

Name: _____

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30 minutes maximum. No aids (book, calculator, etc.) are permitted. Show all work and use proper notation for full credit. Answers should be in reasonably-simplified form. 25 points possible.

1. [8 points] Compute and simplify the following integrals.

a. $\int x^2 2^{(x^3)} dx =$

- b. (*Hint. Write in terms of more basic trigonometric functions.*)

$$\int_0^{\pi/4} \tan x \, dx =$$

2. [4 points] It requires 10 Newtons of force to stretch a spring 25 cm from its equilibrium position. How much work is required to stretch the spring one meter from its equilibrium position? Give your answer in Joules and in simplified form. (*Hint. First, what is the spring constant?*)
3. [4 points] A partly-damp 40 meter firehose has linear density $\rho(x) = e^{-x} + 0.1x$ kg/m, assuming $x = 0$ is the beginning of the hose. What is the total mass of the hose? Please simplify your answer, and provide the units.

4. [9 points]

- a. Sketch the region enclosed by the curves $y = 3^x$, $x = -1$, $x = 1$, and the x -axis. Indicate with a **bold dot** the approximate location of the center of mass (\bar{x}, \bar{y}) .
- b. Set up, but do not evaluate, the three definite integrals needed to compute the center of mass for the region sketched in part a. (*Hint. You may assume $\rho = 1$.*)
- c. Supposing the integrals in part b have been computed, how do you find the center of mass?

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