Homework to be done by October 28th

Section 4.5: Problems 3, 6, 20, 23, 27, 29, 31, 60.
Section 5.2: Problems 3, 13.
Section 5.3: Problems 9, 14, 17, 35, 38, 39, 48, 59.
Section 5.4: Problems 11, 12, 23.

Problems to be handed in on October 28th

Problem 1: A power line is needed to connect a power station on the shore of a (straight) river to an island 4 kilometers down the stream and 1 kilometer offshore.

1.1 Find the minimum cost for such line given that it costs $ 50,000/km to lay wise under the water and $ 30,000/km to lay wire under ground. Also find the point where the line should leave the shore.

1.2 Same questions, with the costs under water and under ground reversed. (The answer is intuitively obvious, but what happens to the calculus solution?)

1.3 Same questions, with costs of $ 50,000 under water and $ 49,000 under ground.

Problem 2. Show that for all $x \in \mathbb{R}$.

$$\int_0^x (t + |t|)^2 \, dt = \frac{2}{3} x^2 (x + |x|).$$

Problem 3. Let f be a function such that f' is continuous on $[a, b]$. Show that

$$\int_a^b f(t) f'(t) \, dt = \frac{1}{2} \left[f^2(b) - f^2(a) \right].$$

Problem 4. Compute the area of the region bounded by the curves $y = x^2 + 1$, $y = x^2 + x$ and $y = 2$ (simultaneously).