

**PHY211 Statics (fall 05)**  
**FINAL, 1-Feb-06**  
**Closed book, 120 minutes**

**PLEASE TAKE NOTE OF THE FOLLOWING**

- Every FBD needed for the solution of a problem should be clearly drawn.
- Points will be deducted for equilibrium equations that do not have a corresponding FBD or an incomplete/incorrect FBD.
- Show all your calculations.
- Points will be deducted for answers that are not supported by proper calculations.
- Write your name on this sheet and return it with the yellow booklet.
- You can use this sheet to draw Basic FBDs.
- Method A is the method of cuts and FBDs
- Method B is the method of relations.

Name: M. TABBARA

ID: \_\_\_\_\_

**Problem 1**

20 points

Draw V and M diagrams for beam AB. Supports: hinge at A and roller at B. **Use Method B**; no points will be given for any other method.

**Problem 2**

20 points

Draw V and M diagrams for beam AB. Supports: hinge at A and roller at B. **Use Method B**; no points will be given for any other method.

**Problem 3**

20 points

Determine the equations for V and M for beam AB. Supports: hinge at A and roller at B. **Use Method A with the origin at point A**; no points will be given for any other method.

**Problem 4**

20 points

ABCD is one member. Draw V and M diagrams for only segment AB. Supports: fixity at A. **Use Method B**; no points will be given for any other method.

**Problem 5**

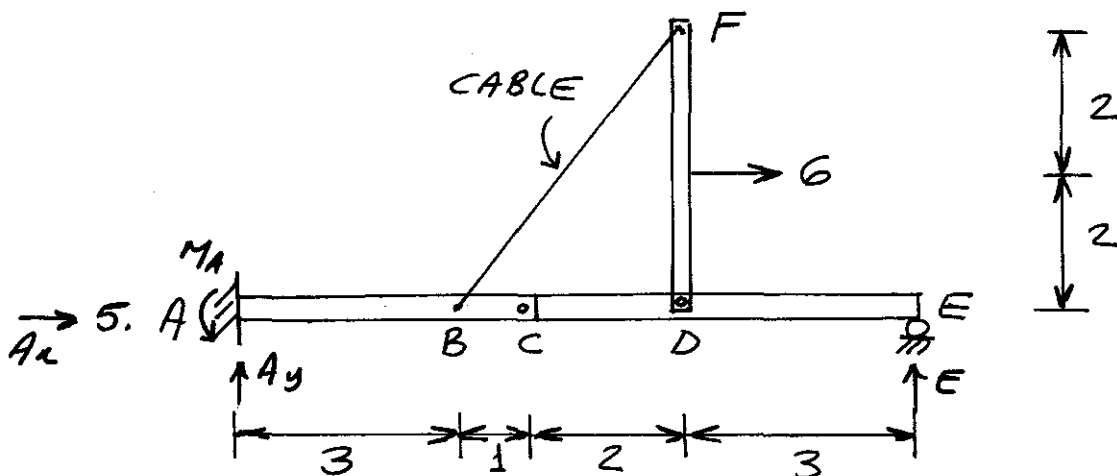
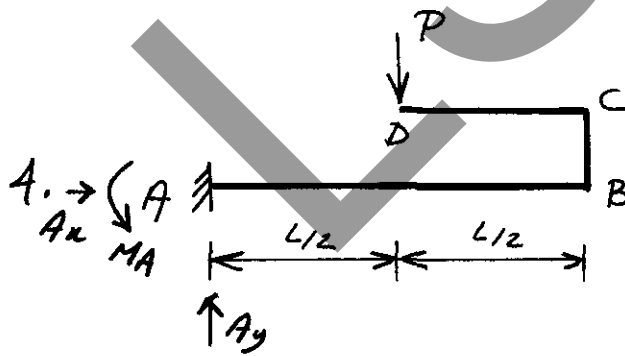
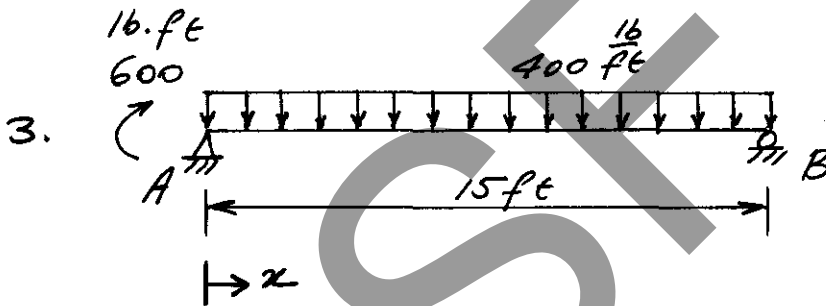
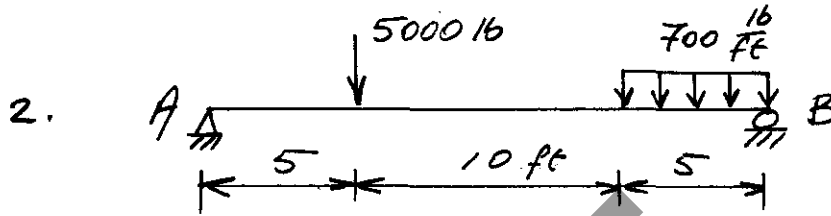
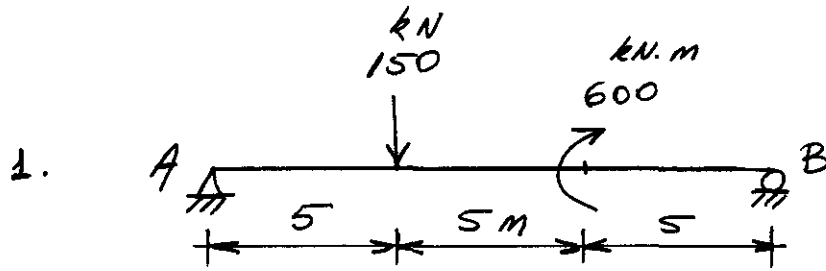
20 points

