Math53: Ordinary Differential Equations
Winter 2004

Homework Assignment 1

Problem Set 1 is due by 2:15p.m. on Friday, 1/16, in 380Y

Problem Set 1:

PS1-Problem 1 (see next page);   1.3: 4,23;   2.1: 8,18;   2.2: 4,12,14,18;   2.3: 4;   2.4: 2,6,13,14,18;
2.5: 4;   2.6: 10,14,26,36;   2.7: 2,4,6,26;   2.9: 20,26,28;   3.1: 12;   3.4: 14.

Note: "2.5: 4," for example, means "Exercise 4 of Section 2.5 in the textbook."

Daily Assignments:

Date	Read	Exercises
1/6 T	1.1-1.3,2.1	PS1-Problem 1; 1.3: 4,23; 2.1: 8,18
1/7 W	2.4	2.4: 2,6,14,18
1/8 R	2.5,3.3,3.4	2.5: 4; 3.4: 14
1/9 F	2.2,2.3	2.2: 4,12,14,18; 2.3: 4; 2.4: 13
1/12 M	2.6	2.6: 10,14,26,36
1/13 T	3.1,3.2	3.1: 12
1/14 W	2.7,2.8	2.7: 2,4,6,26
1/15 R	2.9	2.9: 20,26,28

PS1-Problem 1

(a) State the two Fundamental Theorems of Calculus (no proof necessary).
(b) State the chain rule for the one-variable differentiation (no proof necessary).
(c) State the product rule for the one-variable differentiation (no proof necessary).
(d) If a is a real number and $f(x) = x^a$, what is $f'(x)$? (no proof necessary)
(e) If $f(x) = e^x$, what is $f'(x)$? (no proof necessary)
(f) State the quotient rule for the one-variable differentiation. Deduce it from (b)-(d).
(g) State the change-of-variables formula for the one-variable integration. Deduce it from (a) and (b).
(h) State the integration-by-parts formula for the one-variable integration. Deduce it from (a) and (c).
(i) Suppose $a = a(t)$ is a smooth function, c is a real number,

$$f(t) = \int_c^t a(s)ds, \qquad \text{and} \qquad h(t) = e^{f(t)}.$$

Compute $h'(t)$, using (a), (b), and (e).
(j) Find a nontrivial first-order differential equation which is solved by the function $h = h(t)$ of (i).

Note 1: One can find answers to (a)-(h) in any calculus textbook, but first try to do this problem on your own. If you do need to consult a calculus textbook, feel free to do so, but write your own answers.
Note 2: In (j), a nontrivial differential equation is an equation which cannot be simplified to $0 = 0$. Your answer to (j) should be of the form:

$$h'(t) = Q(t, h(t)),$$

where Q is a function of two variables.