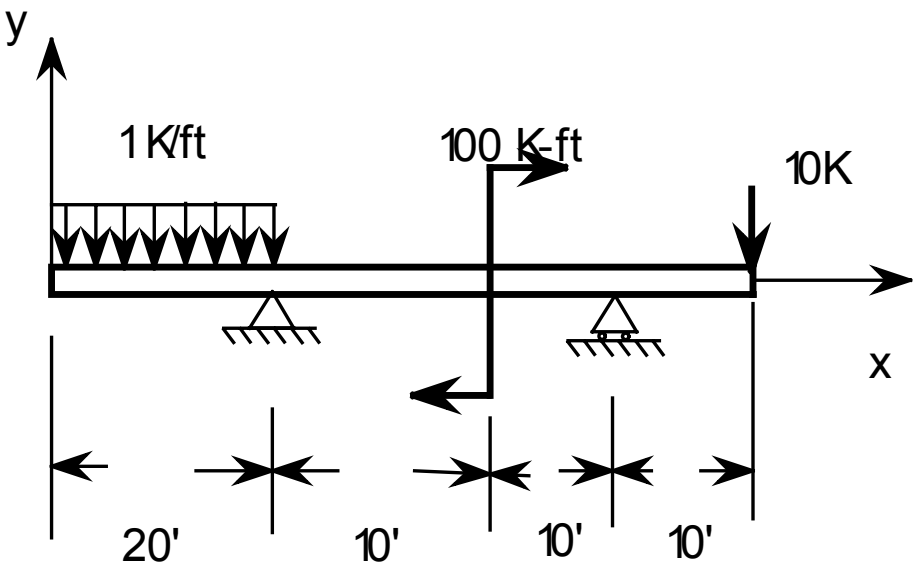
13.122 Ship Structural Design and Analysis

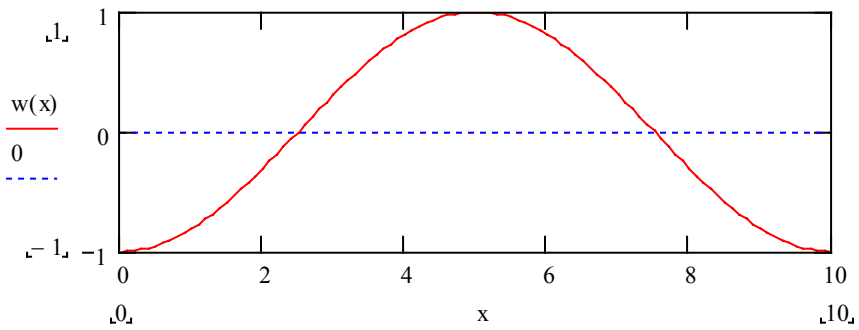
Problem Set 1 2003

Part A: A Quick 13.10 Review

1. Shames (13.10 Text) Problem 10.34. repeated here for info: Find the supporting forces for the simply supported beam in figure. Then sketch the shear-force and bending moment diagrams, labeling key points. 1K = 1000 lbs



2. A simply supported beam is subject to a distributed load $w = -w_o * \cos\left(2\pi \frac{x}{L}\right)$



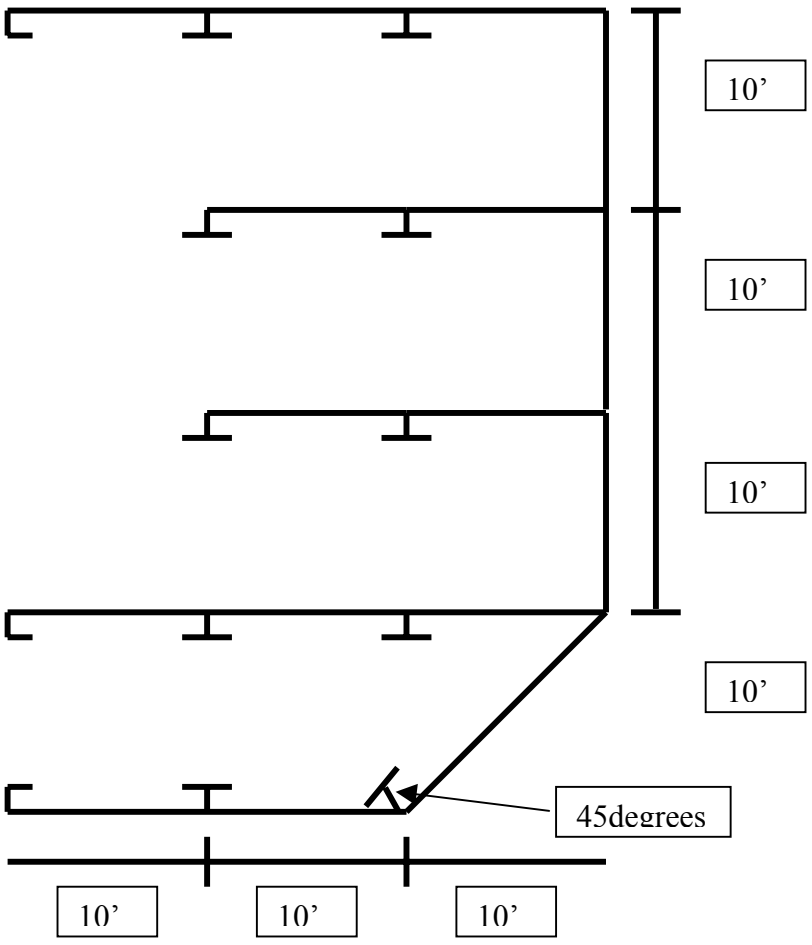
a) Determine reaction forces at the ends
b) Plot shear-force and bending moment diagrams
c) Model the distributed load as a set of four concentrated loads determined by integrating over each quarter length. Locate the load at the mid length of each segment. I.e.

$$F_2 = \int_{\frac{L}{4}}^{\frac{L}{2}} w(x)dx \quad \text{located at } x = \frac{3}{8}L$$

Comment on the static equivalency of this model of the distributed load (is it equivalent in force and moment?)

d) Plot shear-force and bending moment diagram for this loading. Comment on the comparison with b) above.

Part B: Area Properties of a Midship section



Given: Plate Thickness: 0.5 in

	Girder	Stiffener
Web Height	13.91 in	9.87 in
Web Thickness	0.255 in	0.19 in
Flange Breadth	5.03 in	3.96 in
Flange Thickness	0.42 in	0.21 in

Not shown in the drawing are the five longitudinal stiffeners equally spaced along each strake. Take note of the girders on the centerline. Assume all structural material is mild strength steel and the vessel is in salt water.

Provide the following information:

a) Bonjean curve considering the following waterlines: 1',2.5',5',7.5',10',15',20',25',30',35',40'
b) Structural weight per foot
c) Buoyancy per foot
d) Shear Force for 18' immersion
e) Neutral Axis and the Moment of Inertia relative to the Neutral Axis