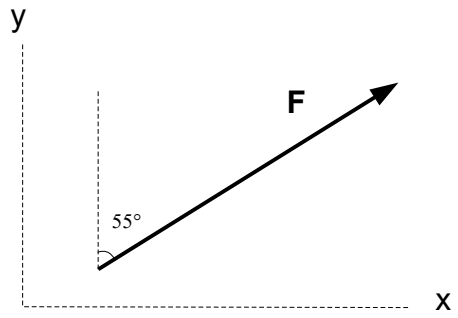
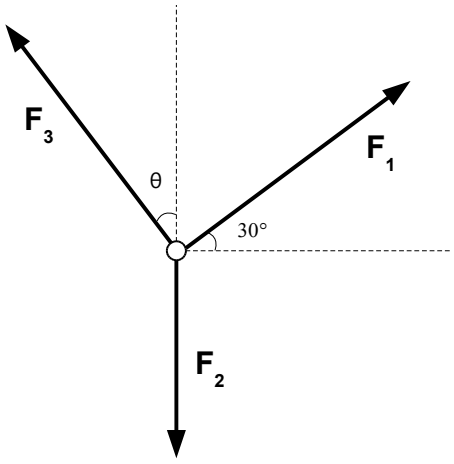
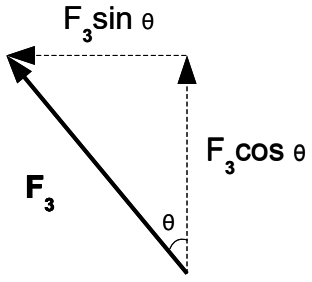
Course Quiz – Statics: Vector Mechanics



1. As shown in the above diagram, the force F = 250 N makes a 55° angle with the y-axis. Find the force in vector form.

   a. **F** = 205**i** + 143**j** N
   b. **F** = 143**i** + 205**j** N
   c. **F** = 160**i** + 178**j** N
   d. **F** = 178**i** + 160**j** N





Setup Problem #2, 3

$\Sigma \mathbf{F} = 0$ (due to equilibrium)

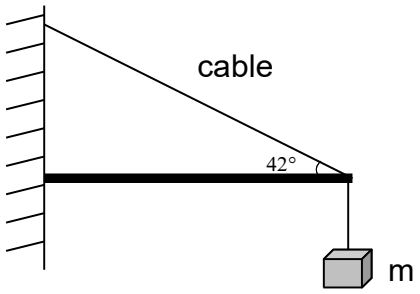
$F_1 + F_2 + F_3 = 0$

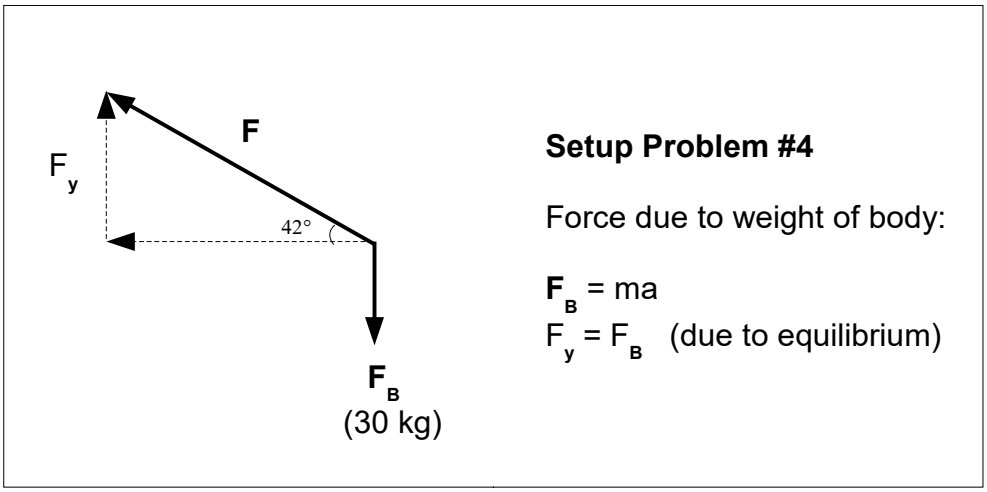
2. As shown in the above diagram, three forces are acting on a particle. The particle is in equilibrium. Two of the forces are known: $F_1 = 150$ N and $F_2 = 80$ N. Find the magnitude of the third force, F_3.

