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Continuing Education Course #553
Vector Mechanics: Statics

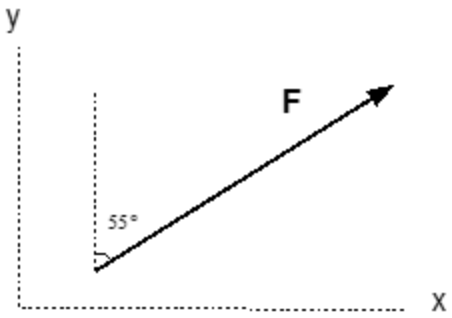



**Figure 1**

1. Using Figure 1, the force F = 250 N makes a 55° angle with the y-axis. Find the force in vector form.

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

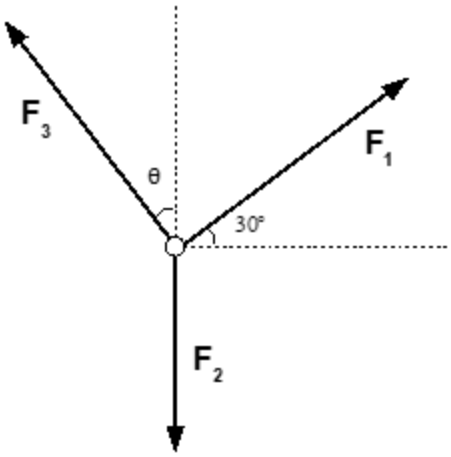
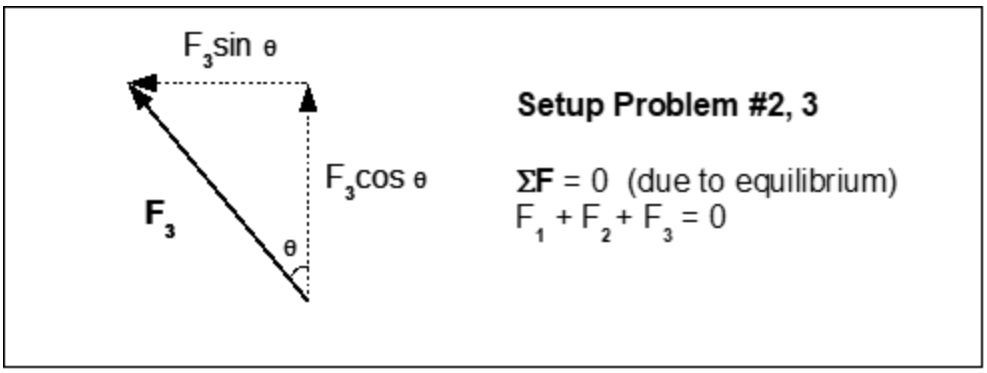



**Figure 2**




2. Using Figure 2, 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. Using Figure 2, find the angle that the force makes with the y-axis.

- a. θ = 57.6 deg
- b. θ = 73.2 deg
- c. θ = 4.31 deg
- d. θ = 87.8 deg

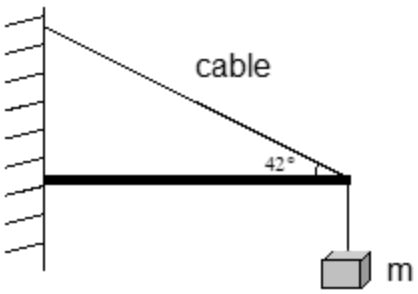
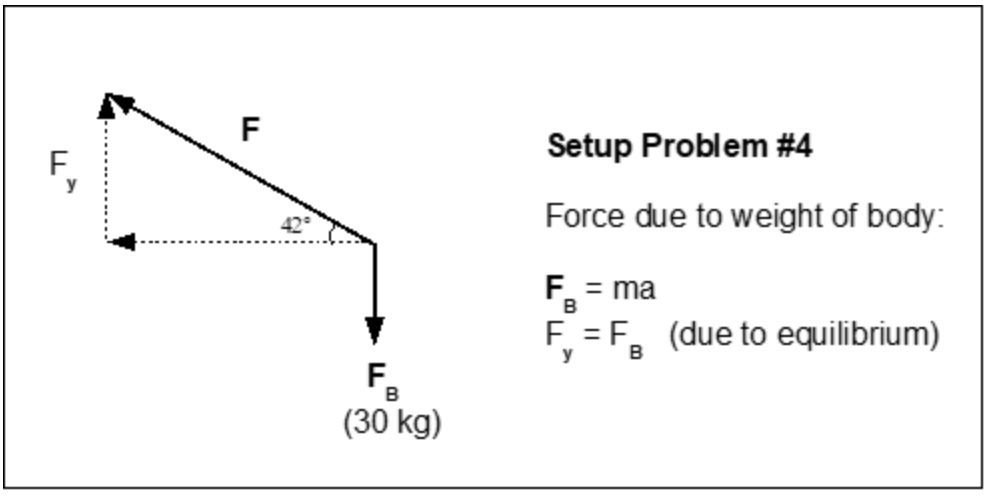



