Guide to Midterm Exam 2

1. Review all your homework problems in hw12-hw16 and quizzes. As usual, the final exam will be more difficult than quiz problems. You practice and familiarity on the homework problems is basis for the final exam.

2. Review integration using an arbitrary coordinate system and the Jacobian.

3. Review the line integrals of pure scalar functions and those related to vector fields, such as work, flux, etc.

4. Review surface integrals, how to compute them, both by projection the surface on a plan and by means of parameters and Jacobian.

5. Review necessary condition for a vector to be conservative, and how to actually find the potential function for a conservative vector field.

6. For each of the three 'fundamental Theorem of calculus' on curves, surfaces and bulk regions. Pick up a simple vector field, such as $\boldsymbol{F}(x, y, z) = (2y, x, x + z)$ and practice the three theorems on simple curves, simple surfaces and simple regions. Make sure you understand the meanings of the Theorems and know how to calculate the corresponding integrals.

7. Pay attention to the cases where the vector field has a singularity (discontinuity) and whether these Theorems still apply. Study what can go wrong with these Theorems when there is a discontinuity in the middle of the surface or in the middle of the bulk region.