   a. $F_3 = 146$ N
   b. $F_3 = 125$ N
   c. $F_3 = 130$ N
   d. $F_3 = 82$ N

3. From the above problem, find the angle that the force makes with the y-axis.

   a. $\theta = 57.6°$
   b. $\theta = 73.2°$
   c. $\theta = 4.31°$
   d. $\theta = 87.8°$

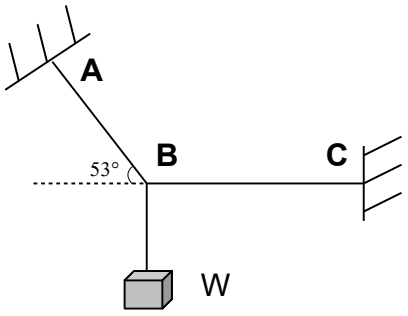


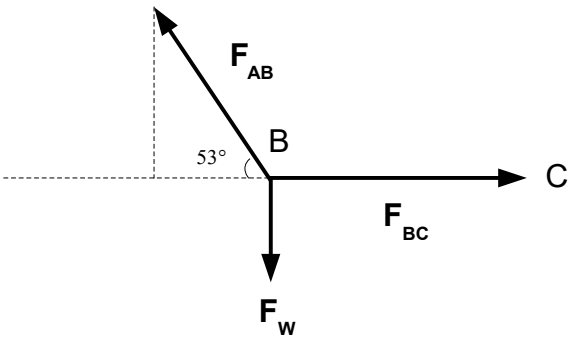


4. As shown in the above diagram, a body is supported by a diagonal cable at an angle of 42° to the horizontal. The body has a mass of 30 kg. The system is in a state of equilibrium. Find the tension in the cable.

   a. 183 N
   b. 440 N
   c. 127 N

d. 561 N





Setup Problem #5, 6

Force due to weight of body:

$\mathbf{F}_W = ma$ $(a = 32.2\ ft/s^2)$

$\Sigma\mathbf{F} = 0$ (due to equilibrium)

$\mathbf{F}_W = F_{AB}\sin 53°$

$\mathbf{F}_{BC} = F_{AB}\cos 53°$

5. As shown in the above diagram, a weight is supported by cables at points A, B and C. The body has a mass of 50 lb. Determine the tension in cable AB.

   a. 1990 lb
   b. 2180 lb
   c. 2020 lb
   d. 1820 lb

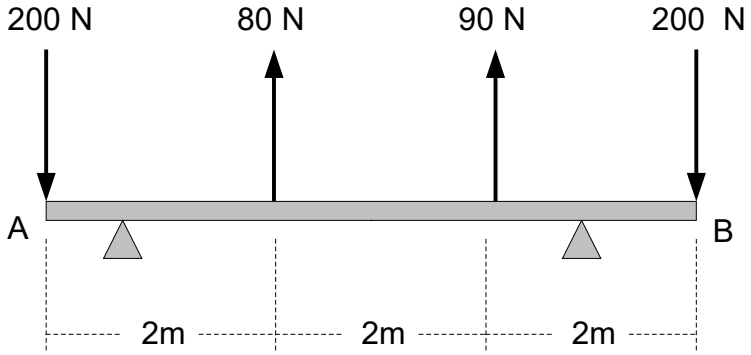
6. From the above problem, determine the tension in cable BC.

