MATH143-01 Exam Two Spring 2009

You may keep this page of questions. Turn in your answers with all of your work on the colored paper. NO calculators are allowed on THIS exam.

(1a) 12 Points. Find the **area** of the region in the xy-plane that is bounded by $y = x + 1$ and $y = (x - 1)^2$.

(1b) 8 Points. Find the **mass** of the region in the xy-plane that is bounded by $y = x + 1$ and $y = (x - 1)^2$ if the density δ at a point (x, y) within the region is given by $\delta = x^2$.

(1c) 8 Points. Find the **moment with respect to the y-axis** for the region in the xy-plane that is bounded by $y = x + 1$ and $y = (x - 1)^2$ if the density δ at a point (x, y) within the region is given by $\delta = x^2$.

(2) 18 Points. Find the volume of the solid of revolution that is generated by revolving the region bounded by $x = 0, y = 9$ and $y = x^3 + 1$ about the y-axis.

(3) 12 Points. A certain HUGE spring has a natural length of 2.0 meters and exerts a force of 50.0 newtons when it is stretched to the length of 7.0 meters. How much work (in joules) is done in stretching this spring from 2.0 meters to 5.0 meters?

(4) 12 Points. Set up, but do not evaluate, a definite integral for the arc length of the curve $y = \sin(3x)$ between $x = -\pi$ and $x = \pi$.

(5a) 14 Points. Analyze and evaluate $\displaystyle\int_0^\infty e^{-x/5}\,dx$.

(5b) 8 Points. Let $f(x) = \begin{cases} 0 & \text{if } x < 0 \\ ke^{-x/5} & \text{if } x \geq 0 \end{cases}$ For what value of k will $f(x)$ be a probability density function?

(5c) 8 Points. Using the value of k for part **(5b),** find the median, T, for the probability distribution having density function $f(x) = \begin{cases} 0 & \text{if } x < 0 \\ ke^{-x/5} & \text{if } x \geq 0 \end{cases}$

I am expecting an exact but irrational answer rather than a decimal approximation.