This exam covers:

- Optimization: finding and classifying critical points, the Extreme Value Theorem, using Lagrange multipliers to find global maxima and minima subject to a constraint (Ch 15)
- Multiple integrals: double integrals in Cartesian and polar coordinates, triple integrals in Cartesian, cylindrical, and spherical coordinates, changing coordinates in a multiple integral using the Jacobian (Ch 16, S 21.2)
- Parametrizing curves and surfaces (S 17.1, S 21.1)
- Vector fields and line integrals (S 17.3, S 18.1-2)

Note: The emphasis will be on topics not already covered on quizzes.

Format of the exam:

- Most problems will be similar to homework problems.
- Calculators will not be permitted; numerical computations will be amenable to hand calculation, at least in my opinion.

Exercises for review from the 6th edition of the textbook are listed below. Your assignment for D Rev consists of the exercises in bold as well as the additional problems below.

- Ch 15 Review: 1-4, **11**, 12, 16, **20**

  Selected answers:
  \# 12: global min: $\sqrt{2}$ at $(0, \sqrt[4]{2})$, global max: 2 at $(1, 1)$
  \# 16: global min: -2 at $(1, -2)$ and $(-1, 2)$, global max: 2 at $(1, 2)$ and $(-1, -2)$
  \# 20: global min: 0 at $(0, 0)$, global max: 9 at $(1, -1)$ and $(-1, 1)$

- Ch 16 Review: 1-13, **14**, 15, 16, 21, 24, 25-27, 38, 40, **41**, 59-62, 69, 70
- Ch 17 Review: 1-11, 23-29
- Ch 18 Review: 1, 2, **8**, 10, 12, **22**, 23, 24

  Selected answers: #8: 0; #10: 2; #12: -1; # 22: 30; # 24: 43/2

- Ch 21 Review: 1, 2, **8**, **9**, 10, 12, 15-18

Additional problems for D Rev:

1. Let W be the solid region whose base is in the xy-plane and which is bounded above by the sphere of radius 3 cm centered at the origin. This region is filled with a material whose density is zero at the origin and which increases linearly with the distance from the origin to a density of 3 g/cm^3 at the outermost points from the origin. Set up (but do not evaluate) an integral for the total mass of the material using (a) spherical coordinates, (b) cylindrical coordinates, and (c) Cartesian coordinates.
2. Let $\mathcal{R}$ be the region in the xy-plane bounded by the curves $y = x$, $y = 2x$, $y = x^2$, and $y = 2x^2$. Consider the integral $\int_{\mathcal{R}} f\, dA$, where $f(x, y) = -y^2/x^6$. Choose new coordinates u and v so that the transformed region $\mathcal{R}'$ in the uv-plane is a rectangle, and use the new coordinates to evaluate the integral.