QUIZ 1
Spring 2001-2002
(Thursday, April 10, 2002)
CVEV 051 – STRUCTURES I
CLOSED BOOK, 1 ½ HOURS

Name: Mrs Key Key **ID#:** April 10, 2002

NOTES

- 2 PROBLEMS – 10 PAGES
- ALL YOUR ANSWERS SHOULD BE PROVIDED ON THE QUESTION SHEETS.
- **ONE EXTRA SHEET IS PROVIDED AT THE END**
- **ASK FOR ADDITIONAL SHEETS IF YOU NEED MORE SPACE.**
- SOME ANSWERS MAY REQUIRE MUCH LESS THAN THE SPACE PROVIDED.
- *DO NOT* USE THE BACK OF THE SHEETS FOR ANSWERS.
- DRAFT BOOKLET WILL BE PROVIDED; BUT DO NOT USE FOR ANSWERS.
- BOTH QUESTION SHEETS AND DRAFT BOOKLET SHOULD BE RETURNED.

YOUR COMMENT(S)

_ _

_ _

DO NOT WRITE IN THE SPACE BELOW

MY COMMENT(S)

_ _

_ _

YOUR GRADE

Problem I: ___ /40
Problem II: ___ /60
Other: ___

TOTAL: /100

Problem I: *(40 points)*

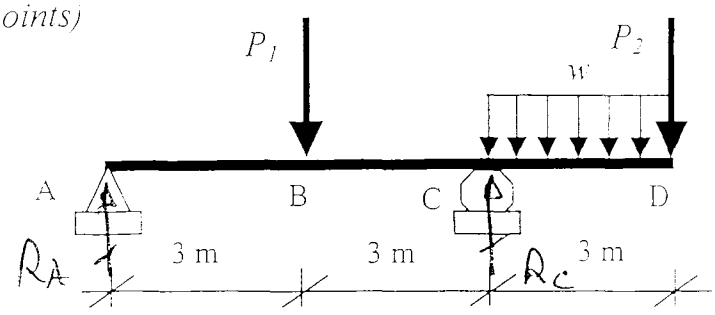
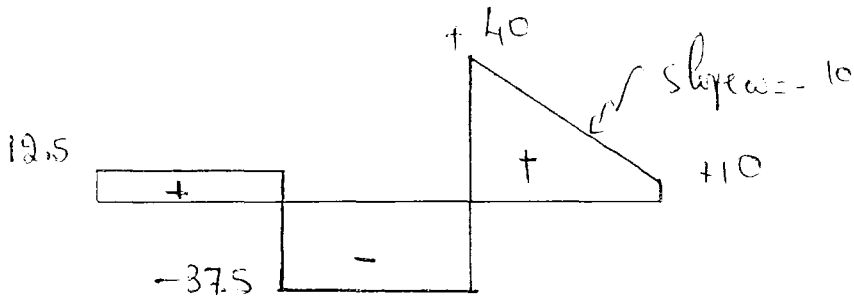


Figure I

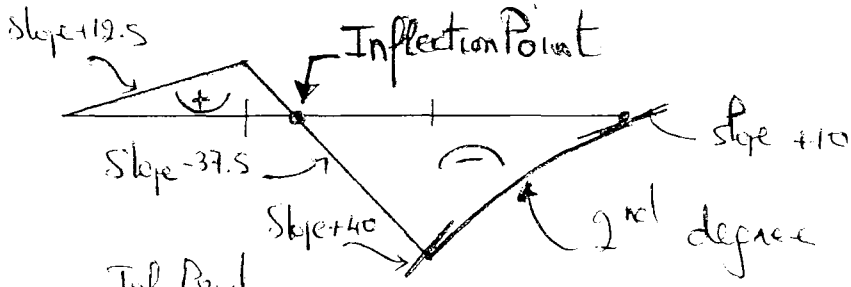
For the beam shown in Figure I, the own weight is neglected.
Your diagrams/sketches should include any feature/value you think is relevant or important.

