Math 141-005 Exam I (FALL 2009)

Be sure to show your work.

Name: ________________________________

Instructor: Amos Ong M T W R 3:35PM – 4:25PM

1. [30 Points] Let \( A \) be the region in the first quadrant bounded between \( y = x^2 \) and \( y = x^3 \).
   (a) Find the area of \( A \).
   (b) Find the volume of solid generated by revolving \( A \) about the \( x \)-axis.

2. [30 Points] Let \( A \) be the region bounded between \( y = 0 \) and \( y = 4x - x^3 \) in the first quadrant. Find the volume generated by revolving \( A \) about the \( y \)-axis.

3. [30 Points] Set up and simplify (but do not evaluate) two different integrals (one \( dx \) and one \( dy \)) that give the arc length of the graph of \( y = \frac{2}{3}x^{3/2} \) from \((1, \frac{2}{3})\) to \((9, 18)\).

4. [60 Points] Evaluate the following indefinite integrals
   (a) \( \int x^3 \cos x \, dx \)
   (b) \( \int 3x^2 \ln x \, dx \)
   (c) \( \int \frac{e^{1/t}}{t^2} \, dx \)
   (d) \( \int \frac{\ln x}{x} \, dx \)
   (e) \( \int \frac{1}{\sqrt{5 - 4x - x^2}} \, dx \)
   (f) \( \int \arctan x \, dx \)

Bonus: Find the volume of a solid whose base is bounded by the circle \( x^2 + y^2 = 9 \) and whose cross-sections, taken perpendicular to the \( x \)-axis, are all rhombuses of smaller angle \( \pi/6 \) and bigger angle \( 5\pi/6 \).