ARCH 631. Assignment #1

**Date:** 8/27/13, *due 9/5/13*   *Worth 20 pts.*

Problems:

1.   A 24-foot-long steel beam is installed when the temperature is 45°F. How much will it expand if the temperature rises to 75°F? The coefficient of expansion of steel is 0.0000065.
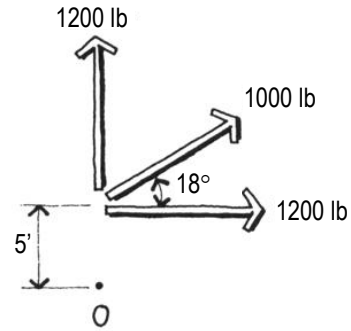
   Answer: 0.056 in

2.   What is the horizontal thrust at each end of the three-hinged arch shown below?

   770 lb/ft

   17' – 0"

   210' – 0"

   Answer: 249.7 k

3.

   1200 lb

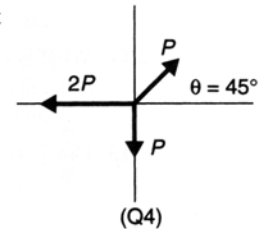   1000 lb

   18°

   1200 lb

   5'

   O
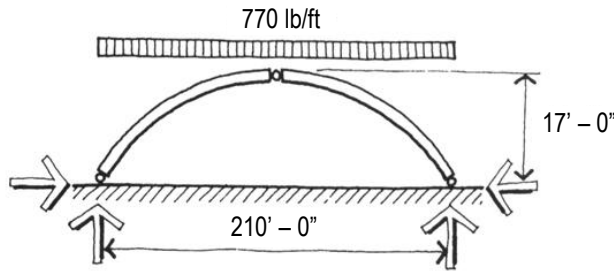
   What is the moment about point O of the three forces shown above?
   Answer: 10,755 lb-ft

4. Complete text problem 2.4 on page 85.

   2.4 The following three forces act through a point: P at $\theta_x = 45°$, $2P$ at $\theta_x = 180°$, and P at $\theta_x = 270°$. Find the equivalent resultant force. [See Figure 2.59(Q4).]
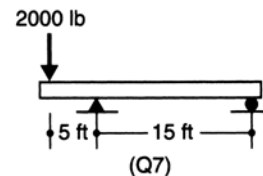   Answer: 1.33P at 192.8°.

   2P $\theta = 45°$
   P
   P
   (Q4)

5. Complete text problem 2.7 on page 85.

   2.7 Determine the reactions for the structure shown in Figure 2.59(Q7).
   Answer: $R_A = 2667$ lb ↑ and $R_B = 667$ lb ↓.

   2000 lb
   5 ft   15 ft
   (Q7)

6. Complete text problem 2.13 on page 85 *for figure Q13c*.

   2.13 Determine the reactions for the beams shown in Figure 2.59(Q13).
   Answer: $R_{Ax} = P/2 \rightarrow$, $R_{Bx} = P/2 \leftarrow$, $R_{By} = P$ ↑.

   P
   L
   L/2   L/2
   (Q13c)
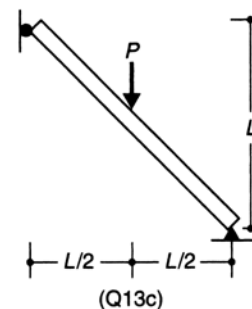
7. Complete text problem 2.24 on page 86.

2.24 What is the unit strain present in an aluminum specimen loaded to 10,000 lb/in.^{2}? Assume that $E_a = 11.3 \times 10^6$ lb/in.^{2}

Answer: 0.000885 in./in.

8. Complete text problem 2.27 on page 86.

2.27 A steel bar that is 20 mm in diameter is 5 m long and carries a tension force of 20 kN. How much does the bar elongate? Assume that $E_s = 0.204 \times 10^6$ N/mm^2.

Answer: 1.56 mm.