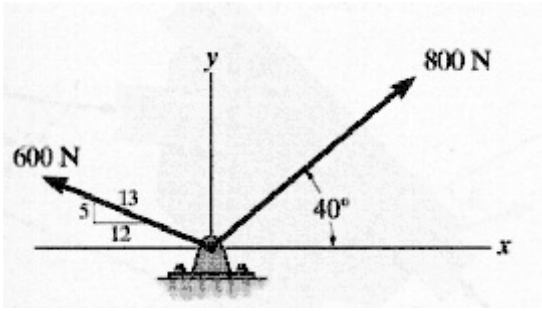
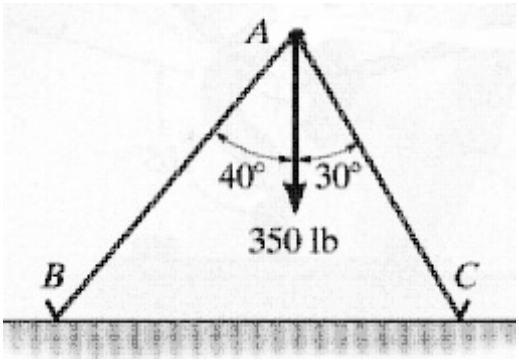
Name_____ ESM 2104 Sample Final Exam

Closed book, but you may use one 8½"x 11" formula sheet (one side only). ***There are 22 questions, equally weighted.***
1. Fill in your name on this exam sheet. 2. Fill in your name and ID number on the orange opscan form 3. On the upper right-hand corner of the this exam is a Form Letter. Fill in your Form letter on your opscan
Sign the following pledge: *I have neither given nor received unauthorized aid on this exam.* _____

1. The magnitude of the resultant of the two forces is most nearly



   1. 1400 N
   2. 1384 N
   3. 1201 N
   4. 1134 N
   5. 1166 N
   6. 1128 N
   7. 1000 N
   8. 853 N
   9. 747 N
   10. 529 N



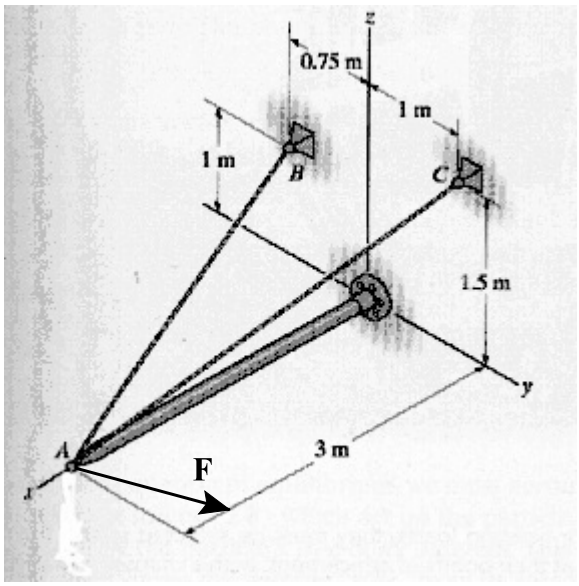
The 350-lb force is to be broken into components along the lines *AB* and *AC*.

2. The component along *AC* is most nearly

   1. 175.0 lb
   2. 186.2 lb
   3. 202 lb
   4. 225 lb
   5. 239 lb
   6. 268 lb
   7. 294 lb
   8. 303 lb
   9. 404 lb
   10. 457 lb

The Force $\mathbf{F}$ can be written

$$\mathbf{F} = \{-60\mathbf{i} + 30\mathbf{j} - 20\mathbf{k}\}\text{N}$$



3. The magnitude of the projection of the force $\mathbf{F}$ along the line *AC* is most nearly

    1. 20.0 N
    2. 30.0 N
    3. 42.3 N
    4. 47.5 N
    5. 51.4 N
    6. 55.8 N
    7. 60.0 N
    8. 80.0 N
    9. 166.2 N
    10. 181.3 N

