Université d'Ottawa
Faculté de genie

Départment de
Génie civil

University of Ottawa
Faculty of Engineering

Department of
Civil Engineering

uOttawa

L'Université canadienne
Canada's university

CVG 2140
MECHANICS OF MATERIALS (I)
MIDTERM EXAM

Length of Examination: 1 hr 20 mins **14th Feb, 2013 (13:00 - 14:20)**
Professors: Alaa Mohammed Abdulridha & Won Taek Oh

First Name: _____

Last Name: _____

Student Number: _____

Signature _____

(i) This is a closed book exam. No textbooks are allowed
(ii) If you do not understand a question, clearly state an assumption and proceed.
(iii) Non programmable calculators are permitted
(iv) Questions have the values shown next to the question.
(v) Marks will be taken out for missing units and labels.
(vi) Answers should be succinct.

At the end of the exam, when time is up:
- Stop working and turn your exam upside down.
- Please remain silent.
- Do not move or speak until ALL exams have been picked up, and a TA or the Professor gives the go-ahead to leave.

Question	**Max Marks**	**Marks Awarded**
1	30	
2	30	
3	40	
Total	**100%**	

Question 1 (30 Marks)

For the shape illustrated in Figure 1, determine:

- **a.** The location of the centroid C. **(15 Marks)**
- **b.** The moments of inertia I_{xc}, I_{yc} with respect to its centroidal axes **(15 Marks)**

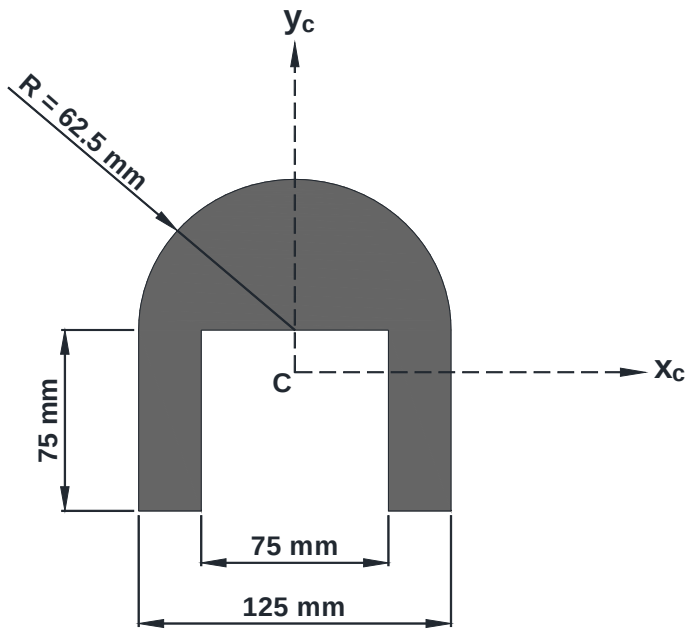


Figure 1

Question 2 (30 Marks)

V(kN) m(kN·m)

For the beam shown in Figure 2, draw the shear and moment diagrams for the beam. Indicate values at the supports and at the points where a change in load occurs.

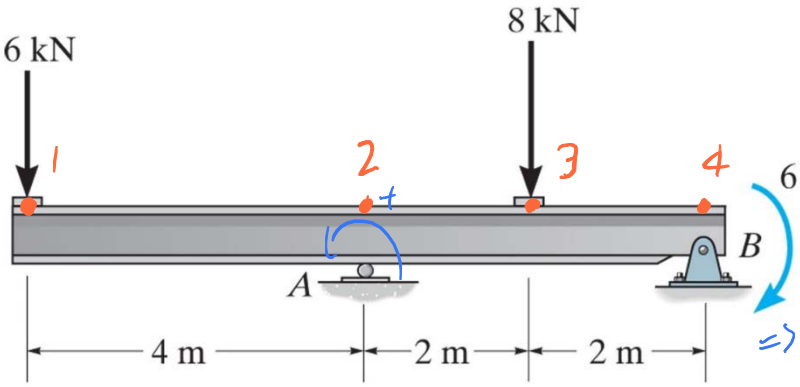


Figure 2

$\circlearrowleft \Sigma M_A = 0$

$\Rightarrow 0 = (6\,kN)(4m) - (8\,kN)(2m) + B_y(4m) - 6\,kN\cdot m$

$\therefore +\uparrow B_y = -0.5\,kN\cdot m$ ✓

$\Sigma F_y = 0,$

$A_y + B_y = 6\,kN + 8\,kN$

$A_y = 6\,kN + 8\,kN + 0.5\,kN$

$+\uparrow A_y = 14.5\,kN$

(?)