**Figure 3**



4. Using Figure 3, 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. F = 183 N
- b. F = 440 N
- c. F = 127 N
- d. F = 561 N

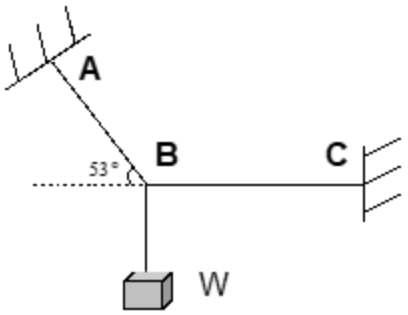
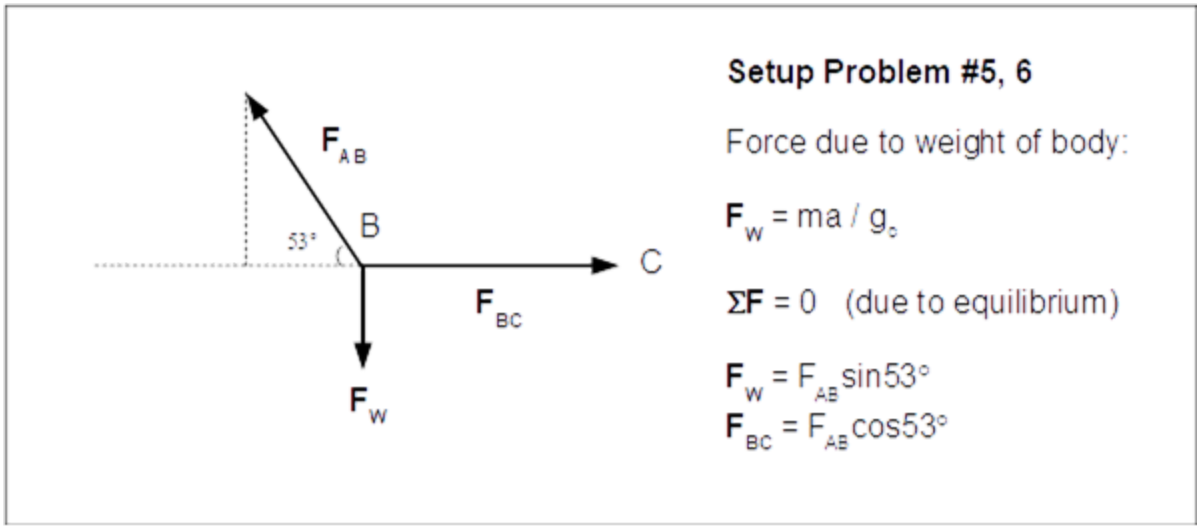



**Figure 4**




5. Using Figure 4, a weight is supported by cables at points A, B and C. The body has a mass of 50 lbm. Determine the tension in cable AB.

- a. F = 52.2 lbf
- b. F = 23.4 lbf
- c. F = 62.6 lbf
- d. F = 72.4 lbf

6. Using Figure 4, determine the tension in cable BC.

- a. F = 37.7 lbf
- b. F = 25.5 lbf
- c. F = 102 lbf
- d. F = 53.4 lbf

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

- a. M = 26k Nm
- b. M = 34j Nm

○ c. M = 26j Nm
○ d. M = 34k Nm

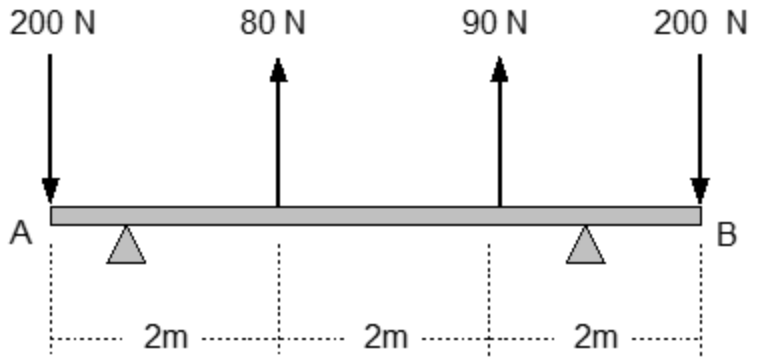



**Figure 5**

**Setup Problem #8, 9, 10**

resultant force **R** = **ΣF**

$\mathbf{M_A}$ = d x R (d is the distance of the resultant force, R)