The moment of the force **F** about point *C* can be written

$$\mathbf{M}_C = M_x\mathbf{i} + M_y\mathbf{j} + M_z\mathbf{k}$$

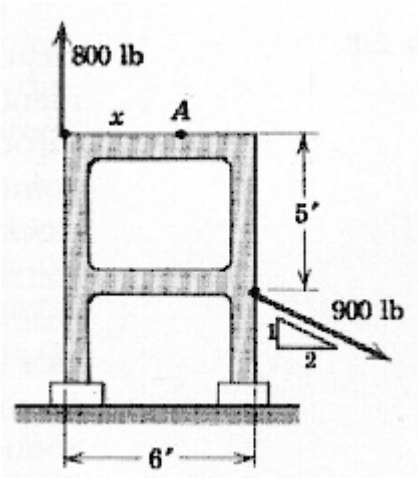
4. The component M_x is most nearly

    1. 15.00 Nm
    2. -15.00 Nm
    3. 30.0 Nm
    4. -30.0 Nm
    5. 65.0 Nm
    6. -65.0 Nm
    7. 120.0 Nm
    8. -120.0 Nm
    9. 135.0 Nm
    10. -135.0 Nm

5. The component M_z is most nearly

    1. 15.00 Nm
    2. -15.00 Nm
    3. 30.0 Nm
    4. -30.0 Nm
    5. 65.0 Nm
    6. -65.0 Nm
    7. 120.0 Nm
    8. -120.0 Nm
    9. 135.0 Nm
    10. -135.0 Nm

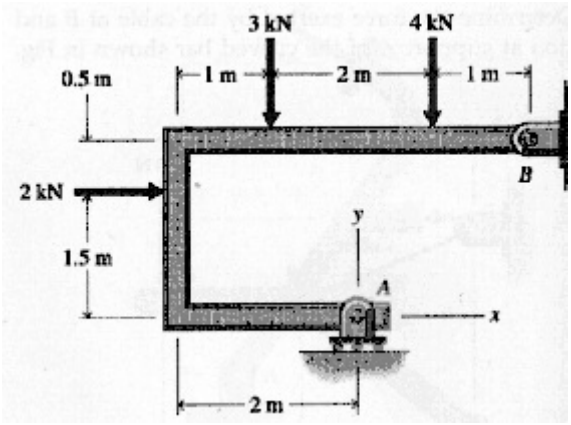
The two forces are to be replaced by a single equivalent force at point *A*.



6. The distance *x* is most nearly

    1. 0
    2. 1.000 ft
    3. 1.793 ft
    4. 2.00 ft
    5. 2.03 ft
    6. 3.00 ft
    7. 4.05 ft
    8. 4.33 ft
    9. 5.25 ft
    10. 6.00 ft

Rigid Body *AB* is pinned at *B* and there is a roller at *A*.



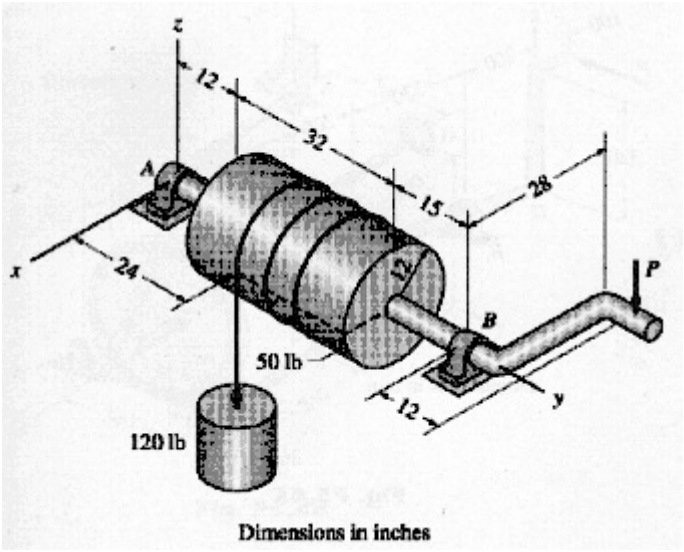
7. The force at the roller *A* is most nearly

    1. 0 kN
    2. 2.00 kN
    3. 3.00 kN
    4. 3.61 kN
    5. 4.00 kN
    6. 5.00 kN
    7. 6.50 kN
    8. 6.80 kN
    9. 7.00 kN
    10. 7.28 kN

8. The force in the pin at *B* is most nearly

    1. 0 kN
    2. 2.00 kN
    3. 3.00 kN
    4. 3.61 kN
    5. 4.00 kN
    6. 5.00 kN
    7. 6.50 kN
    8. 6.80 kN
    9. 7.00 kN
    10. 7.28 kN

The 120 lb weight is attached to the cable which winds around the 50 lb drum. The force P is vertical, the bearing at A is a thrust bearing and the bearing at B is a slip bearing.