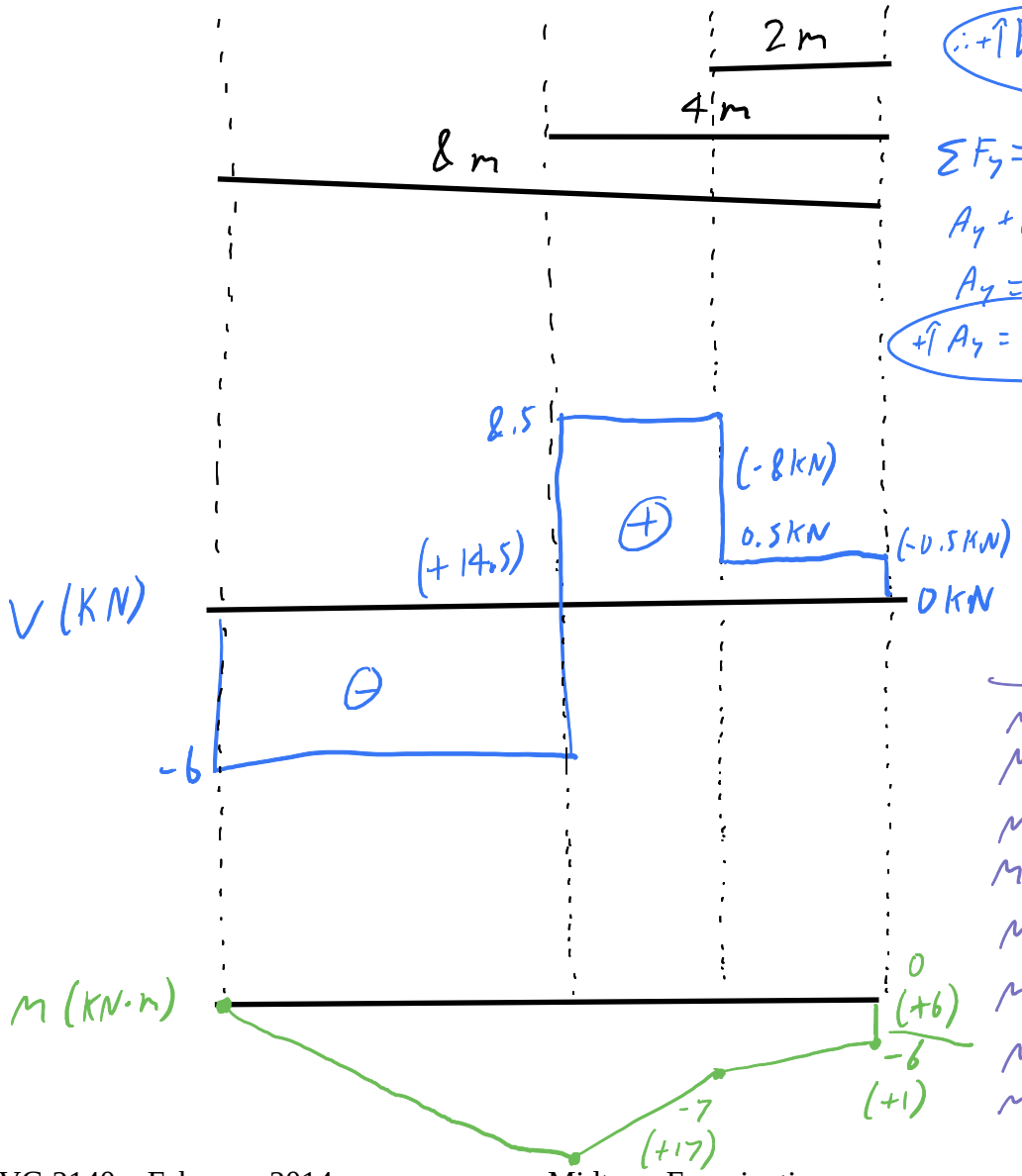
$V_{1-} = 0\,kN$

$V_{1-2} = -6\,kN$

$V_{2-3} = 8.5\,kN$

$V_{3-4} = 0.5\,kN$

$V_{4+} = 0\,kN$



$M_{1-} = 0\,kN\cdot m$

$M_{1-2} = (-6\,kN)(x)$

$M_2 = -24\,kN\cdot m$

$M_{2-3} = (8.5\,kN)(x)$

$M_3 = -7\,kN\cdot m$

$M_{3-4} = (0.5\,kN)(x)$

$M_{4-} = -6\,kN\cdot m$

$M_{4+} = 0\,kN\cdot m$

(?)

Pretty sure both are correct

Question 3 (40 Marks)

For the A-36 steel rod (Cross-sectional area = 50 mm^2, Modulus of Elasticity E=200 GPa) subjected to the loading shown in Figure 3,

a. Draw the axial load diagram. **(10 Marks)**

b. Calculate the overall change in length of the member. **(20 points)**

c. Determine the maximum normal stress in the member. **(10 points)**

(Neglect the size of the couplings at B, C, and D),

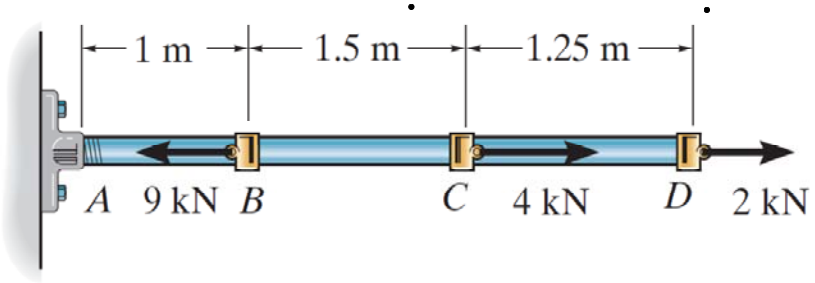


Figure 3