8. Using Figure 5, 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. R = -250j N
○ b. R = 280j N
○ c. R = -230j N
○ d. R = -30j N

9. Using Figure 5, find the moment at B.

○ a. $M_B$ = 600k Nm
○ b. $M_B$ = 530k Nm
○ c. $M_B$ = 700k Nm
○ d. $M_B$ = -470k Nm

10. Using Figure 5, find the position (distance) of the resultant force from A.

○ a. $r_B$ = 2.03 m
○ b. $r_B$ = 4.31 m
○ c. $r_B$ = 1.83 m
○ d. $r_B$ = 2.96 m

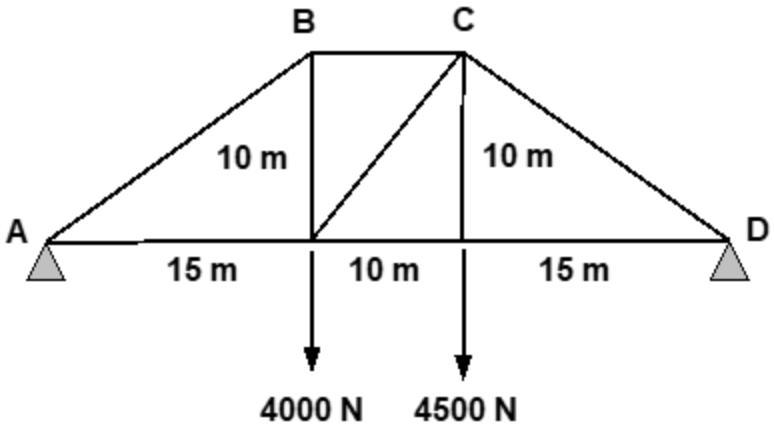
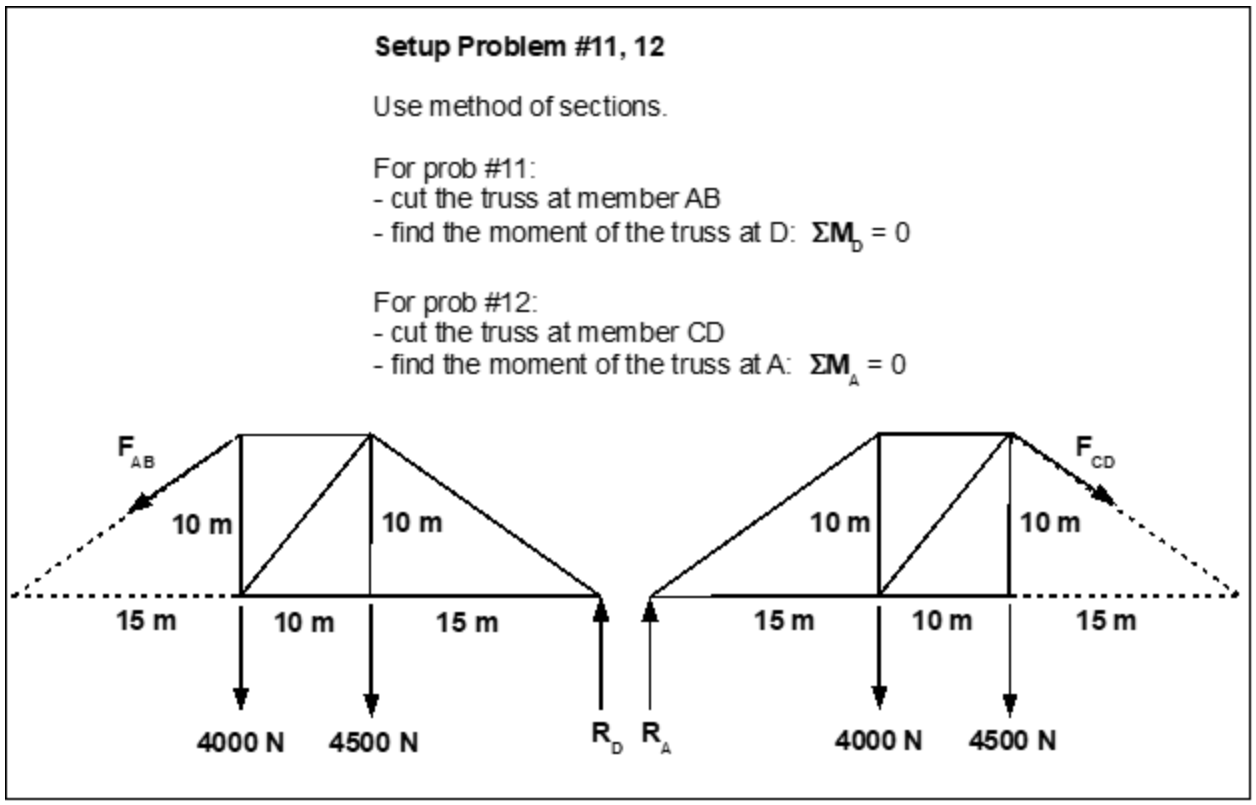