   a. 1210 lb
   b. 1630 lb
   c. 1190 lb
   d. 1090 lb

7. Determine the moment of $\mathbf{F} = 5\mathbf{i} + 7\mathbf{j}$ N about a point with a position vector of $\mathbf{r} = 2\mathbf{i} - 4\mathbf{j}$ m.

   a. $\mathbf{M} = 26\mathbf{k}$ Nm
   b. $\mathbf{M} = 34\mathbf{j}$ Nm
   c. $\mathbf{M} = 26\mathbf{j}$ Nm

d. $\mathbf{M} = 34\mathbf{k}$ Nm



Setup Problem #8, 9, 10

resultant force $\mathbf{R} = \Sigma\mathbf{F}$

$\mathbf{M}_A = d \times R$ (d is the distance of the resultant force, R)

8. As shown in the above diagram, a 6m beam is subjected to the forces shown. Reduce the system of forces to an equivalent force-couple system at B. Find a single resultant force.

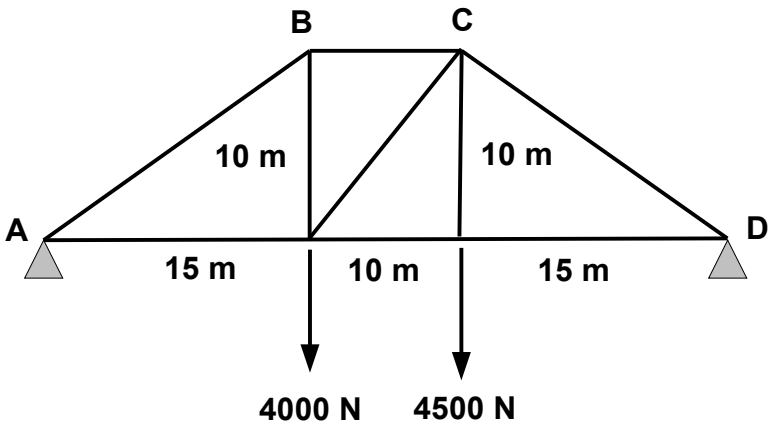
   a. $\mathbf{R} = -250\mathbf{j}$ N
   b. $\mathbf{R} = 280\mathbf{j}$ N
   c. $\mathbf{R} = -230\mathbf{j}$ N
   d. $\mathbf{R} = -30\mathbf{j}$ N

9. From the above problem, find the moment at B.

   a. $\mathbf{M_B} = 600\mathbf{k}$ Nm
   b. $\mathbf{M_B} = 530\mathbf{k}$ Nm
   c. $\mathbf{M_B} = 700\mathbf{k}$ Nm
   d. $\mathbf{M_B} = -470\mathbf{k}$ Nm

10. From the above problem, find the position (distance) of the resultant force from A.

    a. $\mathbf{r_B} = 2.03$ m
    b. $\mathbf{r_B} = 4.31$ m
    c. $\mathbf{r_B} = 1.83$ m
    d. $\mathbf{r_B} = 2.96$ m

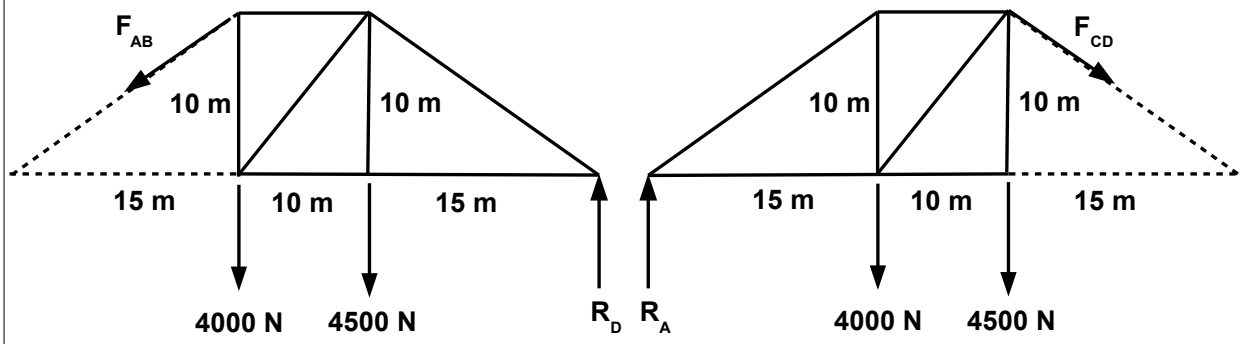


Setup Problem #11, 12

Use method of sections.

