MEMORIAL UNIVERSITY OF NEWFOUNDLAND

Faculty of Engineering and Applied Science

Engineering 5003 - Ship Structures

MID-TERM EXAMINATION

With SOLUTIONS

Date: Fri., Feb. 13, 2015 **Professor: Dr. C. Daley**
Time: 10:00 - 10:50 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.

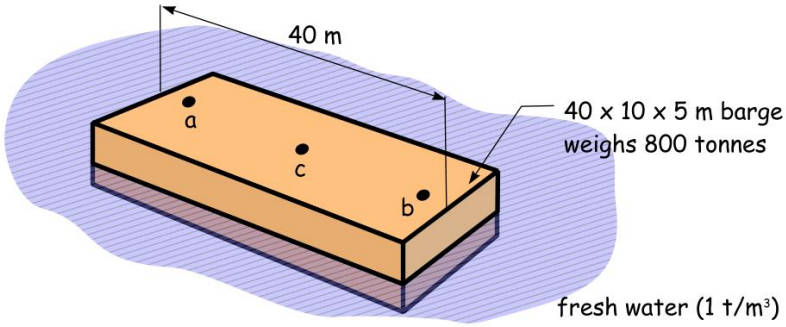
Good luck.

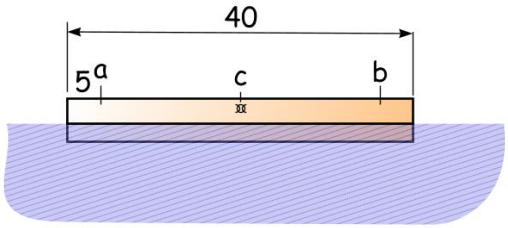
1. Consider the barge as sketched below. Point c is in the center of the barge. Points a and b are 5m in from the ends of the barge.

a) What would be the change in the moment at midhips if you moved a 1. tonne weight from point a to point b? **[2]**

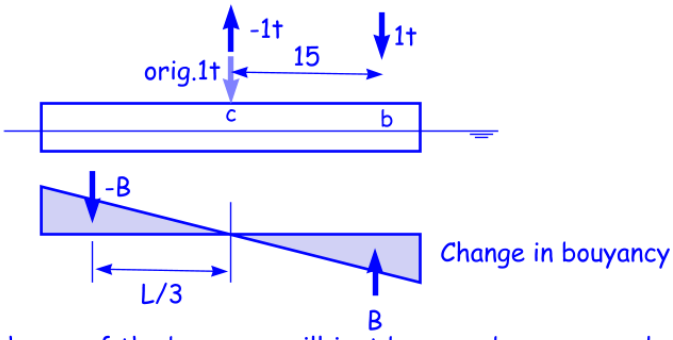
no change, both cause same hogging moment

b) what would be the change in the moment at midhips if you moved a 1. tonne weight from point c to point b?





moving 1t by 15m is exactly like applying a 15 t-m couple



the change of the bouyancy will just be more buoyancy under one end and less under the other end, with no change in buoyancy at midships. Each half of the buoyancy change is termed B with a center of effect at 2/3 of the half length. The magnitude of B must enough to create a moment to exactly counteract the moment caused by the shifted weight :

