MEMORIAL UNIVERSITY OF NEWFOUNDLAND

Faculty of Engineering and Applied Science

Engineering 5003 - Ship Structures

MID-TERM EXAMINATION

SOLUTIONS

Date: Fri., Feb. 14, 2012 **Professor: Dr. C. Daley**
Time: 9:00 - 9:50 pm

Answer all questions on the question paper. If you must, use the back of the page, Total 20 marks. Each question is worth marks indicated **[x].**

Name: _____

Student No: _____

Watch your time. 60min
Think through your answers, then write and sketch clearly and concisely.

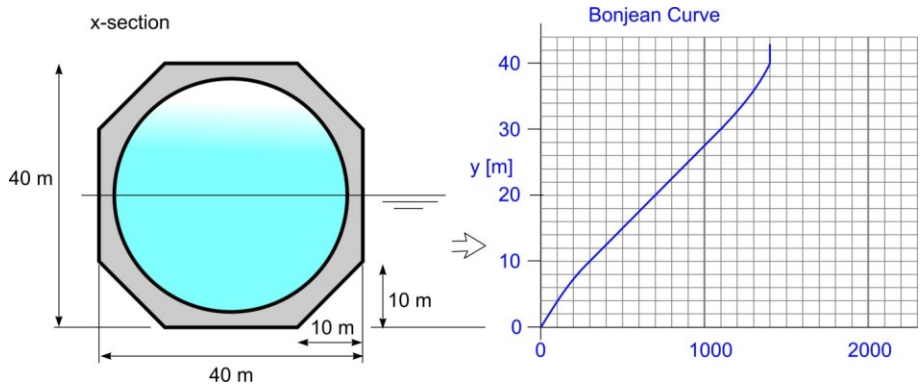
Good luck.

1. Discuss the issue of 'structural hierarchy' in ships **[2]**

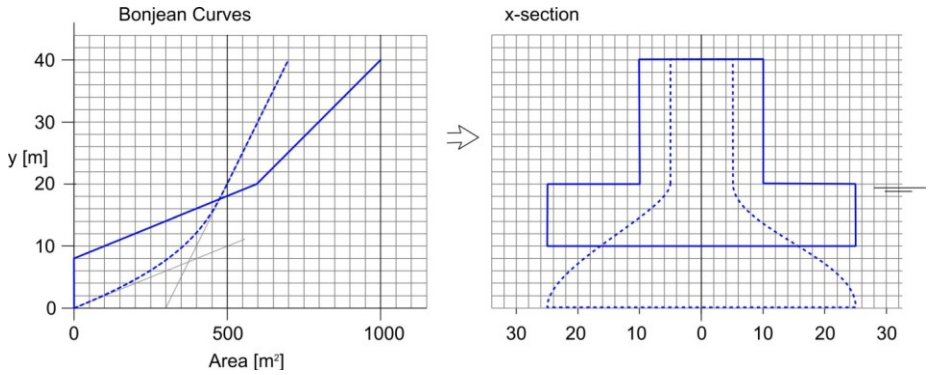
Structural Hierarchy includes a number of related issues and effects.

- Ships are comprised of small structural elements that are also part of larger and larger things (ie plate is an element, but also the flange of a frame and also the extreme fiver of the whole hull girder.)
- Lower levels in the hierarchy support by the higher levels. (primary supports secondary which supports tertiary)
- There is a sequence of structural issues that differ depending on scale. Smallest is material behavior. Large are single structural elements. Largest level is a structural system. There is different theory and methods for each level.

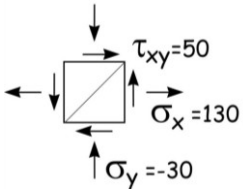
2. For the three station profiles shown below, sketch the corresponding bonjean curves
a) draw the bonjean curve to scale for the section of an enclosed LNG hull shown **[2]**

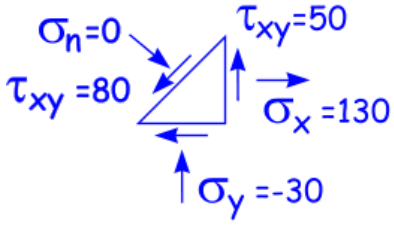


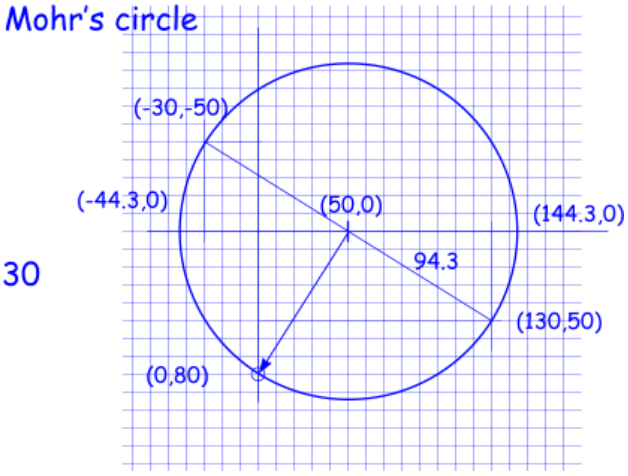
b) draw the x-sections to scale for the two bonjean curves shown **[2]**



3. For the case of stress shown below,
a) draw a Mohr's circle. **[2]**
b) What are the stresses on a 45deg diagonal plane (the line in the sketch). **[2]**







4. Still Water Bending Moment.

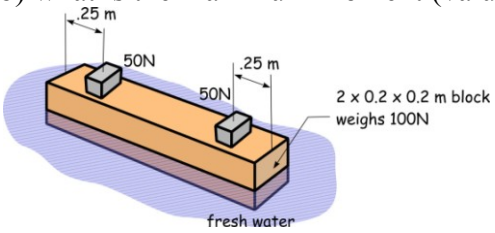
a) for the floating blocks shown below, draw **[3]**