**Figure 6**




11. Using Figure 6, 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. F = 8650 N
- ○ b. F = 6480 N
- ○ c. F = 9870 N
- ○ d. F = 7550 N

12. Using Figure 6, find the axial force in member CD.

- ○ a. F = 8123 N
- ○ b. F = 7780 N
- ○ c. F = 1050 N
- ○ d. F = 9530 N

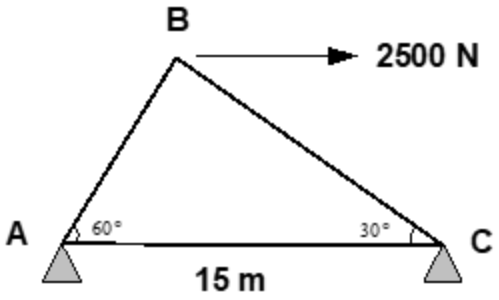
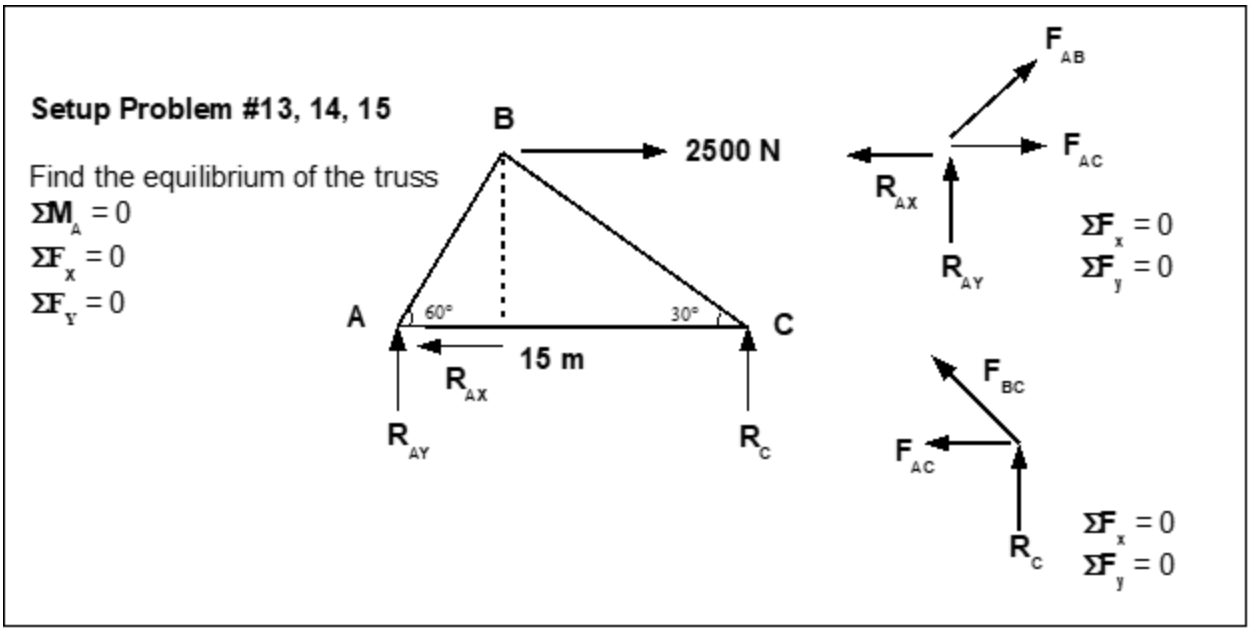