For prob #11:
- cut the truss at member AB
- find the moment of the truss at D: $\Sigma M_D = 0$

For prob #12:
- cut the truss at member CD
- find the moment of the truss at A: $\Sigma M_A = 0$



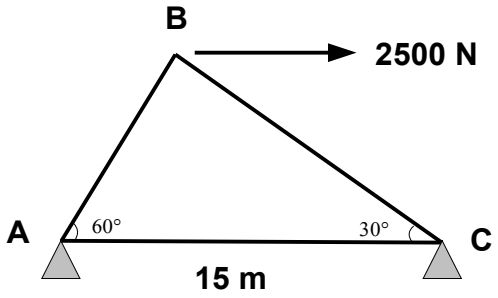
11. As shown in the above diagram, a truss that rests at points A and B have downward forces of 4000 N and 4500 N. Find the axial force in member AB.

    a. 8650 N
    b. 6480 N
    c. 9870 N
    d. 7550 N

12. From the above problem, find the axial force in member CD.

    a. 8123 N
    b. 7780 N

c. 1050 N
d. 9530 N



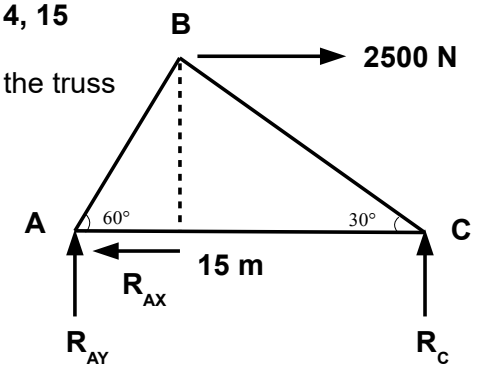
Setup Problem #13, 14, 15

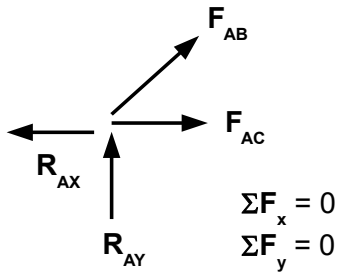
Find the equilibrium of the truss

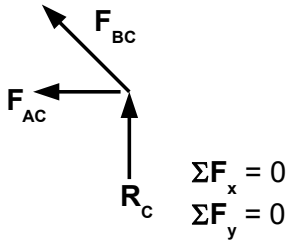
$\Sigma M_A = 0$

$\Sigma F_X = 0$

$\Sigma F_Y = 0$







13. As shown in the above diagram, a truss that is mounted at points A and C with a horizontal force of 2500 N, find the axial force in member AB.

    a. 1470 N
    b. 1170 N
    c. 1250 N
    d. 1160 N

14. From the above problem, find the axial force in member BC.

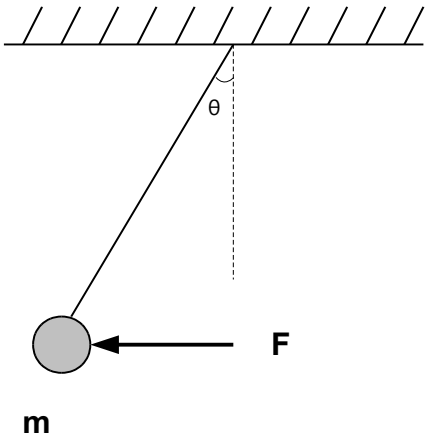
    a. 2170 N
    b. 2290 N
    c. 1870 N
    d. 2790 N