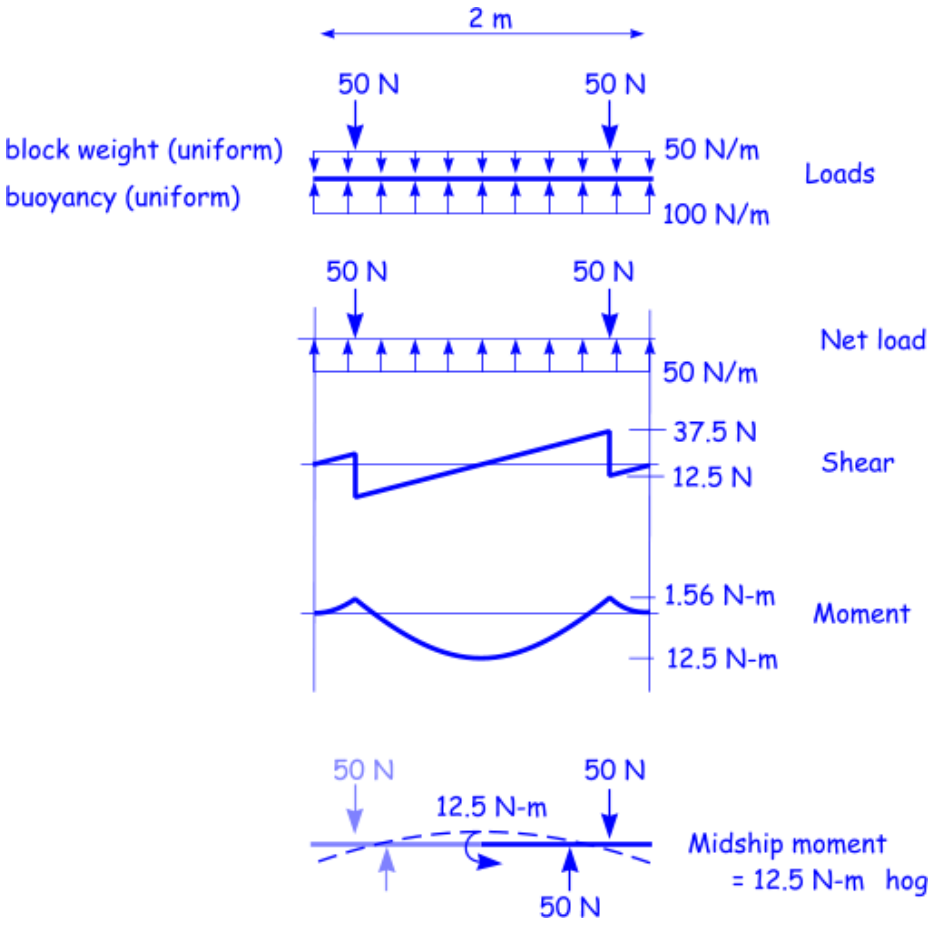
i. net load,

ii. shear and

iii. bending moment diagrams.

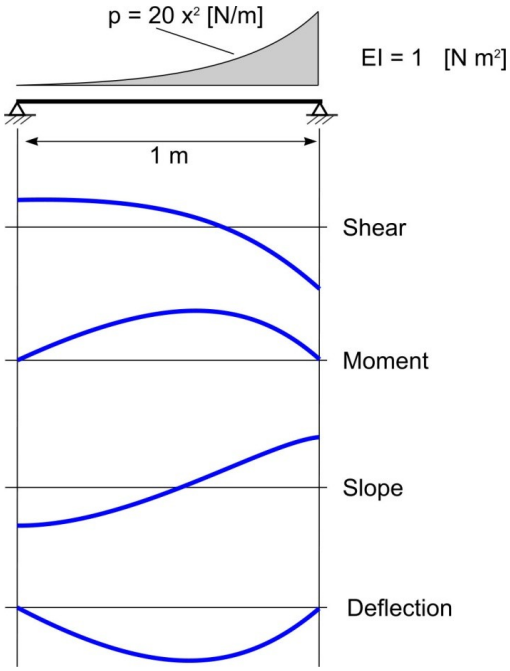
b) what is the maximum moment (value + sag or hog)? **[1]**



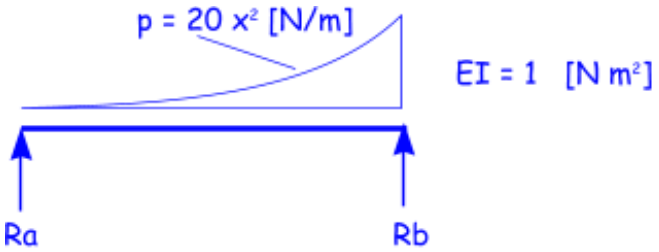


5. Beam Mechanics. For the beam sketch below:

a) sketch (without numbers) the shear, moment, slope and deflection. Use any construction lines to indicate min, max and zero values. **[3]**



b) solve the shear and bending using direct integration. **[3]**



$$Q(x) = Qo + \int p(x)\,dx$$
$$= Ra - \int_0^x 20\,x^2\,dx$$
$$= Ra - 20/3\,x^3$$

$$M(x) = Mo + \int Q(x)\,dx$$
$$= 0 + \int_0^x Ra - 20/3\,x^3\,dx$$
$$= Ra\,x - 5/3\,x^4$$

we know: $M(L) = 0 = Ra\,L - 5/3\,L^4$

therefor: $Ra = 5/3\,L^3 = 5/3$

$Q(x) = 5/3 - 20/3\,x^3$ <- Ans

$M(x) = 5/3\,x - 5/3\,x^4$ <- Ans