf{i} - 3x^2y^2\mathbf{j}$.
   (a) Show that $\mathbf{F}$ is conservative.
   (b) Find a potential function for $\mathbf{F}$.
   (c) Evaluate the line integral of $\mathbf{F}$ along the curve, $x = \cos^3 t$, $y = \sin^3 t$, $0 \le t \le \pi/2$.
4. Let C be the curve of intersection of the plane $y + z = 5$ and the cylinder $x^2 + y^2 = 9$, going counterclockwise as viewed from above.
   (a) Find a parametrization of C. (Note that you are parametrizing a curve, so your answer should be a function on just one parameter. If that parameter is t, your answer would be in the form $\boldsymbol{r}(t) = \langle x(t), y(t), z(t)\rangle$, or just the trio of functions $x(t)$, $y(t)$, $z(t)$.)
   (b) Use your parametrization to compute $\int_C \boldsymbol{F} \cdot d\boldsymbol{r}$, if $\boldsymbol{F} = \langle x, 2y, -4\rangle$