Three members AC, CE and DF are connected by pins at C and D. A cable connects B to F. Determine all the reactions.

PHY211 STATICS  
FINAL  
FIGURES

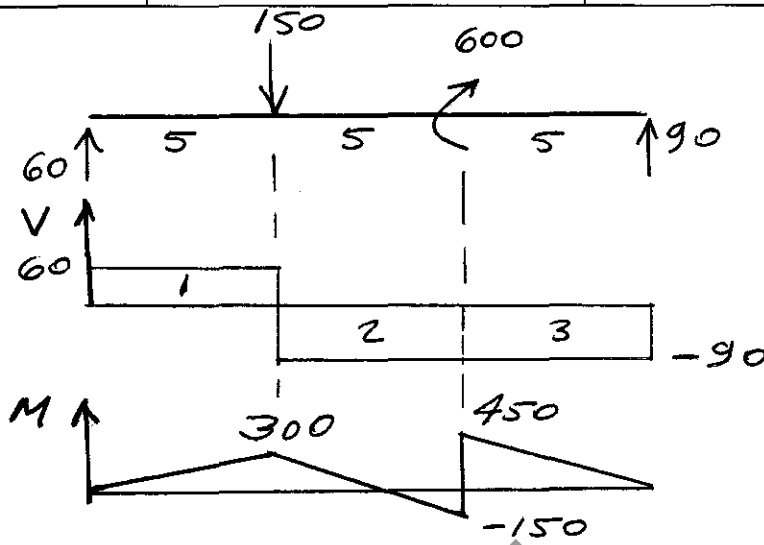
FALL 05

3/3



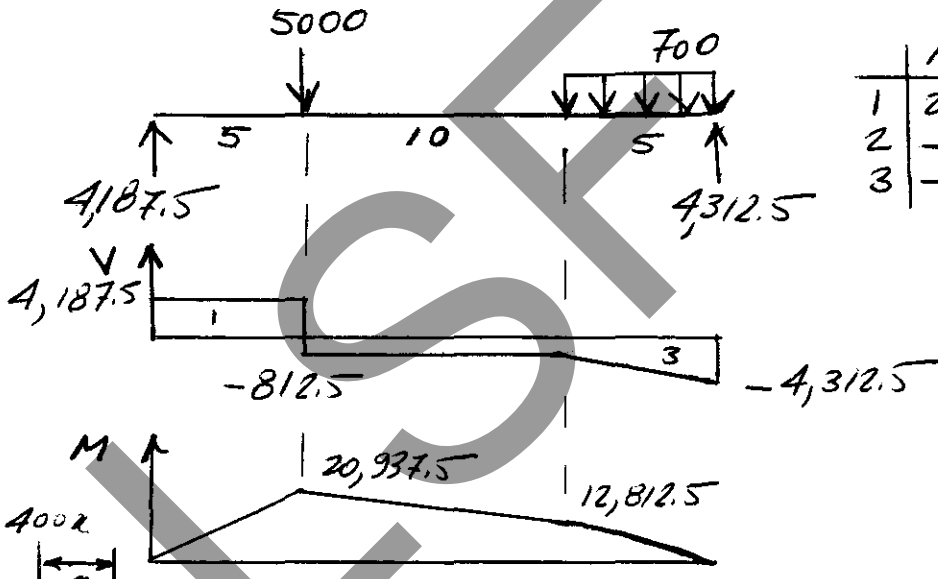
PHY 211 STATICS  
FINAL FALL 05  
SOLUTION

