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## MATH 582 Homework 5

Carefully Read and Follow Directions Clearly label your work and attach it to this sheet. No credit will be given for unsubstantiated answers.

1. Consider the functional $f(u)$ given in problem 2.5 on page 97 of your textbook.
(a) Show that the functional is a quadratic functional. Be sure to correctly identify the set $\tilde{V}$.
(b) Consider the case when $b<\pi$, and show that the function $\hat{u}=0$ is the unique strong global minimizer of the functional $f$. Hint: begin by finding the stationary point.
(c) Consider the case when $b=\pi$, and show that the functional $f$ has a "family" of global minimizers given by $\hat{u}_{c}(x)=c \sin x$ for any real number $c$.
2. In Problem Problem 2 of Homework 4, you went through the specific calculations of the right-hand side vector for the test problem outlined there. In particular, your code "hard-wired" the right-hand side vector of integrals

$$
b_{i}=\int_{0}^{1} f(x) \phi_{i}(x) d x, \quad i=1,2, \ldots N
$$

For this assignment, we take the a more general approach. Create a Matlab function which builds the right-hand side vector for a function $f(x)$. We just discussed this in class, and you will need to download a couple of functions from the class homepage. These m-files are gauss.m and shape.m. Continue to assume that the basis functions creating our approximation space $S$ are the "hat functions." Consult your class notes for pseudo-code for constructing this vector.

