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.