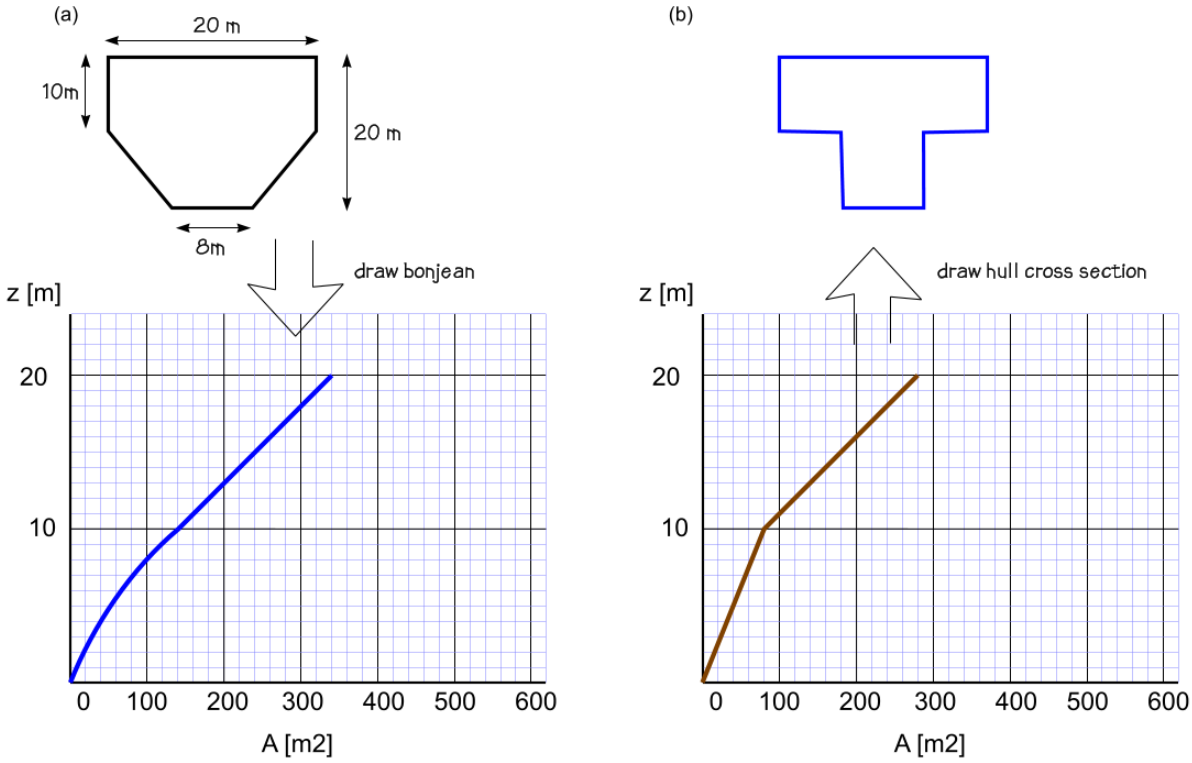
$$B \times 2/3 \times 40 = 15 \rightarrow B = .5625 \text{ t}$$

the moment change at midships can be found by considering the moment that is needed to resist the effect of the changed buoyancy:

$$M_c = B \times 40/3 = 7.5 \text{ t-m}$$

2. For part (a) shown below, sketch the bonjean curve. For part (b) draw the hull cross section. **[4]**

Answers sketched below



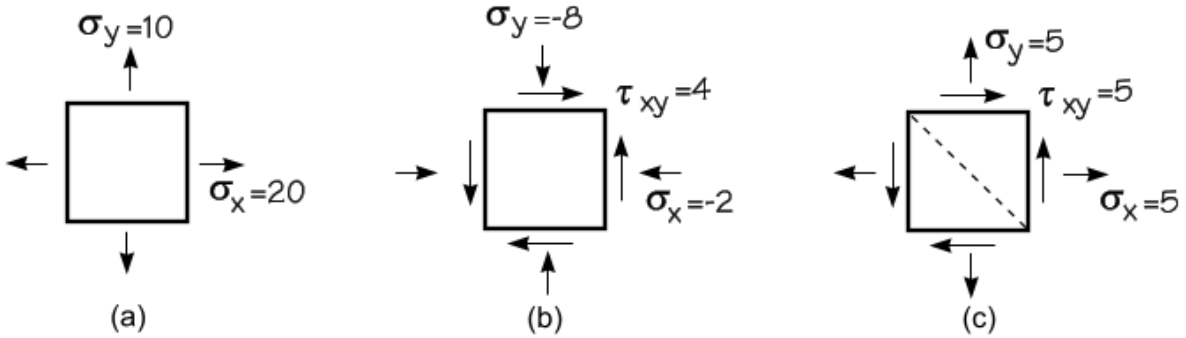
3. For the three cases of stress shown below,