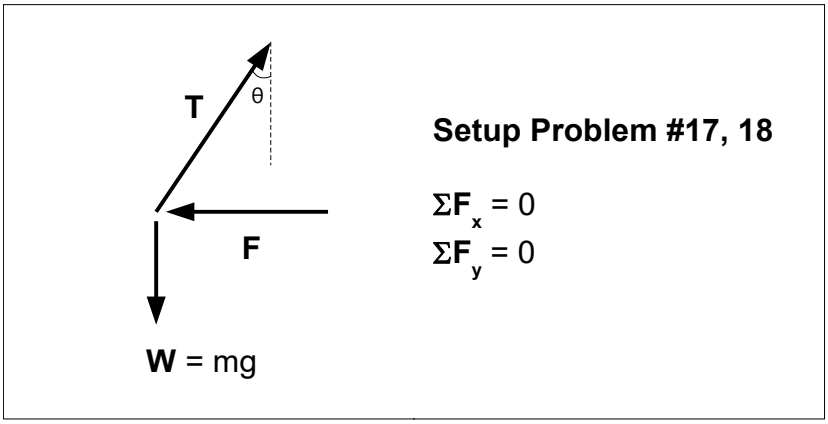
15. From the above problem, find the axial force in member AC.

a. 1290 N
b. 3540 N
c. 1880 N
d. 750 N

16. A body whose mass is 50 kg is on an inclined plane at an angle of 23°. The coefficient of static friction is 0.27. Find the force of friction between the body and the plane.

a. 151 N
b. 107 N
c. 163 N
d. 122 N



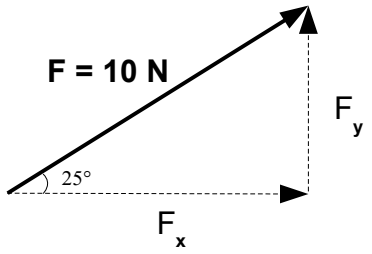


17. As shown in the above diagram, a weight with mass of 10 kg is suspended by a cable and is pushed in the horizontal direction by a force of 27 N. Determine the angle that the cable makes with the vertical.

a. 23.7°
b. 15.4°
c. 13.1°
d. 27.8°

18. From the above problem, determine the tension in the cable.

a. 53.4 N
b. 78.3 N
c. 132 N
d. 102 N

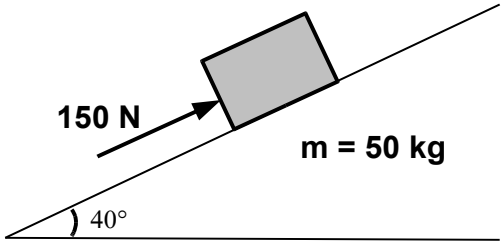


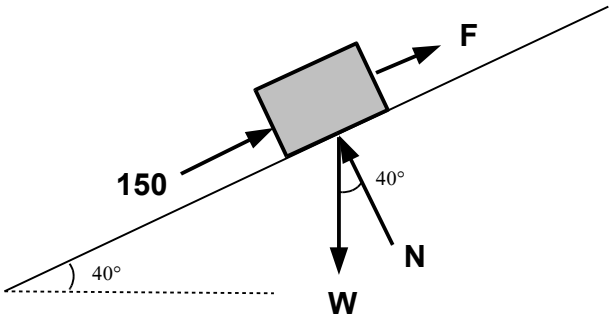
19. As shown in the above diagram, write the force in vector form.

a. 8.83**i** + 5.97**j** N
b. 5.63**i** + 7.01**j** N
c. 9.06**i** + 4.23**j** N
d. 6.23**i** + 8.12**j** N

20. Find the moment of the force F = 5**i** + 7**j** N and the position vector r = 2**i** – 9**j** m.

a. –53**k** Nm
b. 59**k** Nm
c. 65**i** Nm
d. 47**j** Nm





Setup Problem #21, 22, 23

$\Sigma F_x = 0$

$\Sigma F_y = 0$

21. As shown in the above diagram, a block of mass 50 kg is resting on an inclined plane. A force of 150 N is directed at the block parallel to the slope. The coefficient of static friction is 0.26 and the coefficient of kinetic friction is 0.21. Find the force required for equilibrium.