1. Let w=**10 kN/m**, P_1=**50 kN**, and P_2=**10 kN**
   Draw the shear and bending moment diagrams and sketch the deflected shape.
   (30 points)

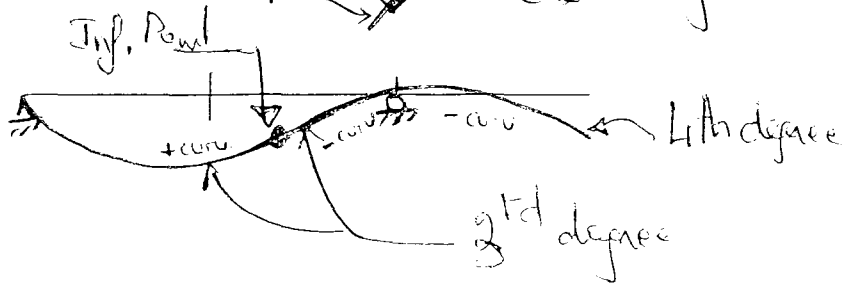
SHEAR:
(kN)



MOMENT:



DEFLECTION:



Calculations:

Reactions: $\circlearrowleft \sum M_{A=0} \Rightarrow R_C \times 6 = 50 \times 3 + 10 \times 9 + 10 \times 3 \times 7.5$

$\Rightarrow R_C = 77.5\,kN \quad (\uparrow)$

$\Rightarrow \sum F_y = 0 \Rightarrow R_A = 50 + 10 + 10 \times 3 - 77.5$

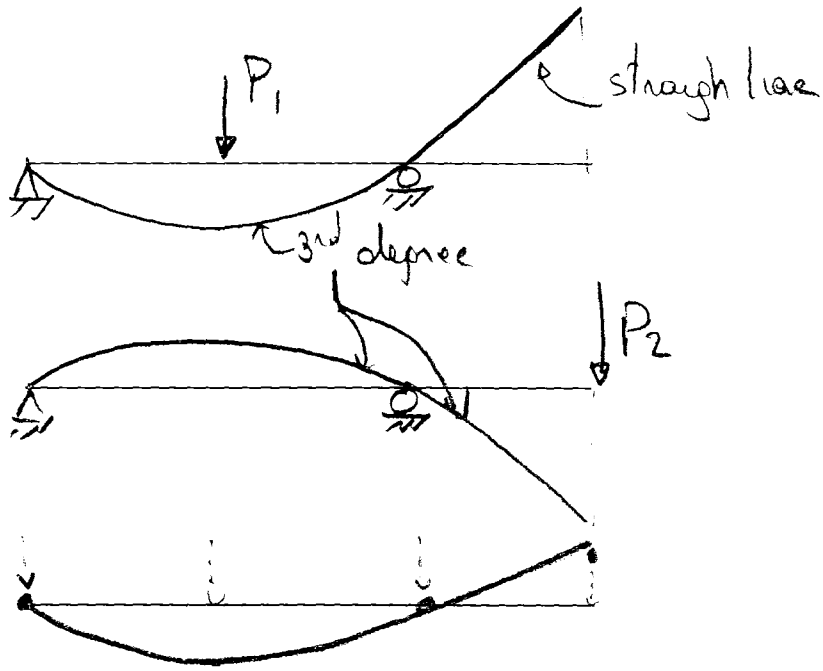
$R_A = 12.5\,kN \quad (\uparrow)$

2. In this question, *no calculations* are required; use your intuition and best judgement.
   Sketch the deflected shape when P_1 only is applied (w=0 and P_2=0).
   Sketch the deflected shape when P_2 only is applied (w=0 and P_1=0).
   Deduce the influence line of the deflection at B (Assume upward deflection is positive).
   (10 points)

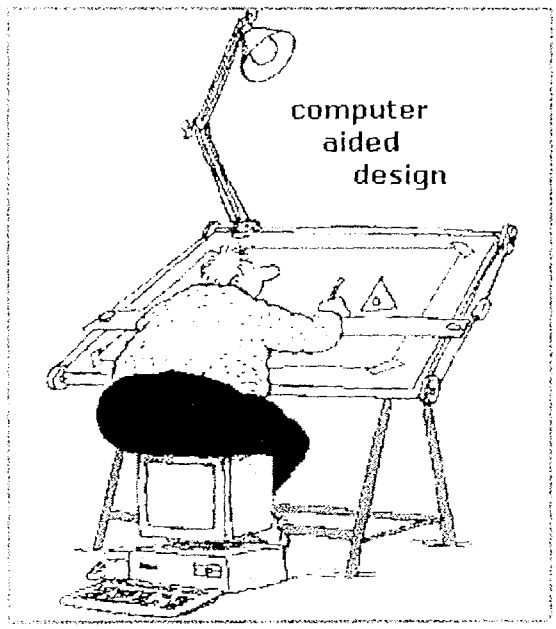
Deflection due to P_1:

Deflection due to P_2:

INF. DEF. at B:



take a break



Problem II: *(60 points)*

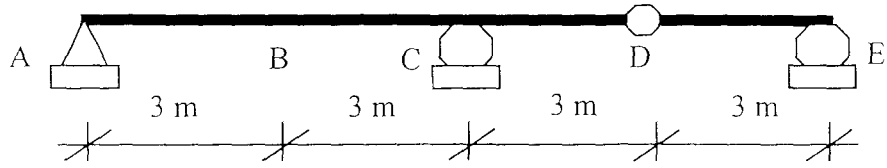


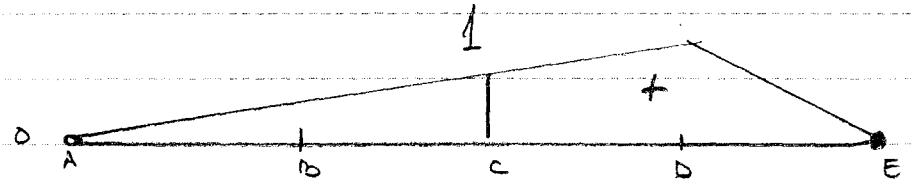
Figure II

No R_D → = 0

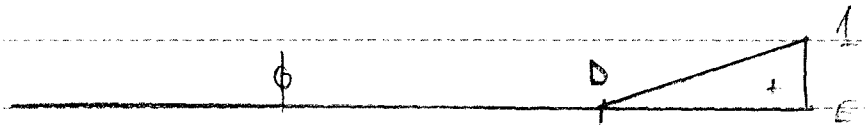
1. Referring to Figure II, draw the influence lines for R_C, R_D, R_E, V_C, V_D, M_B, M_C, and M_D. *(40 points)*

Calculations and Diagrams: (Free Body Diagram type 6)