**Figure 7**




13. Using Figure 7, 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. F = 1470 N
- ○ b. F = 1170 N
- ○ c. F = 1250 N
- ○ d. F = 1160 N

14. Using Figure 7, find the axial force in member BC.

- ○ a. F = 2170 N
- ○ b. F = 2290 N
- ○ c. F = 1870 N
- ○ d. F = 2790 N

15. Using Figure 7, find the axial force in member AC.

- ○ a. F = 1290 N
- ○ b. F = 3540 N
- ○ c. F = 1880 N
- ○ d. F = 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. F = 151 N
- ○ b. F = 107 N

○ c. F = 163 N
○ d. F = 122 N

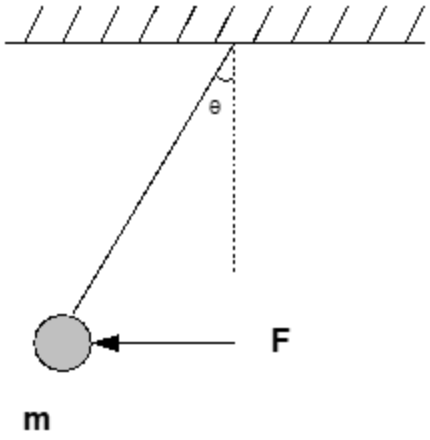
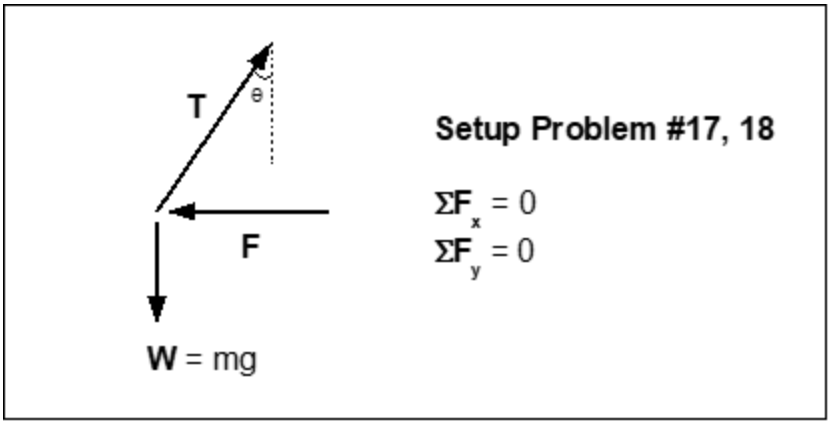



**Figure 8**




17. Using Figure 8, 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. theta = 23.7 deg
○ b. theta = 15.4 deg
○ c. theta = 13.1 deg
○ d. theta = 27.8 deg