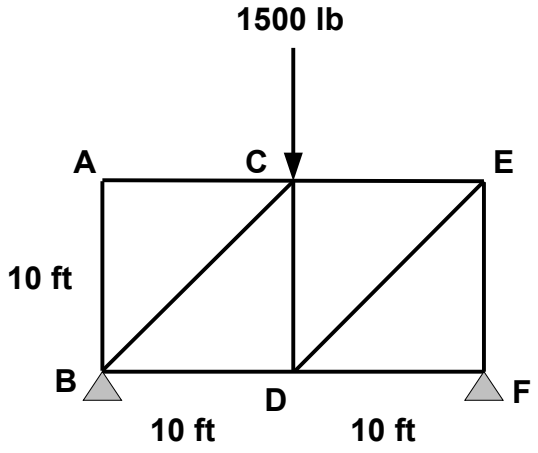
    a. 187 N
    b. 154 N
    c. 165 N
    d. 173 N

22. From the above problem, find the force of friction (static if in equilibrium, kinetic if moving).

    a. 83.3 N
    b. 79.0 N
    c. 65.3 N
    d. 57.1 N

23. From the above problem, determine if the block is in equilibrium.

    a. Block is moving.
    b. Block is not moving.



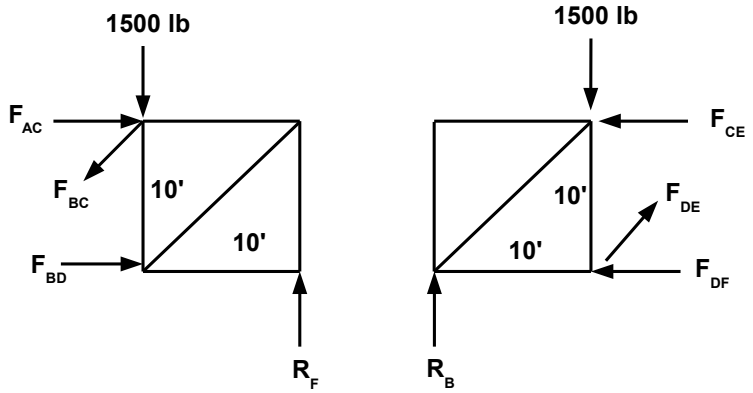
Setup Problem #24, 25, 26

Find equilibrium for entire truss (to find $\mathbf{R_F}$, $\mathbf{R_B}$)

$\Sigma \mathbf{M_B} = 0$, $\Sigma \mathbf{M_F} = 0$

For prob #24, 26:
- cut the truss at members AC, BC, BD
- find the equilibrium:
  $\Sigma \mathbf{M_F} = 0$, $\Sigma \mathbf{F_x} = 0$, $\Sigma \mathbf{F_y} = 0$

For prob #25:
- cut the truss at members CE, DE, DF
- find the equilibrium:
  $\Sigma \mathbf{M_B} = 0$, $\Sigma \mathbf{F_x} = 0$, $\Sigma \mathbf{F_y} = 0$



24. As shown in the above diagram, a truss is subjected to a 1500 lb force at point C and is supported at points B and F. Find the axial force in member AC.

