

# MAT 127: Calculus C, Fall 2009

## Homework Assignment 1

**Problem Set 1 is due by the beginning of lecture on**  
**Wednesday, 09/09** if enrolled in L01, L02  
**Thursday, 09/10** if enrolled in L03, L04

Please read Section 7.1 thoroughly before starting on the problem set.

**Problem Set 1:** 7.1 2,3,10,12; Problem A (below)

*Show your work; correct answers without explanation will receive no credit, unless noted otherwise*

*Please write your solutions legibly; the graders may disregard solutions that are not readily readable. All solutions must be stapled (no paper clips) and have your name and lecture number in the upper-right corner of the first page.*

### Problem A

- (a) State the two Fundamental Theorems of Calculus (answer only).
- (b) State the chain rule for one-variable differentiation (answer only).
- (c) State the product rule for one-variable differentiation (answer only).
- (d) If  $a$  is a real number and  $f(x) = x^a$ , what is  $f'(x)$ ? (answer only)
- (e) If  $f(x) = e^x$ , what is  $f'(x)$ ? (answer only)
- (f) State the quotient rule for one-variable differentiation. Deduce it from (b)-(d).
- (g) State the change-of-variables formula for one-variable integration. Deduce it from (a) and (b).
- (h) State the integration-by-parts formula for one-variable integration. Deduce it from (a) and (c).
- (i) Suppose  $a = a(t)$  is a smooth function,  $c$  is a real number,

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

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). Your answer should be of the form

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

where  $Q$  is a function of two variables.