9. The force P needed for equilibrium is most nearly

    1. 22.4 lb
    2. 51.4 lb
    3. 56.7 lb
    4. 85.0 lb
    5. 87.0 lb
    6. 89.6 lb
    7. 91.3 lb
    8. 96.3 lb
    9. 134.4 lb
    10. 150.0 lb

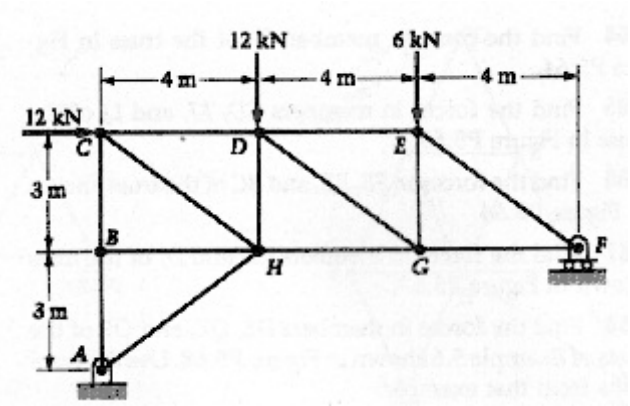
10. The magnitude of the force in the bearing at B is most nearly

    1. 22.4 lb
    2. 51.4 lb
    3. 56.7 lb
    4. 85.0 lb
    5. 87.0 lb
    6. 89.6 lb
    7. 91.3 lb
    8. 96.3 lb
    9. 134.4 lb
    10. 150.0 lb

11. The magnitude of the force in the bearing at A is most nearly

    1. 22.4 lb
    2. 51.4 lb
    3. 56.7 lb
    4. 85.0 lb
    5. 87.0 lb
    6. 89.6 lb
    7. 91.3 lb
    8. 96.3 lb
    9. 134.4 lb
    10. 150.0 lb

12. The force in member *DH* is most nearly



1. 4.00 kN T
2. 4.00 kN C
3. 10.00 kN T
4. 10.00 kN C
5. 13.33 kN T
6. 13.33 kN C
7. 21.7 kN T
8. 21.7 kN C
9. 29.3 kN T
10. 29.3 kN C

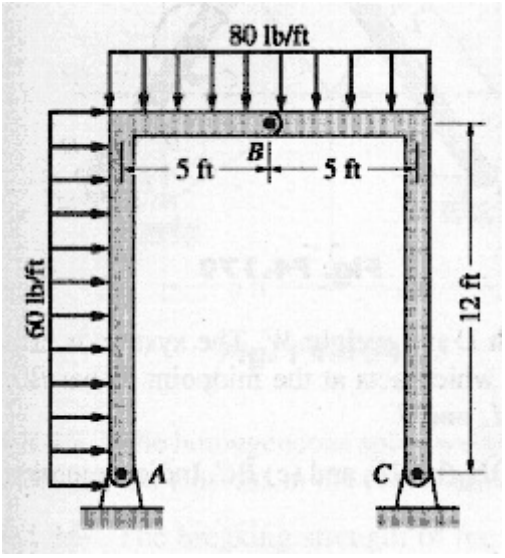
13. The force in member *HG* is most nearly

1. 4.00 kN T
2. 4.00 kN C
3. 10.00 kN T
4. 10.00 kN C
5. 13.33 kN T
6. 13.33 kN C
7. 21.7 kN T
8. 21.7 kN C
9. 29.3 kN T
10. 29.3 kN C

14. The force in member *CH* is most nearly

1. 4.00 kN T
2. 4.00 kN C
3. 10.00 kN T
4. 10.00 kN C
5. 13.33 kN T
6. 13.33 kN C
7. 21.7 kN T
8. 21.7 kN C
9. 29.3 kN T
10. 29.3 kN C

Ab and *BC* are rigid bodies. Neglect their weight. There are two distributed loads as shown.



