Logistical Information

- 1:30 pm - 3:30 pm Thurs May 17, in OWS 257
- 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 FTCLI 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 (by "pure thought", by using a special case, or by parametrization) and evaluation using the Divergence Theorem (Ch 19, S 21.3)
- Circulation density and the curl of a 3D vector field, evaluating line integral in 3D or a flux integral using Stokes' Theorem, the Curl Test, the Divergence Test (Ch 20)

Review Exercises for Unit 3. *Problems for discussion assignment* (DRev) *are in* **bold.**

From the 6th edition of the textbook:

- Ch 18 Rev: 1-31, 36-39, 41-47; **D: 18**, **21**, **41**, **44**
- Ch 19 Rev: 1-3, 10-20, 30-34, 40; Challenge: 55, 56, 58; **D: 18**, **19**,**32**, **34**
- Ch 20 Rev: 17-20, 22, 25, 26, 31-40; **D: 22**, **32**, **37**, **40***
- Ch 21 Rev: **D: 6** (answer: 195)

*For this problem, assume the cylinder is *closed* (so has sides and two ends), and oriented outward.

Additional review problems:

1. Calculate the circulation of $\vec{F} = xy^2\,\hat{i} + 2x^2y\,\hat{j}$ around the triangle with vertices $(0,0)$, $(1,0)$, and $(1,1)$, traversed in that order.
2. **Evaluate the line integral of $\vec{F} = y^3\,\hat{i} - x^3\,\hat{j}$ along the unit circle, oriented clockwise.**
3. Compute the circulation of $\vec{F} = y\,\hat{i} + z\,\hat{j} + x\,\hat{k}$ around the circle of radius 2 in the lying in the plane $3x - y + 2z = 6$, centered at the point $(0,0,3)$, and oriented counter-clockwise when viewed from above.
4. 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.

5. **Evaluate the line integral of** $\vec{F} = (2x + y)\hat{\imath} + (x - 2y)\hat{k}$ **around the parallelogram whose vertices are** $(0, -6, 0)$**,** $(2, 0, 0)$**,** $(2, 6, 3)$**, and** $(0, 0, 3)$**, traversed in that order.**
6. **Evaluate** $\int_C \vec{F} \cdot d\vec{r}$**, where** $\vec{F} = yz\,\hat{\imath} + 3xz^2\,\hat{\jmath} + x^2y\,\hat{k}$ **and** C **is the boundary of the rectangle in the plane** $x = 2$ **with vertices** $(2, 0, 0)$**,** $(2, 3, 0)$**,** $(2, 3, 1)$**, and** $(2, 0, 1)$**, traversed in that order.**

Answers: 1. $1/4$, 2. $3\pi/2$, 3. $-16\pi/\sqrt{14}$, 4. 0, 5. -42, 6. -6.