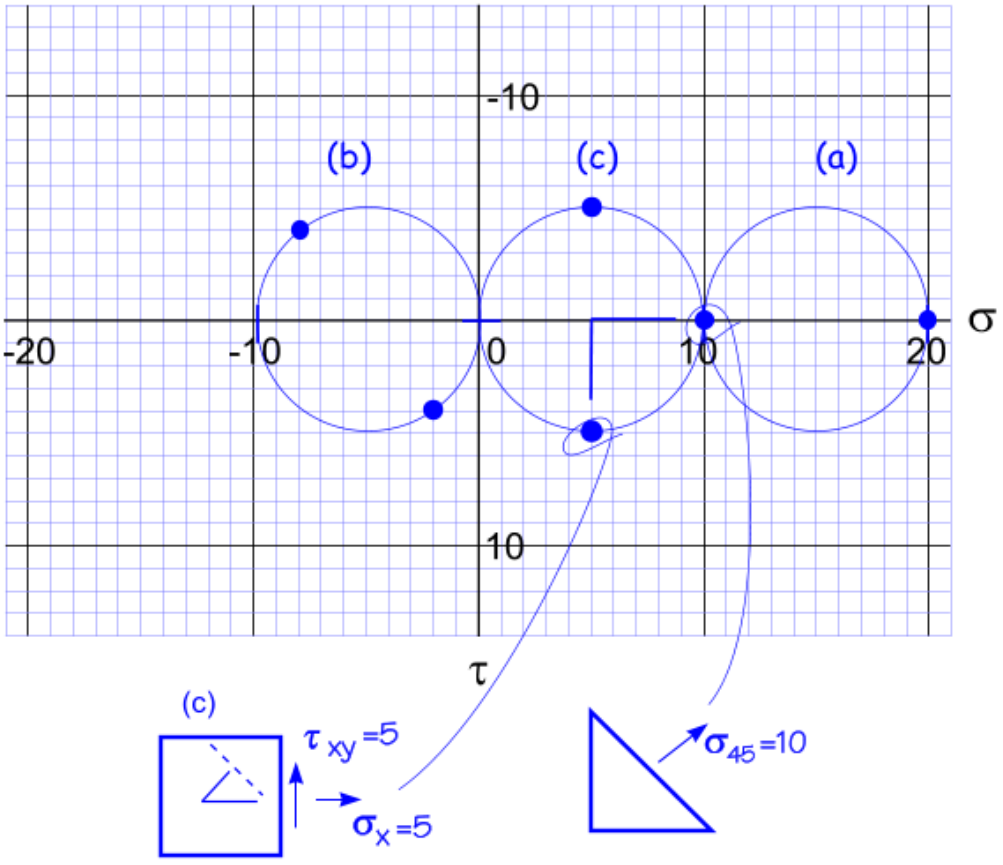
a) draw a Mohr's circle.

Answers sketched below

b) For case (c) what are the stresses on a 45deg diagonal plane (the dashed lines in the sketch). **[5]**

10 MPa tension

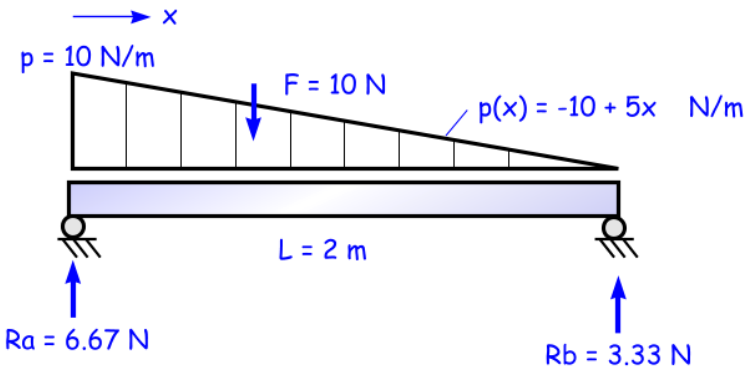




4. Beam Mechanics. For the beam sketched below:

a) Solve the problem above using direct manual integration. Give the equation for shear and moment, and the location and magnitude of the maximum moment (ie give numbers).

[5]



$$Q(x) = Qo + \int p(x)\,dx \qquad Qo = Ra$$

$$Q(x) = 6.67 - 10\,x + 2.5\,x^2$$

$$M(x) = Mo + \int Q(x)\,dx \qquad Mo = 0$$

$$M(x) = 6.67x - 5x^2 + .833\,x^3$$

M_{MAX} : where $Q(x) = 0$

solve $2.5\,x^2 - 10\,x + 6.67 = 0$ >> $x = .845$

$$M_{MAX} = 2.57 \text{ N-m}$$

b) sketch by hand the shear, moment, slope and deflection diagrams (just sketch, no numbers)

[2]