    a. 740 lb
    b. 760 lb
    c. 1500 lb
    d. 0 lb

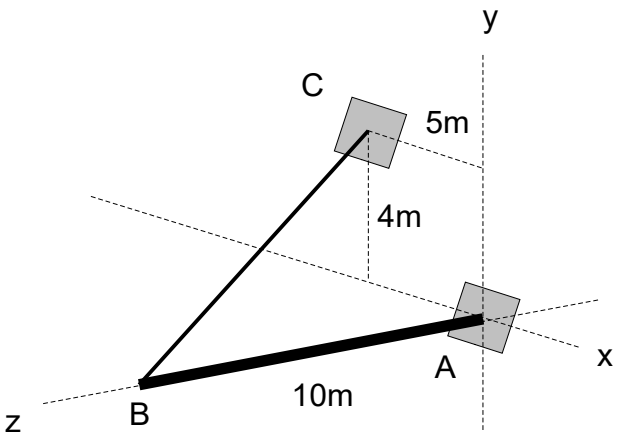
25. From the above problem, find the axial force in member DE.

    a. 1060 lb
    b. 1020 lb
    c. 1070 lb
    d. 942 lb

26. From the above problem, find the axial force in member BD.

    a. 1020 lb
    b. 540 lb
    c. 750 lb

d. 1750 lb

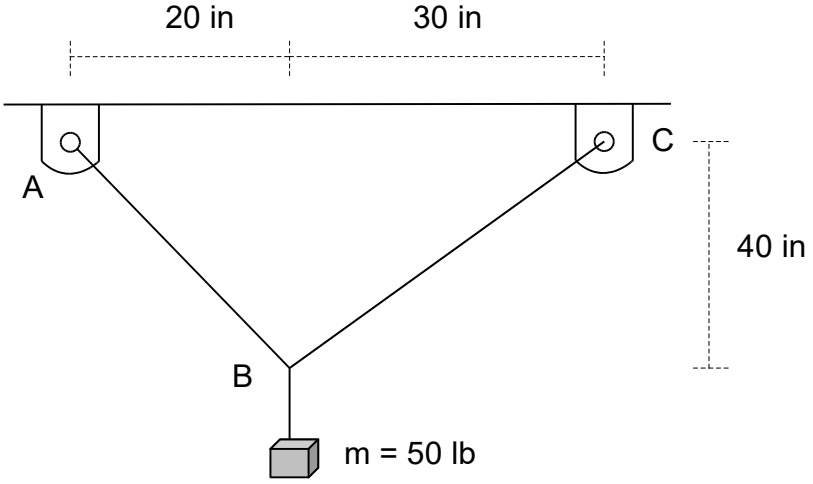


27. As shown in the above diagram, a boom AB is fixed at point A. A cable is attached to point B on the boom and to a wall at point C. The boom is 10m in length and the tension in the cable is known to be 1200N. Find the force exerted by the cable in vector form.

    a. $\mathbf{F} = -306\mathbf{i} + 364\mathbf{j} - 2094\mathbf{k}$ N
    b. $\mathbf{F} = -505\mathbf{i} + 404\mathbf{j} + 1010\mathbf{k}$ N
    c. $\mathbf{F} = 274\mathbf{i} + 532\mathbf{j} - 263\mathbf{k}$ N
    d. $\mathbf{F} = 254\mathbf{i} - 836\mathbf{j} + 275\mathbf{k}$ N

28. From the above problem find the moment about point A of the force exerted by the cable at point B.

    a. $\mathbf{M} = 3826\mathbf{i} - 5344\mathbf{j}$ Nm
    b. $\mathbf{M} = -2743\mathbf{i} + 8443\mathbf{k}$ Nm
    c. $\mathbf{M} = -4040\mathbf{i} - 5050\mathbf{j}$ Nm
    d. $\mathbf{M} = 4826\mathbf{i} - 3645\mathbf{j}$ Nm



29. As shown in the above diagram, a weight is suspended by two cables AB and BC. Find the tension in cable AB.

    a. 1080 lb
    b. 721 lb
    c. 522 lb
    d. 976 lb

30. From the above problem, find the tension in cable BC.

    a. 503 lb
    b. 657 lb
    c. 1030 lb
    d. 805 lb