April 7, 2009

MAE 105 Homework #2
Due: Tuesday, 04/14/09

PROBLEM 1 (2 Points):

Use the identity, $e^{\pm i\theta} = \cos\theta \pm i \sin\theta$ to express $\sin\alpha \sin\beta$, $\sin\alpha \cos\beta$, $\cos\alpha \cos\beta$, in terms of $\sin(\alpha \pm \beta)$, and $\cos(\alpha \pm \beta)$.

PROBLEM 2 (1.5 Points):

Use the results from PROBLEM 1, to explicitly integrate the following definite integral:

$$I_1 = \int_0^x \cos(\alpha\, x')\cos(\beta\, x')\, dx', \qquad I_2 = \int_0^x \sin(\alpha\, x')\sin(\beta\, x')\, dx',$$

$$I_3 = \int_0^x \cos(\alpha\, x')\sin(\beta\, x')\, dx'.$$

PROBLEM 3 (6 Points):

Consider the following ODE:

$$\frac{d^2\phi}{dx^2} + \alpha\,\phi = 0, \qquad 0 < x < \pi. \tag{B-1}$$

(a) Find the general solution when $\alpha = 9$.

(b) Find the general solution when $\alpha = -9$.

(c) Find the general solution when $\alpha = 0$.

[Note 1: Each of your general solution must include two integration constants.]

For each of the following boundary conditions, viewed as separate problem, find the complete solution of (B-1) for all cases, (a), (b), and (c) above:

$$(A): \qquad \phi(0) = \phi(\pi) = 0. \tag{B-2}$$

$$(B): \qquad \frac{d\phi}{dx}(x = 0) = 0. \tag{B-3}$$

$$\phi(\pi) = 0,$$

Note 2: To receive full credit, *all steps must be neatly shown.* Writing down the final results will receive no credit.

Note 3: Homeworks must be turned in at the start of due-date class. Late homeworks will be graded but *will receive zero credit*.