13.400 Introduction to Naval Architecture Name_____
Fall 04

QUIZ #1
25 October 2004

1. (10 points total). The USS COMMENCEMENT BAY (CVE 105) is preparing to embark on her first wartime deployment after commissioning in 1944. The AirBoss and Commanding Officer are engaged in a discussion about bringing additional airframes on board to increase the "Bay's" firepower. You, the Chief Engineer, a 13A graduate, are called upon to render an engineering recommendation based on facts. The following data applies:

General Stability Diagram is based on a VCG of 27 feet above the keel.
The BUSHIPS recommended deployment displacement is 24,000 LT.

The Air Boss has found an additional 4000 LT of aircraft, but the only available stowage location for them is at a center of gravity 37.5 feet above the keel, and 3.5 feet to starboard of the centerline, at the LCF.

a. (4 pts) Using the GSD provided, determine the Range of Stability, Maximum Corrected Righting Arm, and Angle of Inclination at the Max GZ, if the Air Boss gets his way.

b. (1 pt) Using the GSD corrections you developed in part a, make an estimate of the metacentric height.

c. (2 pts) Your able-minded Damage Control Assistant tells you he has used the "Bay's" Displacement and Other Curves and determined the height of the transverse metacenter above the keel with the proposed additional payload is 32.3 feet. What will be the resultant angle of inclination using this value for KM?

d. (2 pts) Based on the shape of the uncorrected righting arm curves, make a qualitative statement of how the metacentric height and righting arm will vary at the lightest and heaviest displacements shown.

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e. (1 pt) So, based on your calculations, do you support the Air Boss' recommendation, or the more conservative Commanding Officer (who is, of course, responsible for the safety of his ship and crew) who is not in favor of embarking the additional aircraft? Why?

2. (15 points total) The following are characteristics of the second class armored battleship, USS MAINE (BB10):

LPP = 320 ft DWL is 22 ft ABL Displacement at DWL = 6916 LT

Table of half-breadths in feet:

Sta#	0	.5	1	2	3	4	5	6	7	8	9	9.5	10
½ B	0	6.92	13	21.75	26.17	28.33	28.67	28.5	26.83	23.35	15.83	9.56	1

a. (6 pts) Calculate the Area of the 22 foot waterplane.

b. (3 pts) Determine the longitudinal center of flotation, referenced to amidships.

c. (4 pts) Calculate the transverse metacentric radius.

d. (2 pts) What additional data (if any) do you require to calculate the following parameters: (Do NOT perform any additional computations)?

(1) Tons per inch immersion:

(2) Sectional areas at each station:

(3) Moment to trim one inch:

(4) The height of the transverse metacenter above the keel:

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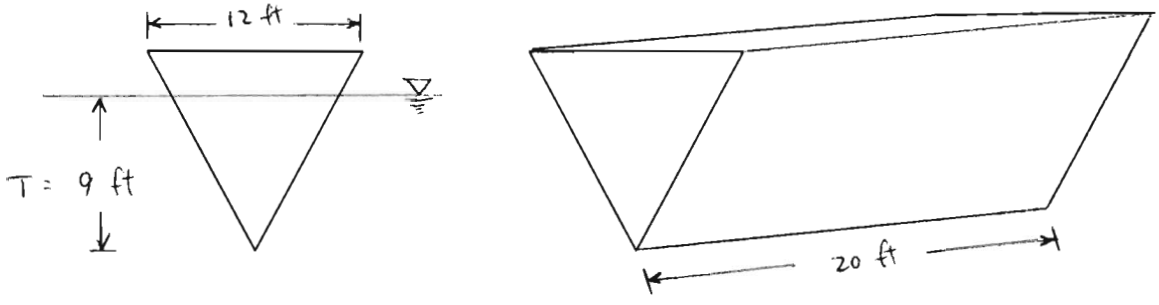
3. (10 points total) An isosceles triangular – shaped "lighter" 12 feet on a side, 20 feet long, of unknown but homogeneous density material is floating in seawater at a draft of 9 feet.



a. (1 pt) Calculate the Block Coefficient.

b. (1 pt) Calculate the Prismatic Coefficient.

c. (2 pts) Calculate the vertical center of buoyancy and vertical center of gravity (both referenced to the "pointy" keel).

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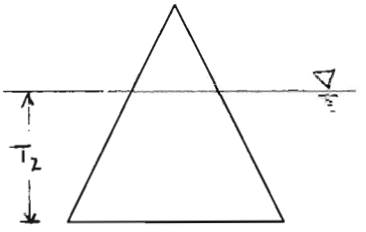
d. (4 pts) An externally applied moment causes the lighter to flip and it is now floating in a broad bottom configuration as shown. Will it reach static equilibrium at a draft of 9 ft? Why or why not. If not, calculate the new draft.



e. (2 pts) Calculate the vertical center of buoyancy referenced to the new "flat" keel.

GENERAL STABILITY DIAGRAM — CVE 105