

**Logistical Information**

- 1:30 pm - 3:30 pm Tues Dec 20, in OWS 150 (3M Auditorium)
- Most problems will be similar to problems on homework, quizzes, and previous exams.
- No calculators, notes, books, cell phones permitted.
- Bring whatever you need to help yourself concentrate for 2 hrs: watch, water bottle, granola bar ...

**The final exam is cumulative.**

- Consult your review sheets for Exams 1 and 2 for lists of basic facts and formulas to know, topics to know, and review problems for Units 1 and 2.
- Also use the problems from Quizzes 1-6 and Exams 1 and 2 for practice.

**Topics from Unit 3: Vector Calculus**

- Line integrals: direct evaluation using parametrization and evaluation using FTC-LI or Green's Theorem, path-independent/conservative fields vs path dependent fields, circulation along a curve, gradient fields, potential function for a gradient field (Ch 18)
- Flux and flux density (divergence), flux integrals: direct evaluation and evaluation using the Divergence Theorem (Ch 19)
- Circulation density and the curl of a 3D vector field, evaluating line integral in 3D using Stokes' Theorem, the Curl Test, the Divergence Test (Ch 20)

**Review Exercises for Unit 3:**

- Ch 18 Rev: 1-31, 36-39, 41-47
- Ch 19 Rev: 1-3, 10-20, 30-34, 40, 58
- Ch 20 Rev: 17-22, 26, 31-40

**Additional Review Problems:**

1. Compute the circulation of  $\vec{F} = y\hat{i} + z\hat{j} + x\hat{k}$  around the circle of radius 2 in the plane  $3x - y + 2z = 6$ , centered at the point  $(0, 0, 3)$ , and oriented counter-clockwise when viewed from above.
2. Calculate  $\int_C \vec{F} \cdot d\vec{r}$ , where  $\vec{F} = (x+y)\hat{i} + (x+z)\hat{j} + (y+z)\hat{k}$  and  $C$  is a square of side length 2 lying in the plane  $3x - y + 2z = 6$ , centered at the point  $(0, 0, 3)$ , and oriented counter-clockwise when viewed from above.
3. Evaluate the line integral of  $\vec{F} = (2x+y)\hat{i} + (x-2y)\hat{k}$  around the parallelogram whose vertices are  $(0, -6, 0)$ ,  $(2, 0, 0)$ ,  $(2, 6, 3)$ , and  $(0, 0, 3)$ , traversed in that order.