Math 116 **ACTIVITY 1:** Establishing teams and reviewing basic antiderivative ideas

Why

You will be working with this team throughout the semester, so you need to begin getting to know your teammates and working with them. To get started on the new material, for the semester, we also need to review the final topic form the Fall.

LEARNING OBJECTIVES

1. Become acquainted with the members of your learning team
2. Work as a team, using the team roles.
3. Sharpen your memory of antiderivative (and derivative) rules.

CITERIA

1. Success in working as a team and in fulfilling the team roles.
2. Success in involving all members of the team in the conversation.
3. Success in completing the review problems

RESOURCES

1. The course syllabus
2. The team role desk markers (handed out in class for use during the semester)
3. 40 minutes

PLAN

1. Select roles, if you have not already done so, and decide how you will carry out steps 2 and 3 (5 minutes)
2. Answer the group I questions below for each member of the team (10 minutes)
3. Work through the group II exercises given here - be sure everyone understands all results & procedures(25 minutes)
4. Assess the team's work and roles performances and prepare the Reflector's and Recorder's reports including team grade (5 minutes).

DISCUSSION

A function $F(x)$ is an *antiderivative* of $f(x)$ if $\dfrac{dF(x)}{dx} = f(x)$. The *general antiderivative* of a function always contains an undetermined constant (represented as C) so that it represents all antiderivatives at once. We use $\int f(x)dx$ to represent "the general antiderivative of $f(x)$ with x as variable"; if $F(x)$ is some antiderivative of $f(x)$, then $\int f(x)dx = F(x) + C$ (for example, since $\dfrac{d}{dx}x^3 = 3x^2$, we know that $\int 3x^2 dx = x^3 + C$—the family on the right includes $x^3 + 5, x^3 - 7$, etc.). Another way to say this is $\int f'dx = f(x) + C$

To get a *particular* antiderivative, you need to know the value of the function (antiderivative) at one point so that you can find a particular value for C. (This is the same as needing the slope *and* a point to get the equation a line). Thus if we know that $g'(x) = 3x^2$ and also that $g(-1) = 5$, the we know that $g(x) = \int 3x^2 dx = x^3 + C$ but also that $5 = g(-1) = (-1)^3 + C$ so $C = 6$ and $g(x) = x^3 + 6$

The antiderivative rules all come from the derivative rules, but using them is not as straightforward when the formulas get more complicated. We begin with a limited range of functions whose antiderivatives we can find, and will stay with those for awhile. (We can find an antiderivative for x^5, for example, but not yet for $(2x + 3)^5$)

Here are the anitderivative rules we have so far:
A. The basic antiderivative rules

1. Constant rule $\int kdx = kx + C$ for any constant k
2. Power rule—nice case: $\displaystyle\int x^n dx = \frac{x^{n+1}}{n+1} + C$ when $n \neq -1$

3. Power rule—less-nice case $\int x^{-1}dx = \int \frac{1}{x}dx = \ln|x| + C$
4. Exponential rule $\int e^{ax}dx = \frac{1}{a}e^{ax} + C$ for any constant a
5. Sine $\int \sin ax dx = -\frac{1}{a}\cos ax + C$ for any constant a
6. Cosine $\int \cos ax dx = \frac{1}{a}\sin ax + C$ for any constant a

B: Reduction rules

1. Constant coefficient rule $\int kf(x)dx = k\int f(x)dx$ for any constant k
2. Sum/difference rule $\int f(x) \pm g(x)dx = \int f(x)dx \pm \int g(x)dx$

EXERCISE

1. Group I: Information on team members. For each member:
   (a) Name
   (b) Hometown – How long have you lived there?
   (c) Favorite college course (before this wonderful & exciting calculus course)–why?
   (d) One surprising/interesting thing about yourself that other people would probably not know.
2. Group II: Some antiderivative exercises
   (a) Use the basic antiderivative rules (including the reduction rules) to give the following general antiderivatives:
      i. $\int t^2 - 4t + \frac{5}{t}\ dt$
      ii. $\int 6\cos 4x\ dx$
      iii. $\int 5e^{4x} - 4e^{5x}\ dx$
   (b) Find the function requested, using the information given:
      i. Give $f(x)$ if $f'(x) = 3x^2 - 2x + 1$ and $f(4) = 70$
      ii. Give $g(t)$ if $g'(t) = 3\sin t$ and $g(\pi) = 4$
   (c) Use the *definition* of "antiderivative" and your derivative rules to show that $\int 2xe^{x^2}dx = e^{x^2} + C$ even though you cannot (yet) directly calculate $\int 2xe^{x^2}dx$.

READING ASSIGNMENT (in preparation for next class)
In your text, read section 5.2

SKILL EXERCISES:(hand in - individually - with assignment for this week)
p.345 #3, 8, 15, 17, 23, 39, 44, 47, 62