①



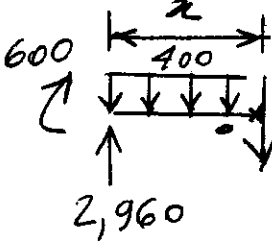
	AREA
1	300
2	-450
3	-450

②



	AREA
1	20,937.5
2	-812.5
3	-12,812.5

③

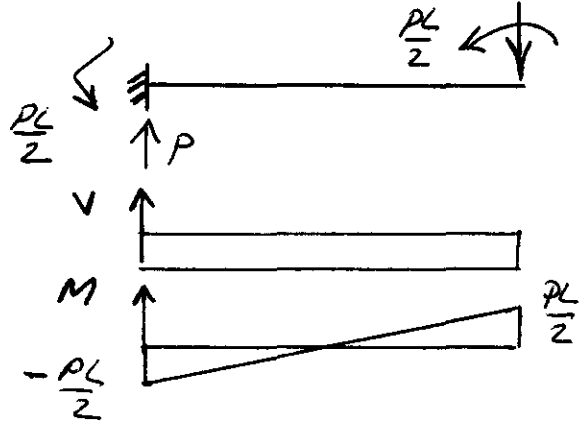


$$\sum F_y = 0 : -V - 400x + 2,960 = 0, \quad V = 2,960 - 400x$$

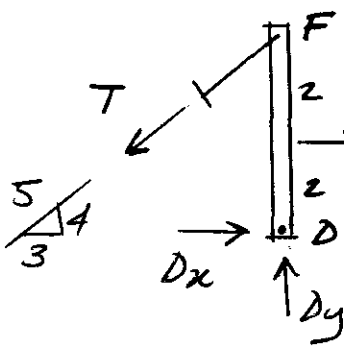
$$\sum M_o = 0 : M - 2,960(x) - 600 + 400x\left(\frac{x}{2}\right) = 0$$

$$M = 2,960x - 200x^2 + 600$$

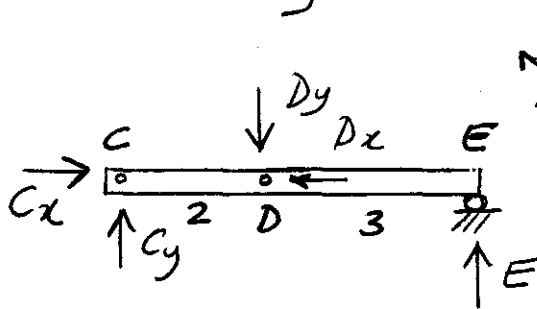
④



⑤



$$\begin{aligned} \sum^+ M_D = 0 &: T \frac{3}{5} (4) - 6(2) = 0, T = 5 \\ \sum^+ F_x = 0 &: D_x + 6 - T \frac{3}{5} = 0, D_x = -3 \\ \sum^+ F_y = 0 &: D_y - T \frac{4}{5} = 0, D_y = 4 \end{aligned}$$



$$\sum^+ M_C = 0: E(5) - D_y(2) = 0$$

$$E = 1.6$$

BASIC FBD

$$\sum^+ F_x = 0: A_x + 6 = 0, A_x = -6$$

$$\sum^+ F_y = 0: A_y + E = 0, A_y = -1.6$$

$$\sum^+ M_A = 0: M_A + E(9) - 6(2) = 0, M_A = -2.4$$

$$A_x = 6 \leftarrow$$

$$A_y = 1.6 \downarrow$$

$$M_A = 2.4 \curvearrowright$$

**CIE200 Statics (spring 06)**  
**FINAL, 14-June-06**  
**Closed book, 120 minutes**

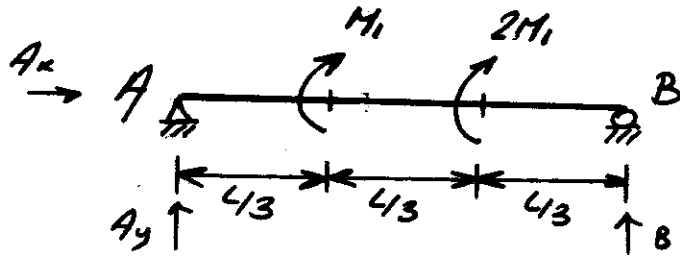
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- Method B is the method of relations.

Name: M. TABBACA

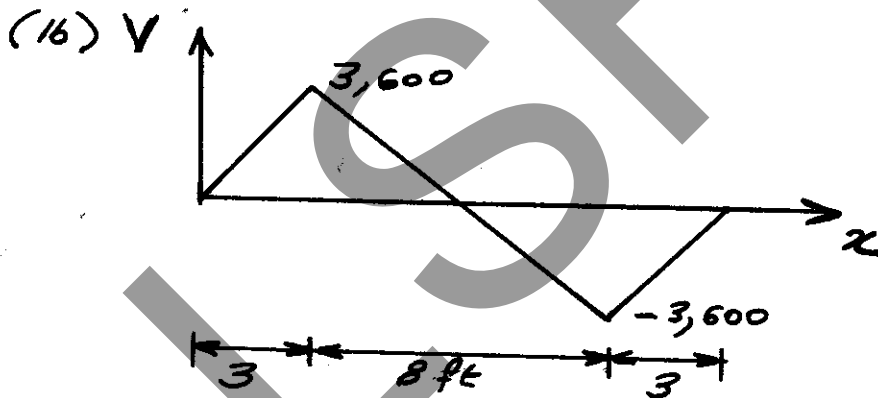
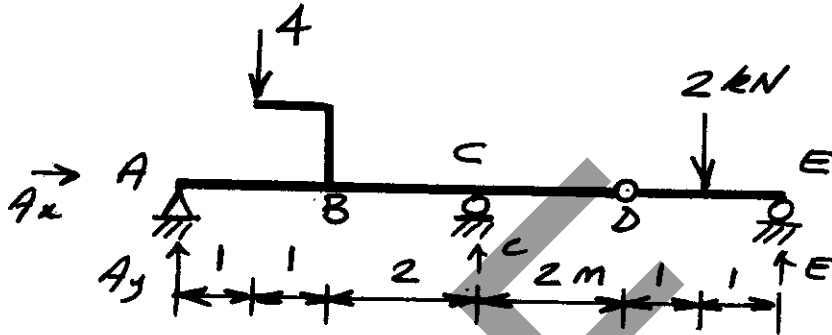
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	15 points
<p>Draw the M-diagram for beam AB, length of beam = L. Supports are: hinge at A and roller at B. <u>Use Method B</u>; no points will be given for any other method.</p>	
	15 points: a = 5, b = 10
<p>Two members AD and DE are connected by a pin at D. Supports are: hinge at A, roller at C and roller at E.</p> <p>(a) Determine all the reactions.</p> <p>(b) Determine all the internal actions at a distance = 1.5 m from A.</p>	
	15 points: a = 10, b = 5
<p>The V-Diagram for a beam is shown. Assuming that no couples act as loads on the beam.</p> <p>(a) Draw the beam and show all the forces that act on it. Make sure to determine the values and directions of the forces.</p> <p>(b) Determine the maximum internal bending moment in the beam.</p>	
	20 points
<p>Draw M-diagram for beam AB. Supports are: hinge at A and roller at B. <u>Use Method B</u>; no points will be given for any other method.</p>	
	20 points
<p>Draw M-diagram for <u>only segment AB</u>. Supports are: roller at C and hinge at D. <u>Use Method B</u>; no points will be given for any other method.</p>	
	15 points
<p>Determine the coordinates of the Centroid <math>(\bar{x}, \bar{y})</math> of the trapezoidal area shown.</p>	

