As before, the appearance of a problem on this review doesn't guarantee the appearance of a similar problem on the exam. Equally, the non-appearance of a sort of problem does not guarantee that a problem of that sort won't appear on the exam. This is a review, intended as something helpful for studying. (FWIW: This is the test I gave to a Calc II class last fall.)

1. Let $f : \mathbb{R}^3 \to \mathbb{R}$ be the following scalar field:

$$f(x, y, z) = y^2 z^3 e^{x^4}$$

* What is the value of $f(0, -1, 2)$?

* Find a vector at $(0, -1, 2)$ that is normal to the level surface of $f$ that passes through $(0, -1, 2)$.

2. There is an entire plane of vectors perpendicular to the one you found in problem (1). Find any non-zero such vector.

3. Find any non-zero vector perpendicular to the two vectors you found in problems (1) and (2).

4. In problems (2) and (3), you found two vectors in the tangent plane to the level surface of $f$ in problem (1). Also, in problem (1), you found a normal to that tangent plane. Using any of the information from the first three problems, give any form of the equation for the tangent plane to that level surface that passes through the point $(0, -1, 2)$.

5. Suppose $f : \mathbb{R}^3 \to \mathbb{R}$ and $\nabla f = \langle\ yz\cos(xyz), xz\cos(xyz), xy\cos(xyz)\ \rangle$. What is $f(x, y, z)$?

6. Let $f(x, y) = \ln(x^2 + y^2 + 1)$. Find $D_{\vec{u}} f(1, 2)$ in the direction of $\vec{v} = \langle 4, -3 \rangle$.

7. Let $g(x, y) = x^4/4 - 8x + y^4/4 - 27y$. Find the critical point(s) for $g$. Show your work!

8. Continuing problem (7): Find the Hessian($g$) and classify the critical point(s) you found.

9. Let $\vec{r}(t) = \langle \cos(t) + t, 1 - \sin(t) \rangle$, where $t \in [0, \infty)$, be the vector-valued function for a neverending cycloid. What is the equation of the tangent line at the point $\vec{r}(\pi/2)$?

10. I will probably give a double integral problem. Probably easy!

Do lots of other problems! Do problems from the book! Odd-numbered problems have answers in the back of the book. Practice doing the problems fast and accurate. You can do this!!