MTH 212 - MULTIVARIATE CALCULUS - STUDY GUIDE FOR FINAL EXAM

No books, notes, calculators, or cell phones are permitted during the test!

Use notes, text, homework, and suggested exercises to prepare for the test.

Note that it is a **cumulative exam** that covers all the material described in Study Guides for Exams I-IV, and some material from Sections 15.1 - 15.4.

Topics since Exam IV (some formulas will be provided on a formula sheet - make sure to check it):

- Section 15.1: *Line Integrals.*

  Know how to set up and evaluate line integrals $\int_C f\ ds$ over parameterized curves in 2D or 3D. Remember the additivity property for piecewise curves.

- Section 15.2: *Vector Fields and Line Integrals.*

  Compute divergence and curl of a vector field.

  Given a vector field $\mathbf{F}$ and a curve C, parameterized by $\mathbf{r}(t)$, $a \leq t \leq b$, use a line integral to calculate:

  - **flow/work** of $\mathbf{F}$ along or **circulation** around C:
    $\int_C \mathbf{F} \cdot \mathbf{T}\ ds = \int_C \mathbf{F} \cdot d\mathbf{r} = \int_C M dx + N dy = \int_a^b \mathbf{F}(\mathbf{r}(\mathrm{t})) \cdot \frac{d\mathbf{r}}{dt}\ dt.$
    (in 3D: $\int_C \mathbf{F} \cdot d\mathbf{r} = \int_C M dx + N dy + P dz$.)
  - **flux** of $\mathbf{F} = M\mathbf{i} + N\mathbf{j}$ across C in the plane: $\int_C \mathbf{F} \cdot \mathbf{n}\ ds = \oint_C M dy - N dx$
    $= \int_a^b (M \frac{dy}{dt} - N \frac{dx}{dt}) dt.$

- Section 15.4 *Green's Theorem in the Plane.*

  Solve 2D problems using Green's theorem: know two formulations (one for circulation and one for flux) and use them for: turning a line integral around a closed smooth curve into a double integral over the interior of the curve or vice versa.