Middlebury College

Calculus II: Spring 2018
Homework
Due April 18, 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), come to office hours, or send me an email. 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. **This will make your life easier!** You can use `piazza` to arrange meet-ups. However, you must write your solutions *on your own* and *in your own words*.
- If you would like more practice then there are (hundreds of) problems in the supplementary course textbooks mentioned in the syllabus, or you can check out `khanacademy.org`.
- You **are not allowed** to use any additional resources. If you are concerned then please ask.

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1. Using the method of substitution determine the following antiderivative problems.

   a. $\displaystyle\int \cos^5(x)\sin^2(x)dx$

   b. $\displaystyle\int \frac{12x^3}{3x^4+1}dx$

   c. $\displaystyle\int \frac{1}{\sqrt{3x-1}}dx$

   d. $\displaystyle\int \frac{2e^x}{e^x+1}dx$

   e. $\displaystyle\int \frac{1}{\sqrt{x}(x+1)}dx$

   f. $\displaystyle\int \frac{1}{x\ln(x)}dx$

2. Determine
$$\int \cos^4(x)\sin^4(x)dx$$
   You will need several trig. identities here

3. In this problem you will determine antiderivative problems of the form
$$\int \tan^n(x)\sec^m(x)dx$$

(a) Show that

$$\frac{d}{dx}\tan(x) = \sec^2(x), \quad \text{and} \quad \frac{d}{dx}\sec(x) = \sec(x)\tan(x)$$

(b) Determine $\int \tan^2(x)dx$ and $\int \sec^2(x)dx$. (*Hint: no substitution required here. A trig. identity may be useful*)

(c) Determine

$$\int \tan(x)\sec^2(x)dx$$

(d) Determine

$$\int \tan^3(x)\sec^4(x)dx$$

(e) Determine

$$\int \tan^4(x)\sec^3(x)dx$$

(f) Determine

$$\int \sec^6(x)dx$$

4. Using the method of inverse trigonometric substitution determine the following antiderivative problems.

a.

$$\int \frac{1}{(4+x^2)^{3/2}}dx$$

b.

$$\int \frac{1}{(1+9x^2)^2}dx$$

c.

$$\int \frac{1}{\sqrt{x^2-8}}dx$$

For c. you will need $\int sec(t)dt = \ln|\sec(t)+\tan(t)| + C$.