

NAME KEY

Section \_\_\_\_\_ Table \_\_\_\_\_

Honor Code: I have neither given nor received unauthorized aid on this test

Signature: \_\_\_\_\_

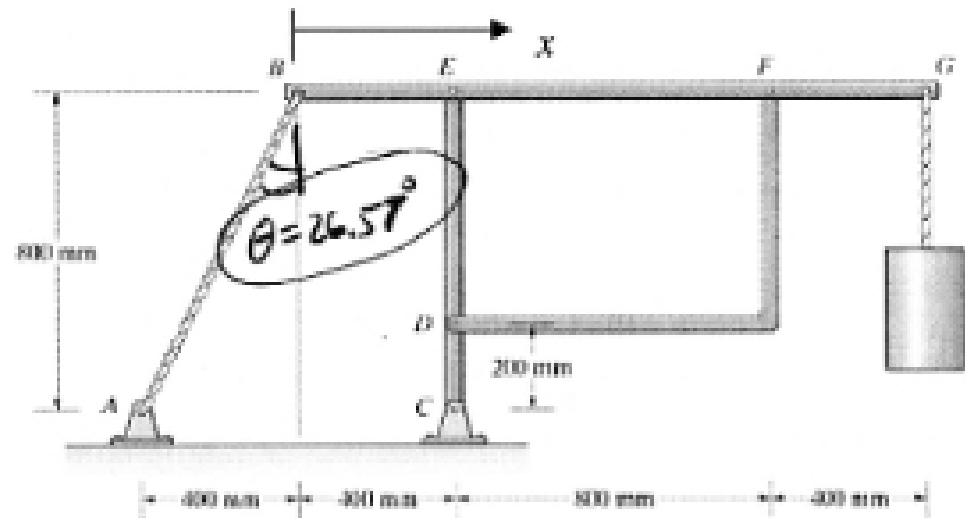
**ME 201 Test #3**

**November 8, 2007**

**NOTES:**

1. *Sign and provide identifying info on every sheet.*
2. *Use proper vector notation in all cases where vectors are used.*
3. *In cases involving Newton's Laws, you are **REQUIRED** to draw complete and correct **FBDs** and when the problem is dynamics, you must also draw complete and correct **KDs**. Then use these to develop your governing equations.*
4. *If you use you calculator to perform any calculus that might involve trig or similar functions, set your calculator to the **radian mode** first.*
5. *In all cases, remember to show results with magnitude, direction, units and put your answer in a box.*

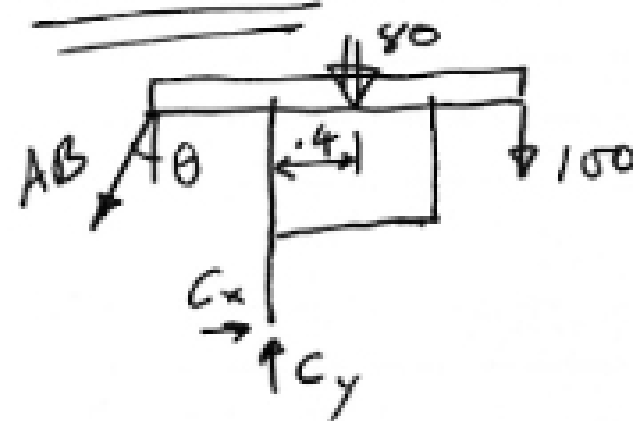
1. (35 pts) The object suspended at  $G$  weighs 100 kN. The uniform continuous horizontal member  $BEFG$  weighs 50 kN/m (i.e. 80 kN total). All other members have negligible weight.  $AB$  is a cable.  $CDE$  is a continuous member. All pin connections at  $A, B, C, D, E, F, G$  are frictionless.



(a) Determine the reactions on member  $BEFG$  at  $B, E, F,$  and  $G$ .

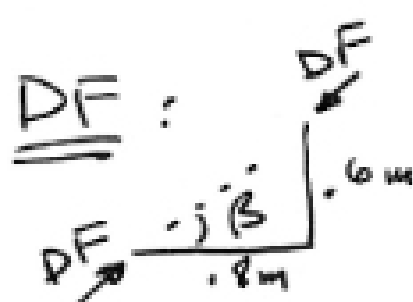
(b) Using the  $x$ -coordinate shown, write the equations for axial force  $F$ , shear force  $V$ , and bending moment  $M$  as functions of  $x$  in member  $BEFG$  that are valid in the portion of the member between  $E$  and  $F$ , i.e. for locations  $0.4 \text{ m} < x < 1.2 \text{ m}$ . Use standard beam sign convention for  $V$  and  $M$  and let  $F$  be positive in tension.

ASSEMBLY : Find cable tension  $AB$



$$\sum M_C = 0 = (AB \cos \theta)(.4) + (AB \sin \theta)(.8) - 80(.4) - 100(1.2)$$

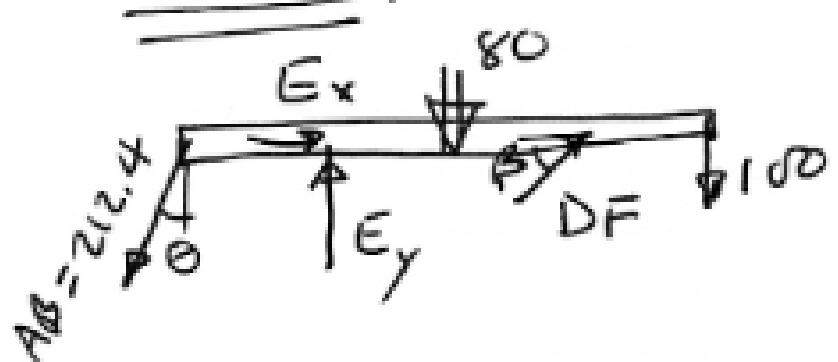
$$AB = 212.4 \text{ kN Tension}$$



$$\beta = \tan^{-1} \frac{.6}{.8} = 36.87^\circ$$

(2-force member)