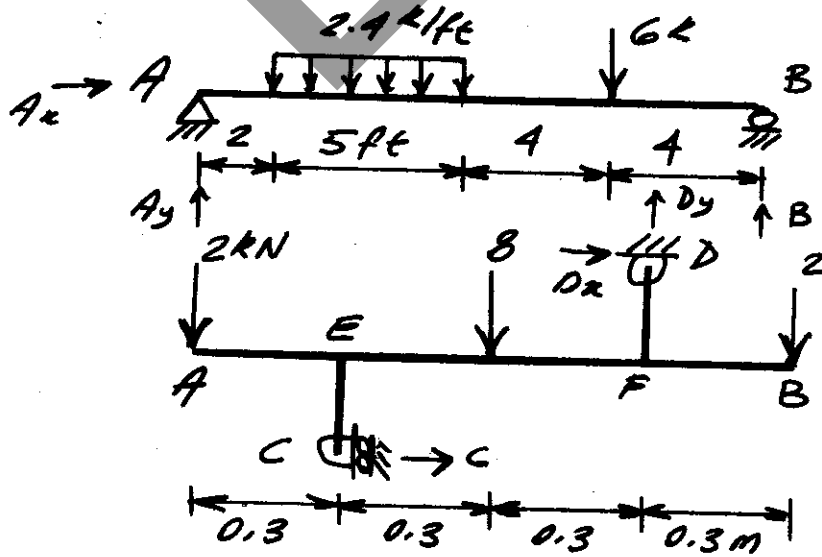
①



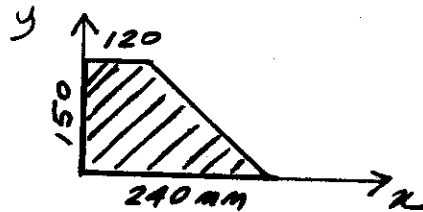
②



③



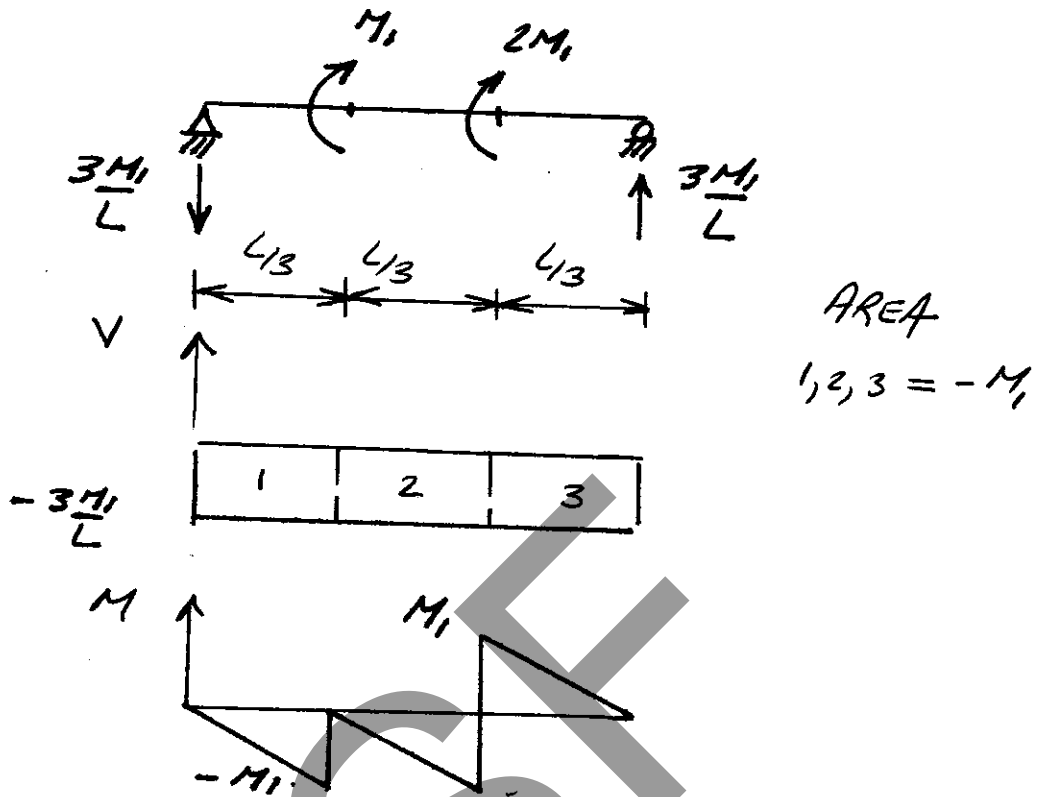
⑤



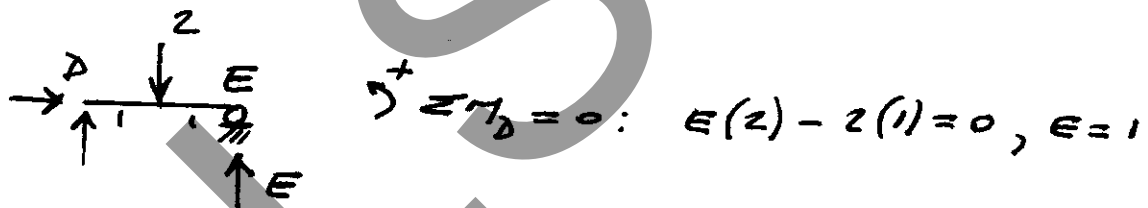
⑥