18. Using Figure 8, determine the tension in the cable.

○ a. F = 53.4 N
○ b. F = 78.3 N
○ c. F = 132 N
○ d. F = 102 N

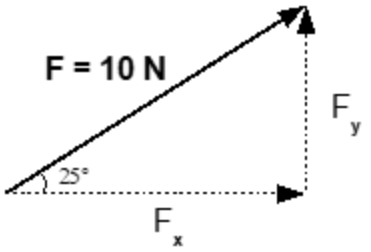



**Figure 9**

19. Using Figure 9, write the force in vector form.

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

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

- a. F = -53k Nm
- b. F = 59k Nm
- c. F = 65i Nm
- d. F = 47j Nm

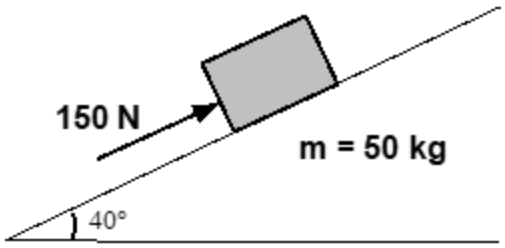
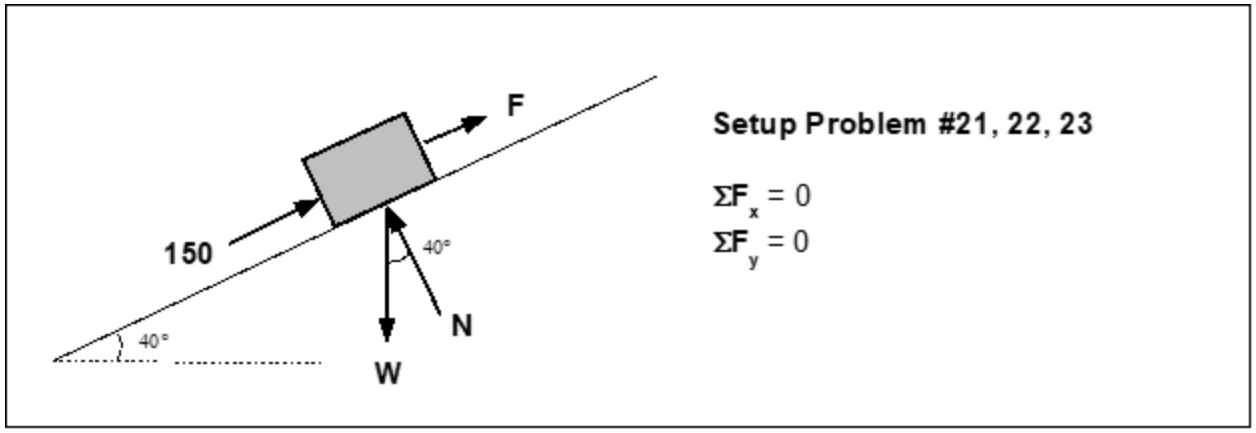



**Figure 10**




21. Using Figure 10, 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. F = 187 N
- b. F = 154 N
- c. F = 165 N
- d. F = 173 N

22. Using Figure 10, find the force of friction (static if in equilibrium, kinetic if moving).

- a. F = 83.3 N
- b. F = 79.0 N
- c. F = 65.3 N
- d. F = 57.1 N

23. Using Figure 10, determine if the block is in equilibrium.

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

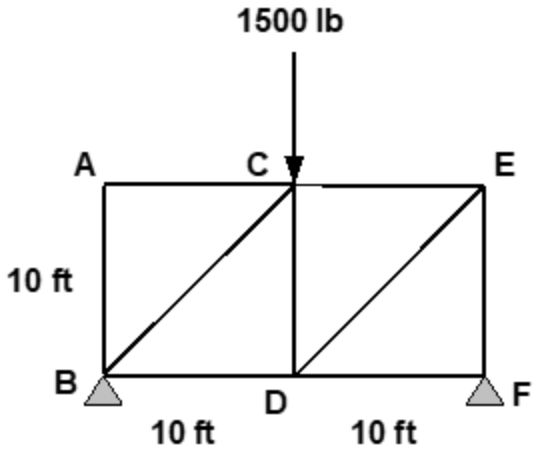



**Figure 11**

**Setup Problem #24, 25, 26**

Find equilibrium for entire truss (to find $R_F$, $R_B$)

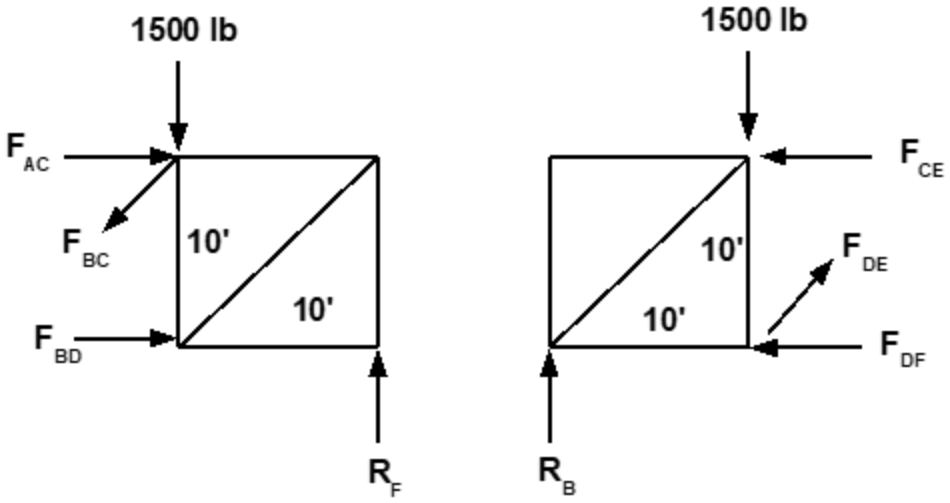
$\Sigma M_B = 0, \ \Sigma M_F = 0$

For prob #24, 26:
- cut the truss at members AC, BC, BD
- find the equilibrium:

$\Sigma M_F = 0, \ \Sigma F_x = 0, \ \Sigma F_y = 0$

For prob #25:
- cut the truss at members CE, DE, DF
- find the equilibrium:

$\Sigma M_B = 0, \ \Sigma F_x = 0, \ \Sigma F_y = 0$




24. Using Figure 11, 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. F = 740 lb
- b. F = 760 lb
- c. F = 1500 lb
- d. F = 0 lb

25. Using Figure 11, find the axial force in member DE.

- a. F = 1060 lb
- b. F = 1020 lb
- c. F = 1070 lb
- d. F = 942 lb

26. Using Figure 11, find the axial force in member BD.

- a. F = 1020 lb
- b. F = 540 lb

○ c. F = 750 lb
○ d. F = 1750 lb

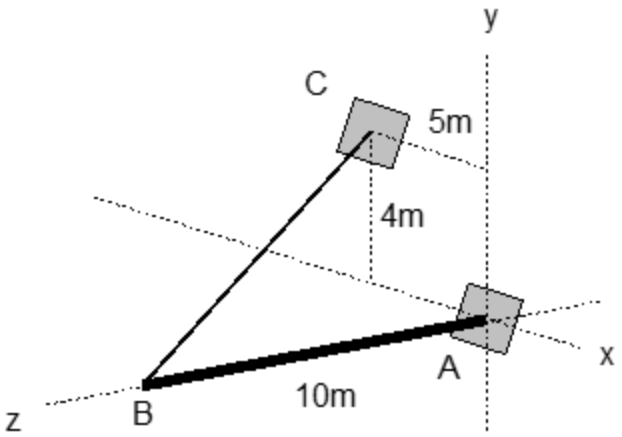



**Figure 12**

27. Using Figure 12, 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. F = -306i + 364j - 2094k N
○ b. F = -505i + 404j + 1010k N
○ c. F = 274i + 532j - 263k N
○ d. F = 254i - 836j + 275k N

28. Using Figure 12, find the moment about point A of the force exerted by the cable at point B.

○ a. M = 3826i - 5344j Nm
○ b. M = -2743i + 8443k Nm
○ c. M = -4040i - 5050j Nm
○ d. M = 4826i - 3645j Nm

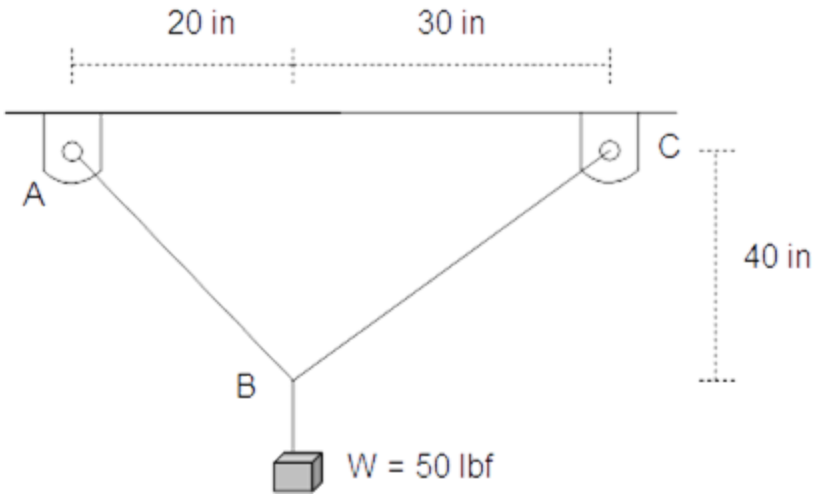



**Figure 13**

29. Using Figure 13, a weight is suspended by two cables AB and BC. Find the tension in cable AB.

- a. F = 33.5 lbf
- b. F = 102 lbf
- c. F = 12.4 lbf
- d. F = 74.3 lbf

30. Using Figure 13, find the tension in cable BC.

- a. F = 18.3 lbf
- b. F = 72.4 lbf
- c. F = 10.2 lbf
- d. F = 25.0 lbf