BEFG :



$$\sum M_E = (AB \cos \theta)(.4) - 80(.4) - 100(1.2) + (DF \sin \beta)(.8) = 0$$

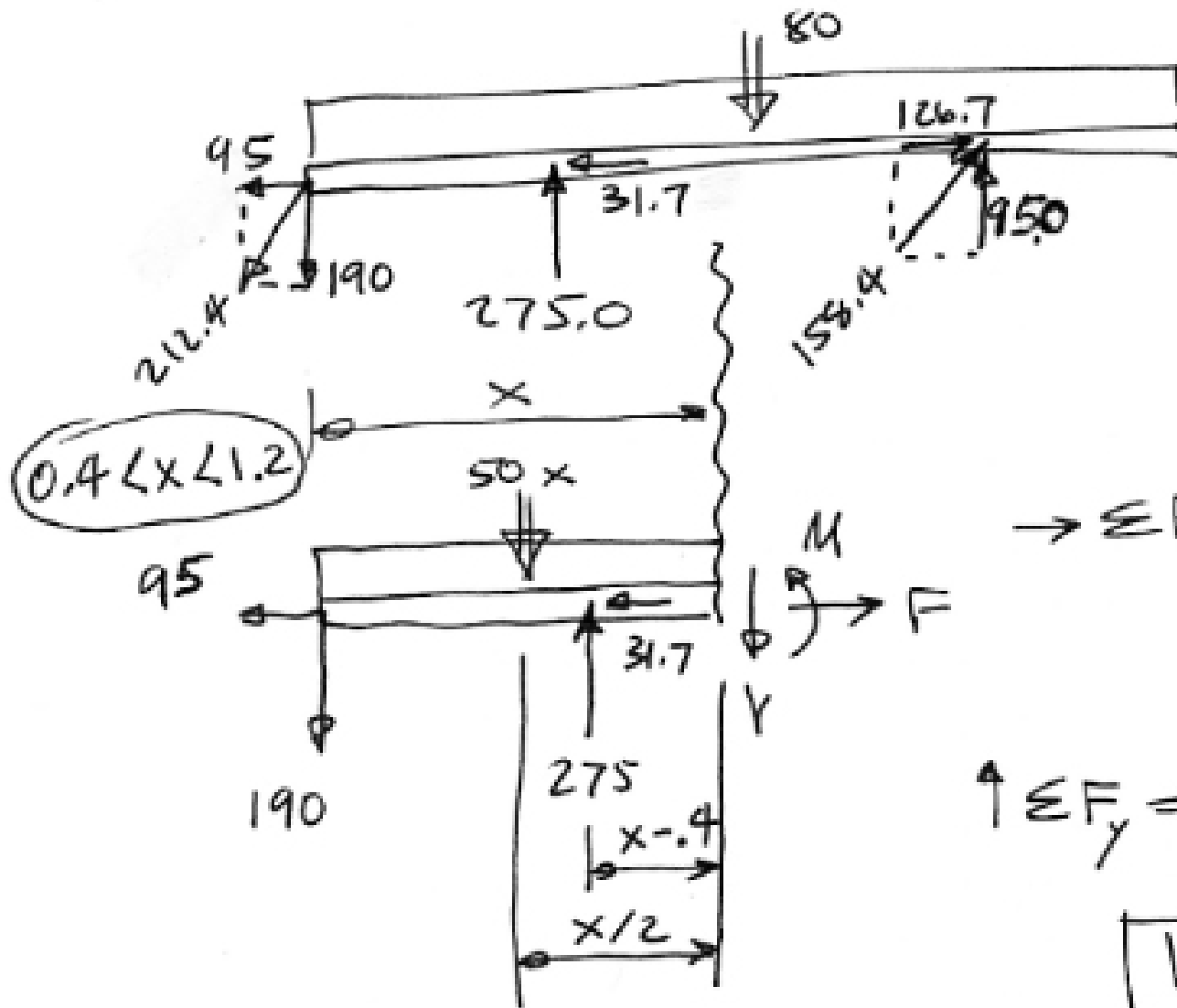
$$\begin{aligned} DF &= 158.3 \text{ kN} \nearrow \\ DF_x &= 126.7 \text{ kN} \rightarrow \\ DF_y &= 95.0 \text{ kN} \uparrow \end{aligned}$$

$$\sum F_x = 0 = E_x - AB \sin \theta + DF \cos \beta$$

$$E_x = -31.7 = 31.7 \text{ kN} \leftarrow$$

$$\uparrow \sum F_y = 0 = E_y - AB \cos \theta - 80 - 100 + DF \sin \theta$$

$$E_y = 275.0 \text{ kN } \uparrow$$



$$\rightarrow \sum F_x = 0 = F - 31.7 - 95$$

$$F = 126.7 \text{ kN tension}$$

$$\uparrow \sum F_y = 0 = -190 - 50x - V + 275$$

$$V = 85 - 50x$$

$$\curvearrow \sum M_{\text{RHS}} = 0 = M + 50x \left( \frac{x}{2} \right) + 190x - 275(x - .4)$$

$$M = -25x^2 + 85x - 110$$

all units  
kN + m