Math53: Ordinary Differential Equations
Autumn 2004

Homework Assignment 1

Problem Set 1 is due by 2:15p.m. on Monday, 10/4, in 380Y

Problem Set 1:

Problem A (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; 2.7: 2,4,6,26; 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*
9/27 M	1.1-1.3,2.1	Problem A; 1.3:4,23; 2.1:8,18
9/28 T	2.4	2.4:2,6,14,18
9/29 W	2.2,2.3	2.2:4,12,14,18; 2.3:4; 2.4:13
9/30 R	2.5,3.1-3.4	2.5:4; 3.1:12; 3.4:14
10/1 F	2.7,2.8	2.7:2,4,6,26

Problem A

(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: Your answer to (j) should be of the form:

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

where Q is a function of one variable.