

## Outline for Exam 3

The exam will cover sections 12.4-12.8. The topics by section are

**12.4** The multivariable chain rule. Tree diagrams, applications of the chain rule.

**12.5** The gradient. Properties of the gradient. Directional derivatives, the direction of most rapid increase, the normal vector to a surface.

**12.6** Linear approximation. The tangent plane. The linear approximation to a function at a given point. The total differential of a function.

**12.7** Local extrema, critical points, the second derivative test.

**12.8** Constrained optimization. The method of Lagrange multipliers.