①



②(a)

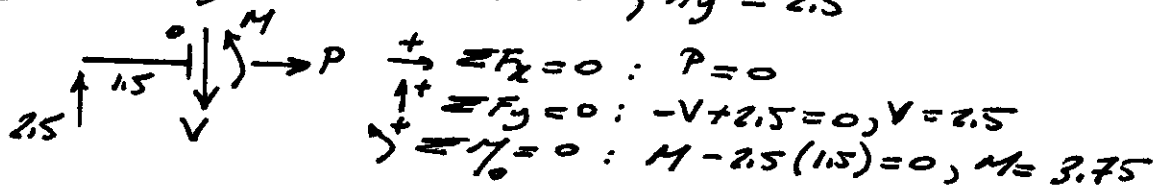


BASIC FBD  $\sum F_x = 0: A_x = 0$

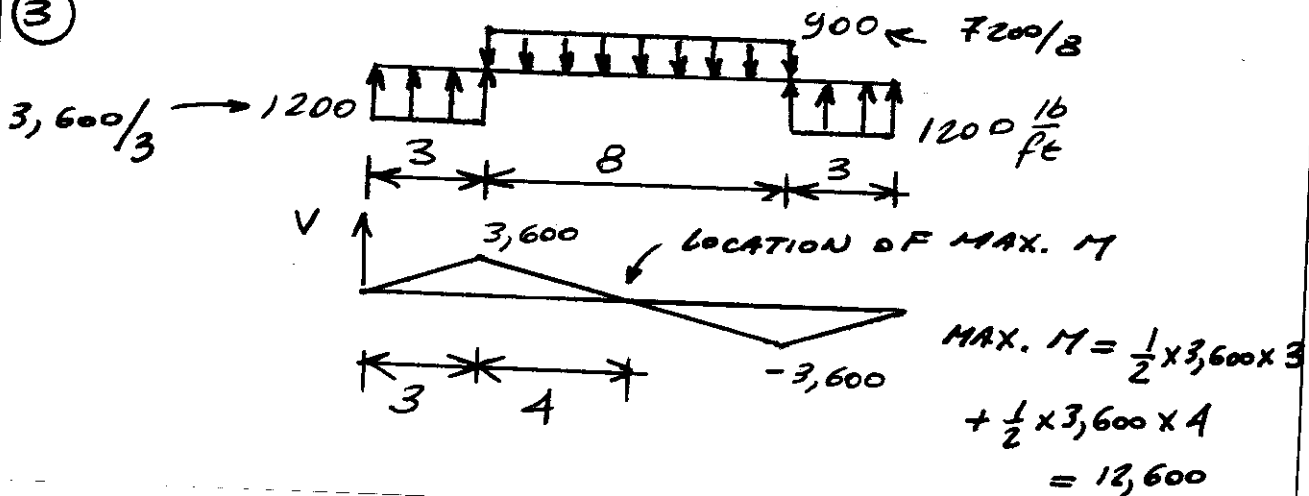
$$\sum M_A = 0: -4(1) - 2(7) + C(4) + E(8) = 0, C = 2.5$$