15. The magnitude of the reaction in pin *B* is most nearly

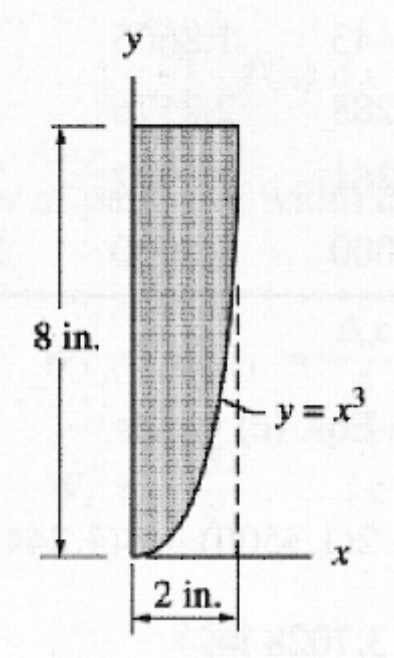
    1. 32.0 lb
    2. 64.0 lb
    3. 263 lb
    4. 400 lb
    5. 432 lb
    6. 458 lb
    7. 506 lb
    8. 720 lb
    9. 832 lb
    10. 873 lb

16. The magnitude of the reaction in pin *A* is most nearly

    1. 32.0 lb
    2. 64.0 lb
    3. 263 lb
    4. 400 lb
    5. 432 lb
    6. 458 lb
    7. 506 lb
    8. 720 lb
    9. 832 lb
    10. 873 lb

17. The x-coordinate of the centroid of the area is most nearly

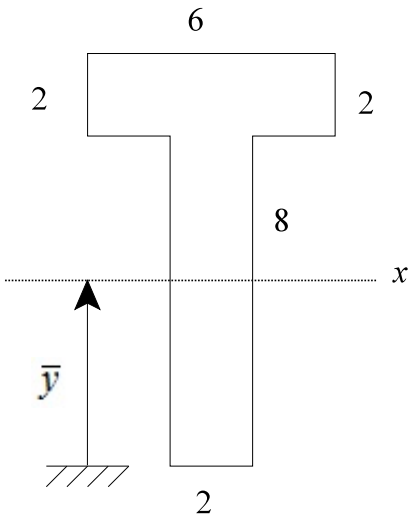
    1. 0.667 in.
    2. 0.750 in.
    3. 0.800 in.
    4. 0.943 in.
    5. 1.000 in.
    6. 4.50 in.
    7. 4.57 in.
    8. 4.67 in.
    9. 5.06 in.
    10. 5.33 in.



18. The radius of gyration about the x-axis is most nearly

    1. 0.667 in.
    2. 0.750 in.
    3. 0.800 in.
    4. 0.943 in.
    5. 1.000 in.
    6. 4.50 in.
    7. 4.57 in.
    8. 4.67 in.
    9. 5.06 in.
    10. 5.33 in.

A beam is made using a 2" x 6" board nailed to a 2" x 8" board. All dimensions are in inches.



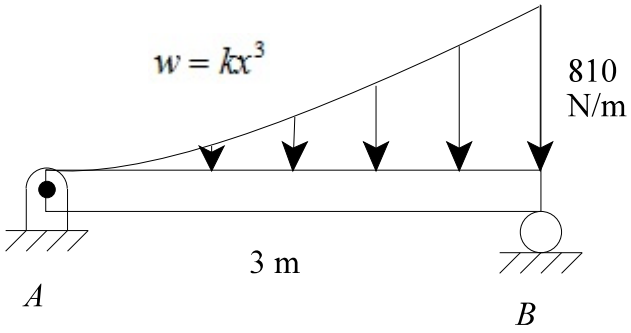
19. The distance $\overline{y}$ to the centroid is most nearly

    1. 4.00 in.
    2. 5.00 in.
    3. 5.56 in.
    4. 5.67 in.
    5. 5.74 in.
    6. 5.82 in.
    7. 6.00 in.
    8. 6.14 in.
    9. 6.50 in.
    10. 7.00 in.

20. The moment of inertia about the centroidal x axis is most nearly

    1. 250 in.^{4}
    2. 261 in.^{4}
    3. 272 in.^{4}
    4. 289 in.^{4}
    5. 297 in.^{4}
    6. 300 in.^{4}
    7. 329 in.^{4}
    8. 333 in.^{4}
    9. 352 in.^{4}
    10. 371 in.^{4}

Beam *AB* is pinned at *A* and there is a roller at *B*. There is a cubic distributed load as shown.



21. The maximum absolute value of the shear force in the beam is most nearly

    1. 121.5 N
    2. 248 N
    3. 405 N
    4. 486 N
    5. 592 N
    6. 600 N
    7. 623 N
    8. 810 N
    9. 906 N
    10. 1215 N

22. The maximum absolute value of the bending moment in the beam is most nearly

    1. 195.0 Nm
    2. 243 Nm
    3. 267 Nm
    4. 300 Nm
    5. 364 Nm
    6. 405 Nm
    7. 486 Nm
    8. 810 Nm
    9. 972 Nm
    10. 1215 Nm