18.01 Single Variable Calculus
Fall 2006

18.01 Problem Set 2A

Due Friday 9/29/06, 1:55 pm

2A is the first half of Problem Set 2, all of which is due a week after Exam 1 (the second half, 2B, will be issued at the exam, or the day before). Even though it won't be collected until later, you should do 2A before the exam, to prepare for it.

Part I (15 points)

Lecture 5. Fri. Sept. 15 Implicit differentiation; inverse functions and their derivatives.
Read: 3.5, Notes G section 5, 9.5 (bottom p.913 - 915)
Work: 1F-3,5,8c; 1A-5b; 5A-1a,b,c(just sin, cos, sec); 5A-3f,h

Lecture 6. Tues. Sept, 19 Exponentials and logs: def'n, algebra, applications, derivatives.
Read: Notes X (8.2 has some of this), 8.3 to middle p. 267; 8.4 to top p. 271
Work: 1H-1, 2, 3a, 5b; 1I-1c,d,e,f,m; 1I-4a

Lecture 7. Thurs. Sept. 21 Logarithmic differentiation. Hyperbolic functions (not on exam). Review.
Read: 9.7 to p. 326 Work: 5A-5abc

Lecture 8. Fri. Sept. 22 **Exam 1** covering 0-7.

Students not passing will get e-mail on Friday evening. Make-up exams are offered Monday-Thursday of the week following at times posted at the web site. (see "Exams" on Syllabus sheet).

Part II (30 points)

Directions: Attempt to solve *each part* of each problem yourself. If you collaborate, solutions must be written up independently. It is illegal to consult materials from previous semesters. With each problem is the day it can be done.

0. (not until due date; 2 points) Write the names of all the people you consulted or with whom you collaborated and the resources you used, or say "none" or "no consultation". (See full explanation on PS1).

1. (now; 4 pts) Graph the even and odd functions you found in Problem 1, Part II of PS1. Directly below, graph their derivatives. Do this qualitatively using your estimation of the slope. Do not use the formulas for the derivatives (except to check your work if you want). You can use a graphing calculator to check your answer, provided that you mention it in Problem 0. (Note, however, that you may not use books, notes or calculators during tests, so it is unwise to rely on a graphing calculator here.)

2. (before Fri; 5 pts = 2 + 3) Compute

a) $(d/dx)\tan^3(x^4)$

b) $(d/dy)(\sin^2 y \cos^2 y)$
(Do this two ways: first use the product rule, then write it as $f(2y)$. Show that the answers agree.)

3. (before Fri; 3pts = 1 + 2)

a) If $y = uv$, show that $y'' = u''v + 2u'v' + uv''$

b) Find y'''.

4. (Fri; 4pts 3 +1)

a) The function $\cos^{-1} x$ is the inverse of the $\cos\theta$ on $0 \le \theta \le \pi$. Use implicit differentiation to derive the formula for $(d/dx)\cos^{-1} x$. Pay particular attention to the sign of the square root. (See the book or lecture for the case of the inverse of sine.)

b) Without calculation, explain why $(d/dx)\cos^{-1} x + (d/dx)\sin^{-1} x = 0$

5. (Tues + Thurs; 10pts = 2+2+2+2+2) Do 8.2/8ac, 10, 11; 8.4/18,19a.

6. (Thurs; 2pts) Derive the formula for $D(u_1 u_2 \cdots u_n)$ from PS1, Part II, 7b, using logarithmic differentiation.