$$\sum F_y = 0: A_y + C + E - 4 - 2 = 0, A_y = 2.5$$

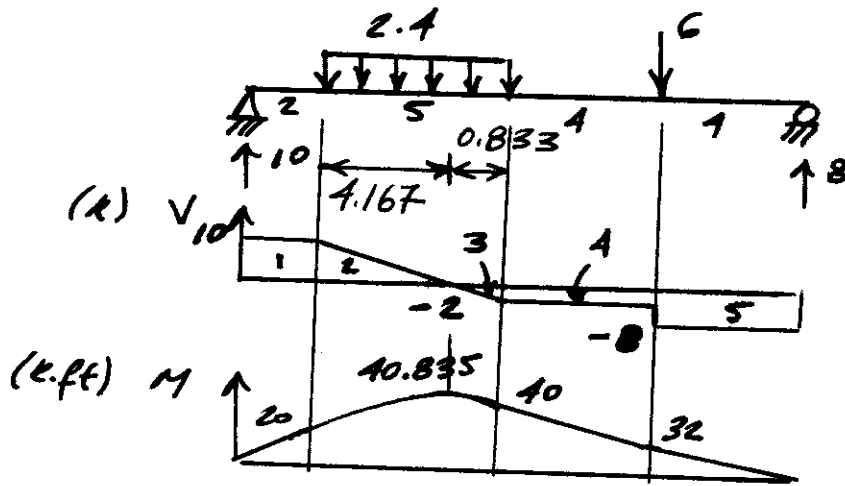
(b)



③

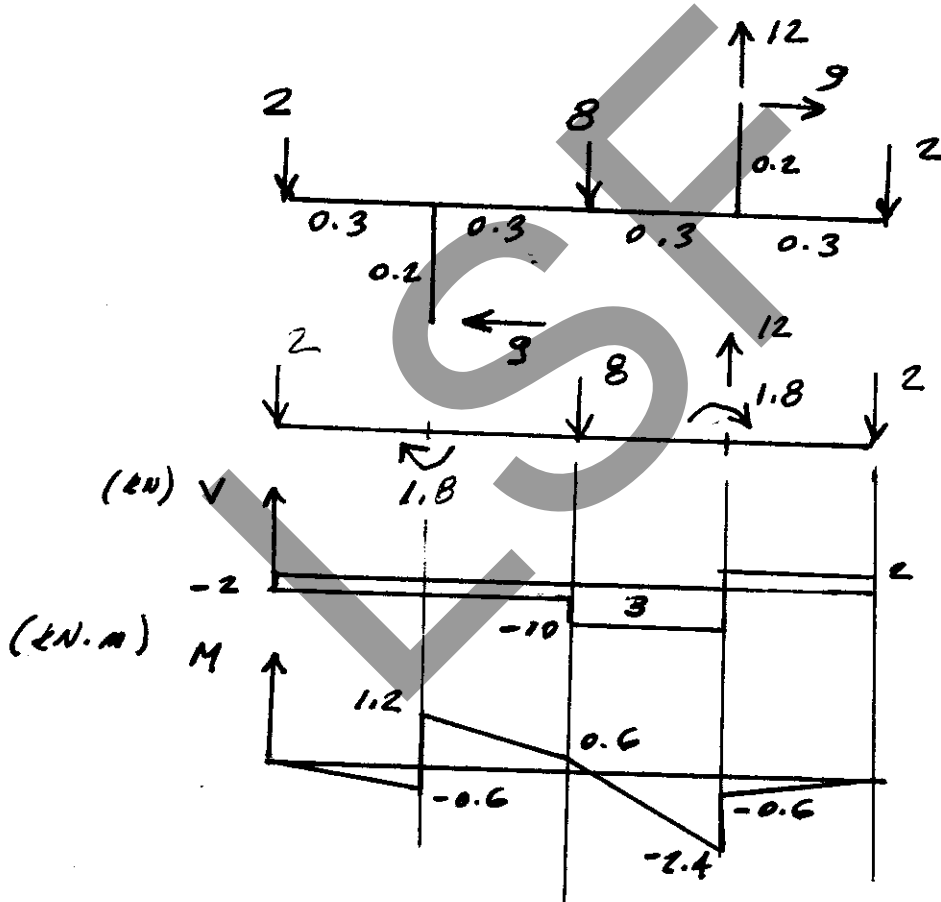


4



	AREA
1	20
2	20.835
3	-0.833
4	-8
5	-32

5



	AREA
1	-0.6
2	-0.6
3	-3
4	+0.6

6

	$A_i$	$x_i$	$y_i$	$x_i A_i$	$y_i A_i$
1	18,000	60	75	1,080,000	1,350,000
2	9,000	160	50	1,440,000	450,000
	<u>27,000</u>			<u>2,520,000</u>	<u>1,800,000</u>
		$\bar{x} = 93.33 \text{ mm}$			
		$\bar{y} = 66.67 \text{ mm}$			

**PHY211 Statics (Fall 04), FINAL, Name \_\_\_\_\_**  
2-Feb-05, Closed book, 120 minutes

Problem (1) 10 points  
The left-hand side FBD of a beam is shown. The equation of the internal moment is:  
 $M = 250x - 4x^3$ . Determine the reaction at A.

Problem (2) 15 points  
Draw V and M diagrams for beam AB. Use METHOD B.

