Middlebury College

Multivariable Calculus: Spring 2018

Homework

Due April 16, 6pm

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Some thoughts and advice:

- You should expect to spend at least $1-2$ hours on problem sets. A lot of practice problem-solving is essential to understand the material and skills covered in class. Be organised and do not leave problem sets until the last-minute. Instead, get a good start on the problems as soon as possible.
- When approaching a problem think about the following: *do you understand the words used to state the problem? what is the problem asking you to do? can you restate the problem in your own words? have you seen a similar problem worked out in class? is there a similar problem worked out in the textbook? what results/skills did you see in class that might be related to the problem?*

  If you are stuck for inspiration, use the course `piazza` forum (accessible via the course Canvas site). However, don't just ask for the solution - provide your thought process, the difficulties you are having, and ask a coherent question in complete English sentences. Remember the 3RA approach to asking questions outlined in the course syllabus.
- Form study groups - get together and work through problem sets together. **This will make your life easier!** However, you must write your solutions *on your own* and *in your own words*.

⋆ ⋆ ⋆ You **are not allowed** to use any additional resources (e.g. solution manuals, `stackoverflow` etc). If you are concerned then please ask.

- The problems in parentheses are for extra practice and optional (in particular, they do not need to be submitted). **Problems for submission from the textbook are underlined. Additional problems not from the textbook must be submitted**.

  To gain mastery of a topic you should expect to attempt a significant proportion of the problems in the textbook ($> 60\%$(!)).
- Answers to odd-numbered exercises are at the back of the textbook. However, you need to submit a worked solution and provide justification for how you determined the answer.

- **Read/recap:** §3.2, 6.1
- **Problems:** §$X.y$ refers to Chaper X, Section y of *Vector Calculus*, by Colley (4th Edition). All problems are taken from the 4th Edition.

  §3.2: 2, 3, 13
  §6.1: 1, 2, (3), 6, (7), 9, (10), 11, (12), (13), 14, 15, (16)

Problem A: Let $\underline{x}(t) = \begin{bmatrix} t \\ t^2 \\ t^3 \end{bmatrix}$, $t \in [0,2]$, and $\underline{F} = \begin{bmatrix} yz \\ xz \\ xy \end{bmatrix}$.

1. Compute $\int_{\underline{x}} \underline{F} \cdot d\underline{s}$ directly.
2. The vector field $\underline{F}$ is conservative. Determine a potential function $f(x,y,z)$ for $\underline{F}$.
3. Verify that $\int_{\underline{x}} \underline{F} \cdot d\underline{s} = f(\underline{x}(2)) - f(\underline{x}(0))$.