Written Homework 4

MATH 126

Solve each of the following problems. Work out your problems on scratch paper first, then write your solutions neatly on the pages you plan to turn in. Write the problems in assigned order, with each problem clearly labeled. Use words to clearly explain your work and methods. The reader should never have to guess or infer your intentions.

For a brief guide to writing homework solutions, see *Writing Mathematics Well* from Harvey Mudd College.

Scan or photograph your solutions and submit them (as a single file) to the Written Homework 4 assignment on Moodle. This assignment is due at classtime on **Friday, September 26**.

1. If $g(x) = \displaystyle\int_{\ln(x)}^{x^2} \frac{\tan(t)}{t+1}\,dt$, then what is $g'(x)$? Use words to justify each step that you take.

2. Let f be a twice-differentiable function such that $f(0) = 3$, $f(2) = 5$, and $f'(2) = 1$. Evaluate the integral

$$\int_0^2 xf''(x)\,dx.$$

Explain your work.

3. The graph of the *hyperbolic cosine* function $y = \cosh(x) = \frac{1}{2}\left(e^x + e^{-x}\right)$ is called a *catenary* and represents the shape of a hanging cable. Set up an integral that represents the length of this graph from $x = -1$ to $x = 1$. Then use technology to evaluate the integral.

4. Draw a careful sketch of the region bounded by the graph $y = x^2 + 1$ and $y = -x^2 + 2x + 5$. What is the volume of the solid formed by rotating this region about the x-axis? Explain your work. You may use technology to evaluate the integral that gives your answer.