Problem (3) 15 points  
The structure consists of 2 members (AC and BD) connected by a pin at B. The supports are hinges at C and D. Draw the V diagram for segment ABC. Use METHOD B.

Problem (4) 20 points  
The structure consists of 4 members (AB, AC, AD and BD) that are connected by pins at A and B. The supports are hinges at C and D.  
(a) Determine all the reactions.  
(b) Determine all the internal actions at the midpoint of AB.

Problem (5) 20 points  
The shear diagram of beam AB is shown. The only support for the beam is a fixed-end at B. No couples act as loads between A and B. Determine all the reactions.

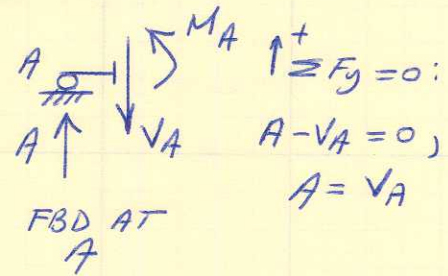
Problem (6) 20 points  
The structure consists of 2 members (AB and BC) connected by a pin at B. The supports are hinges at A and C. Determine all the reactions.

Please take note of the following:

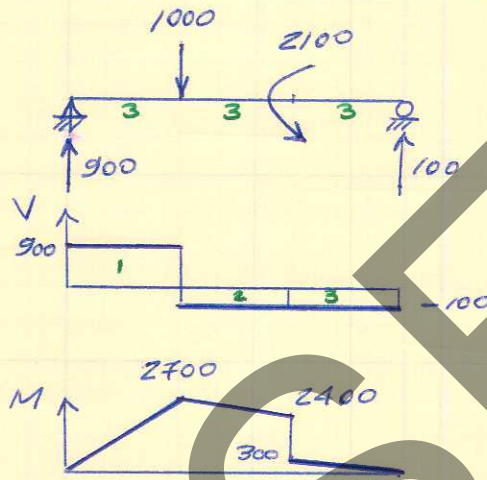
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1.  $V = \frac{dM}{dx}$ ,  $V = 250 - 12x^2$   
 $A = V(0) = 250$

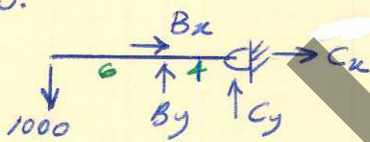


2.



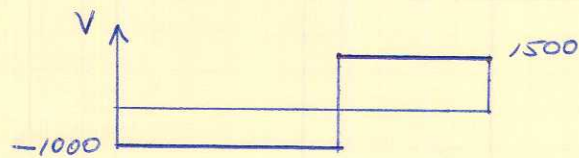
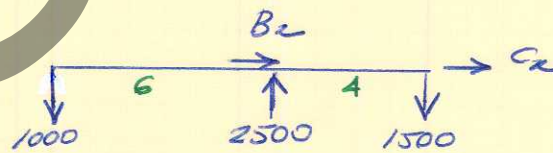
	AREA
1	2700
2	-300
3	-300

3.



FBD OF AC

$\uparrow^+ \Sigma M_C = 0: -B_y(4) + 1000(10) = 0,$   
 $B_y = 2500$   
 $\uparrow^+ \Sigma F_y = 0: -1000 + B_y + C_y = 0,$   
 $C_y = -1500$



4. (a)  $\uparrow^+ \Sigma F_y = 0: C_y = 0$

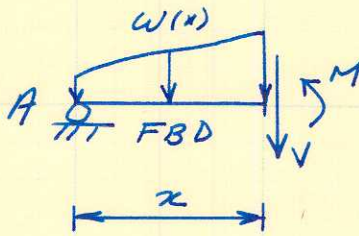
BASIC FBD  $\uparrow^+ \Sigma F_y = 0: C_y + D_y - 280 = 0, D_y = 280$

FBD AT C  $\uparrow^+ \Sigma \tau_C = 0: -D_x(7.5) - 280(11) = 0, D_x = -410.67$

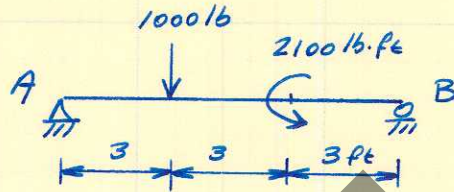
$\rightarrow \Sigma F_x = 0: C_x + D_x = 0, C_x = 410.67$

ANS:  $C_x = 411 \text{ lb} \rightarrow$   $C_y = 0$   $D_x = 411 \text{ lb} \leftarrow$   $D_y = 280 \text{ lb} \uparrow$

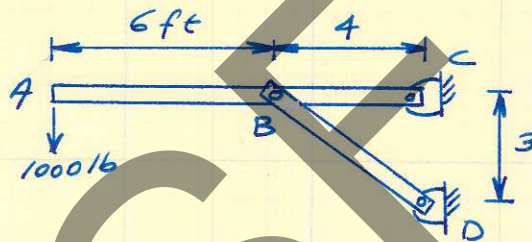
(1)



