Mathematical Analysis II
Question List for the Midterm.

1. Partial derivatives of a function of several variables: definition, examples.
2. Directional derivatives: definition, relation to partial derivatives.
3. Gradient, its relation to partial and directional derivatives.
4. The formula of small increments
5. The tangent plane to a graph of a function: definition, equation.
6. Higher order partial derivatives: definition, examples.
7. The Schwartz lemma.
8. The Hessian of a function: definition, relation to second derivative of a section of a function in a given direction.
9. Sufficient condition for local convexity/concavity.
10. Positive/negative definiteness of a symmetric matrix: definition and the Sylvester criterium.
11. Local extrema: definition and necessary condition in the terms of the gradient
12. Classification of critical points. Sufficient conditions for a critical point to be a local minimum/local maximum
13. Local extrema under given constraints: definition, the Larange multipliers method.
14. The integral of a function of two variables over a rectangle: definition, properties.
15. Normal and regular domains: definitions, examples.
16. Representation of an integral over a normal domain as an iterated integral.
17. Change of variables formula in the integral over a domain $D \subset \mathbf{R}^2$: conditions, formula of the Jacobian, the change of variables formula.
18. Polar coordinates on the plane: definition, examples of domains which are rectangular/normal in polar coordinates. Jacobian and the change of variables formula for polar coordinates.