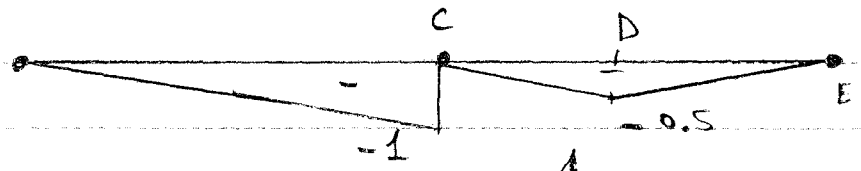
R_C



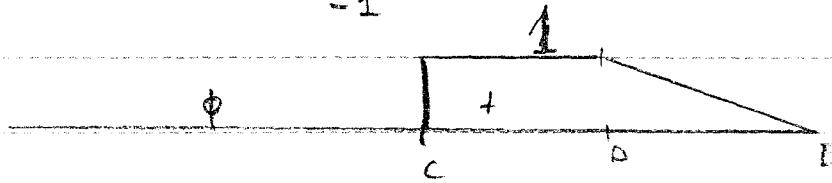
R_E



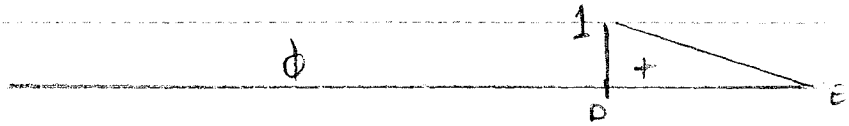
$V_C^{(-)}$



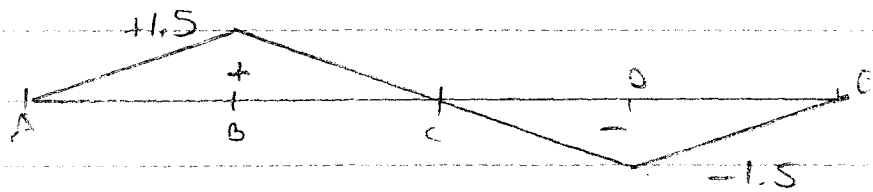
$V_C^{(+)}$



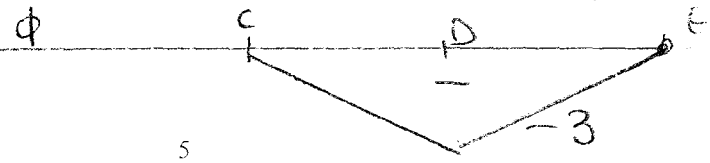
V_D



M_B

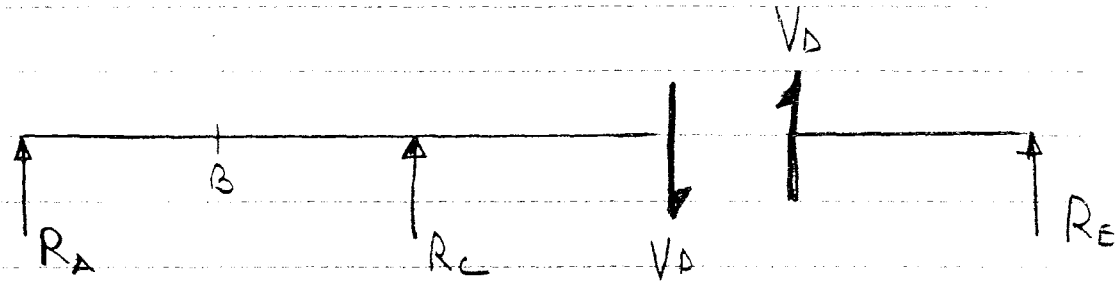


M_C

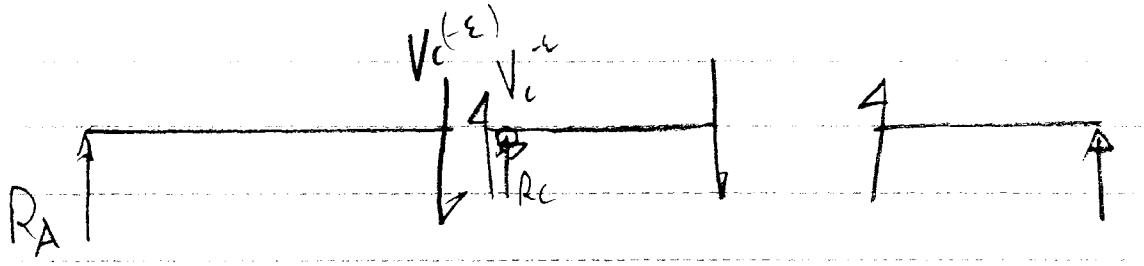


Calculations and Diagrams (cont'd):

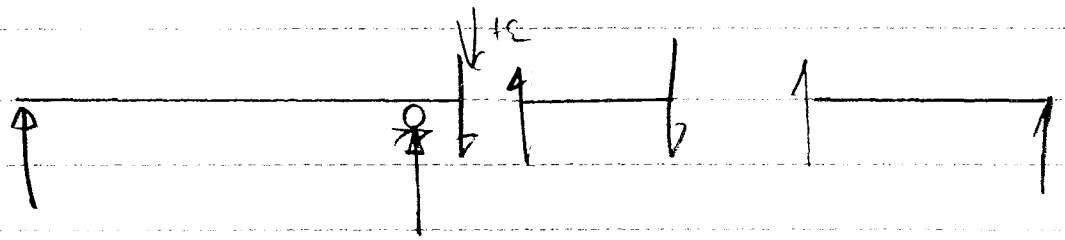
F.B.D



(V_C^-)