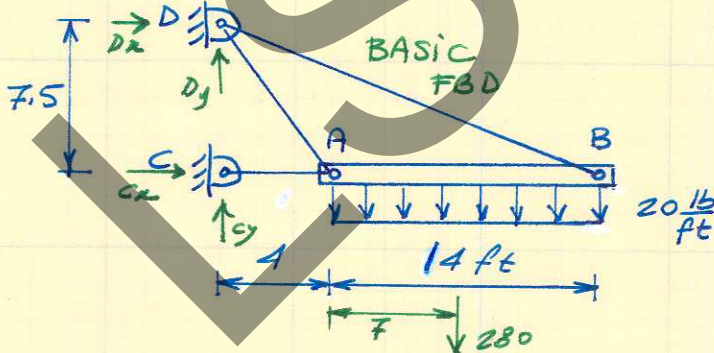
(2)



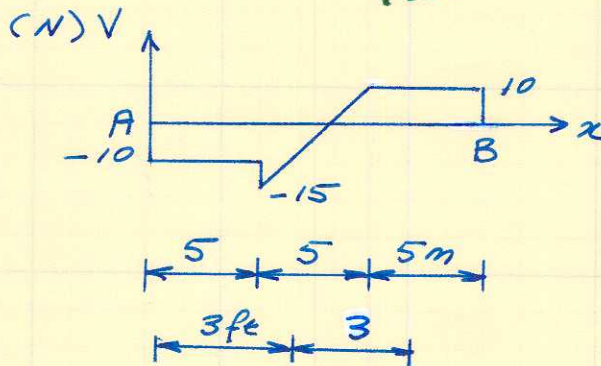
(3)



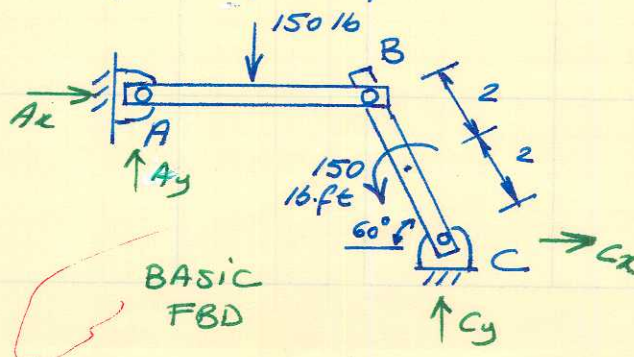
(4)



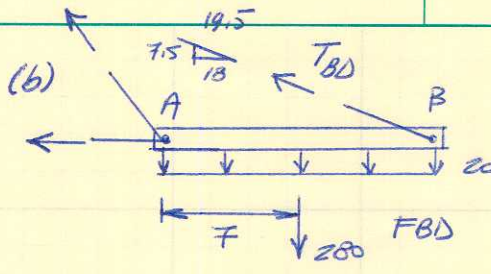
(5)



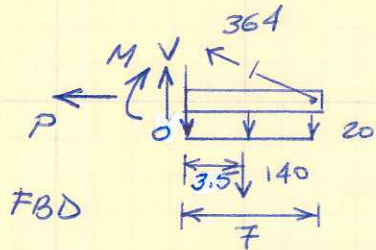
(6)





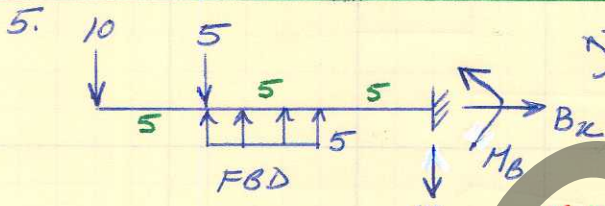


$$\sum^+ M_A = 0 : T_{BD} \frac{7.5}{19.5} (14) - 280(7) = 0, \\ T_{BD} = 364$$



$$\sum^+ F_x = 0 : -P - 364 \times \frac{18}{19.5} = 0, P = -336 \\ \sum^+ F_y = 0 : V + 364 \times \frac{7.5}{19.5} - 140 = 0, V = 0 \\ \sum^+ M = 0 : -M - 140(3.5) + 364 \times \frac{7.5}{19.5} (7) = 0, \\ M = 490$$

ANS:  $P = -336 \text{ lb}$ ,  $V = 0$ ,  $M = 490 \text{ lb}\cdot\text{ft}$



$$\sum^+ M_B = 0 : M_B + 10(15) + 5(10) - 25(7.5) = 0, M_B = -12.5$$

ANS:  $B_y = 10 \downarrow$ ,  $M_B = 12.5 \downarrow$ ,  $B_x = ?$



$$\sum^+ M_B = 0 : -A_y(6) + 150(3) = 0, A_y = 75$$

BASIC FBD

$$\sum^+ F_y = 0 : A_y + C_y - 150 = 0, C_y = 75$$

$$\sum^+ M_C = 0 : -A_x(4 \sin 60) + 150(3 + 4 \cos 60) + 150 = 0, \\ -A_y(6 + 4 \cos 60) = 0, A_x = 86.60$$

$$\sum^+ F_x = 0 : A_x + C_x = 0, C_x = -86.60$$

ANS:  $A_x = 86.6 \text{ lb} \rightarrow$ ,  $A_y = 75 \text{ lb} \uparrow$ ,  $C_x = 86.60 \text{ lb} \leftarrow$ ,  $C_y = 75 \text{ lb} \uparrow$