Exercise 12.2 Calculating Support Reactions

Objective

At the conclusion of this exercise, you will be able to do the following:

1. Identify a pinned support and a roller support.
2. Draw a free-body diagram of a simply supported beam.
3. Apply the equations of equilibrium to calculate the support reactions on a beam.

Procedure

Read the section on simple supports and reactions (pp. 409–413) in Chapter 12 of your textbook.

TIP SHEET

In a simply supported beam, a pinned support ( ) generates both a vertical (y-direction) and a horizontal (x-direction) reaction force.

A roller support ( ) generates only a vertical (y-direction) reaction force.
When applying the equilibrium equation $\Sigma M = 0$ (the sum of the moments about a point is equal to zero) to calculate the support reactions on a beam or truss, assume that all forces that cause clockwise rotation ↻ about a point are negative and all forces that cause counterclockwise ↺ rotation about a point are positive.

Two other equilibrium equations will be helpful as you practice these exercises: $\Sigma F_x = 0$ (sum of forces in the x direction = 0) and $\Sigma F_y = 0$ (sum of forces in the y direction = 0). These remind us that the beams are not accelerating—indeed, they are at rest.

Problem 12.8 Figure 12-12 shows a simply supported beam with a concentrated load of 125 lb applied at point B.

1. In the space provided, draw and label a free-body diagram of the beam:

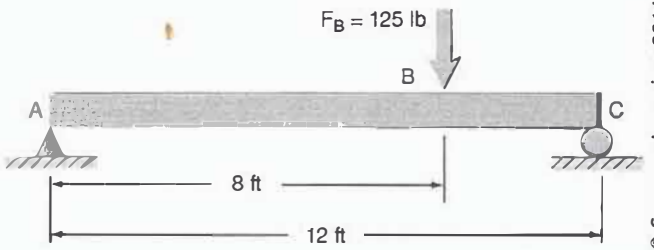

FIGURE 12-12 *A simply supported beam.*

2. Calculate the vertical reaction force at point C. Show your math work and record your answer in the space provided. Use the appropriate sign in your answer.

R_{CY} = _____ lb

3. Calculate the vertical reaction force at point A. Show your math work and record your answer in the space provided. Use the appropriate sign in your answer.

R_{AY} = _____ lb

4. What is R_{AX}? How do you know?

_____

_____

Problem 12.9 Figure 12-13 is a simply supported beam with concentrated loads of 500 lb applied at point B and 150 lb applied at point C.

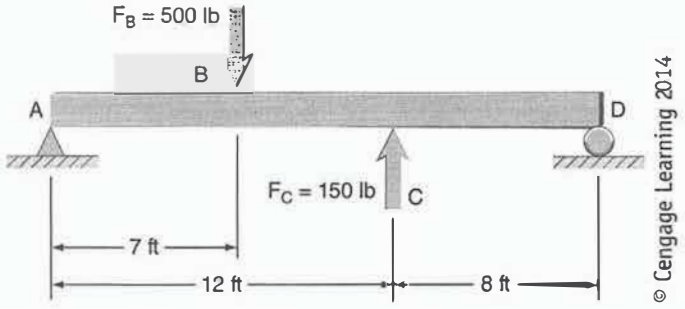

FIGURE 12-13 *A simply supported beam.*

1. In the space provided, draw and label a free-body diagram of the beam:

2. Calculate the vertical reaction force at point D. Show your math work and record your answer in the space provided. Use the appropriate sign in your answer.

R_{DY} = _____ lb

3. Calculate the vertical reaction force at point A. Show your math work and record your answer in the space provided. Use the appropriate sign in your answer.

R_{AY} = _____ lb

4. What is R_{AX}? How do you know?

_____

_____

Problem 12.10 Figure 12-14 is a simply supported beam that has a concentrated 800-lb load applied at a 30° angle at point B and a concentrated 200-lb load applied at point C.

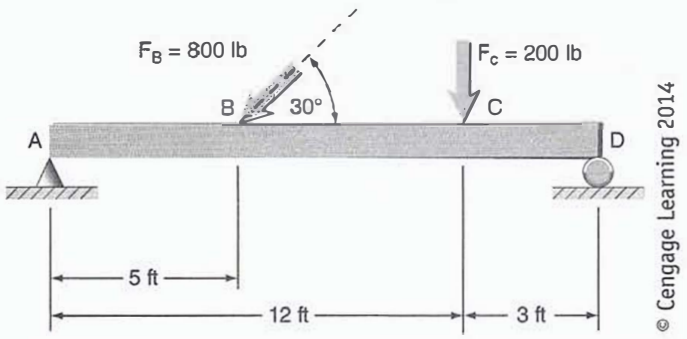

FIGURE 12-14 *A simply supported beam.*

1. In the space provided, draw and label a free-body diagram of the beam:

2. Calculate the vertical and horizontal components of force F_B. Show your math work and record your answers in the space provided. Use the appropriate signs in your answer.

F_{BX} = _____ lb F_{BY} = _____ lb

3. Calculate the vertical reaction force at point D. Show your math work and record your answer in the space provided. Use the appropriate sign in your answer.

R_{DY} = _____lb

4. Calculate the vertical reaction force at point A. Show your math work and record your answer in the space provided. Use the appropriate sign in your answer.

R_{AY} = _____lb

5. Calculate the horizontal reaction force at point A. Show your math work and record your answer in the space provided. Use the appropriate sign in your answer.

R_{AX} = _____lb