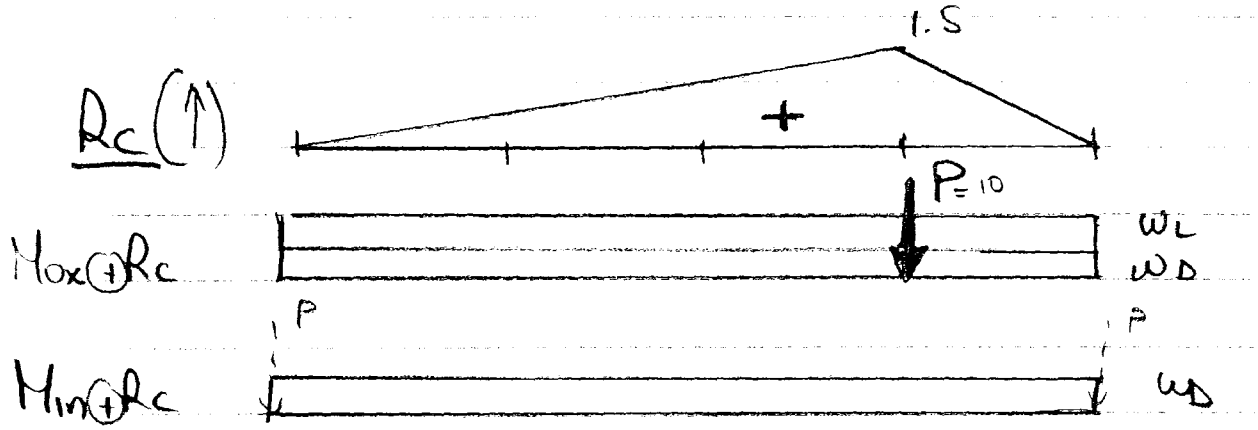


(V_C^{0+})



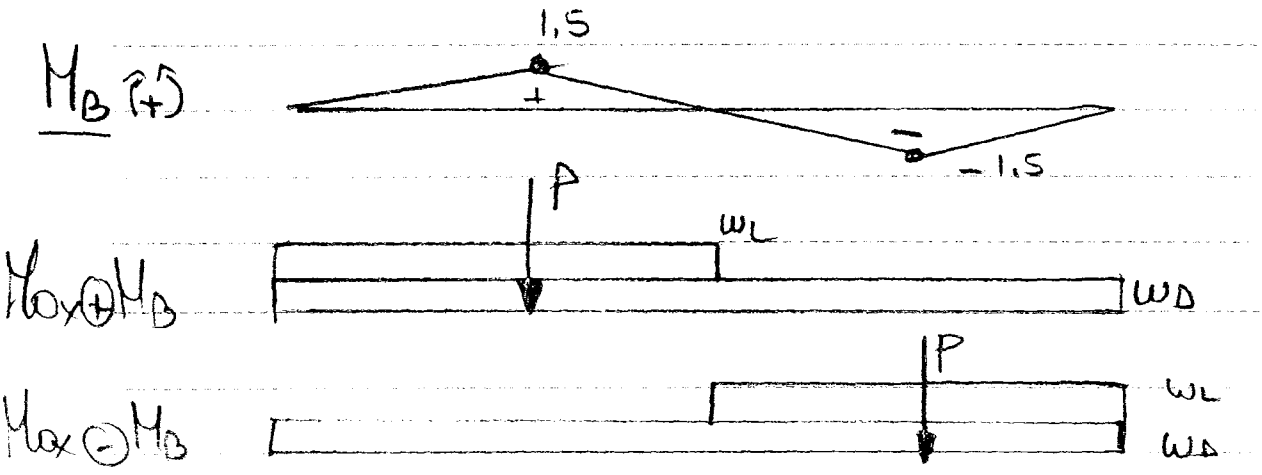
2. Let w_D=10 kN/m (dead load); w_L=10 kN/m and P=10 kN (live loads)
Compute the maximum values (positive and negative or minimum) for R_C and M_B.
(20 points)

Calculations and Diagrams:



$$Max(+)R_C = \overset{(D)}{10} \times \left(\frac{1.5 \times 12}{2}\right) \times \overset{(L)}{2} + \overset{(P)}{10 \times 1.5} = 195\,kN\ (\uparrow)$$

$$Min(+)R_C = \overset{(D)}{10} \times \left(\frac{1.5 \times 12}{2}\right) = 90\,kN\ (\uparrow)$$



Note $w_D \longrightarrow \phi\ M_B$

$$\underset{(\uparrow)}{|Max(+)M_B|} = \underset{(\downarrow)}{|Max(-)M_B|} = \overset{(w_L)}{10 \times \left(\frac{1.5 \times 6}{2}\right)} + \overset{(P)}{10 \times 1.5}$$

$$= 60\,kN\,m$$