

### ARCH 631. Assignment #1

Date: 8/29/17, due 9/7/17

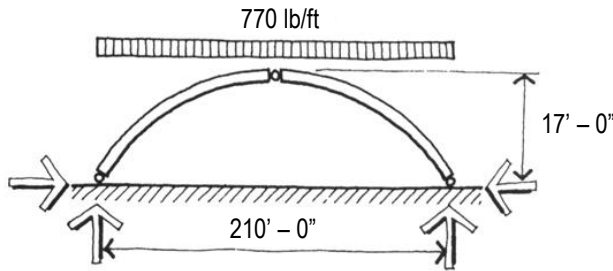
Worth 20 pts.

**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.

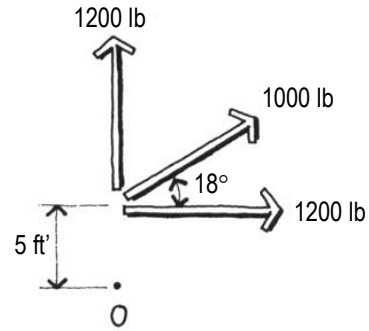
Answer: 0.056 in

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



Answer: 249.7 k

- 3.



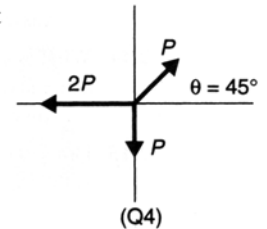
What is the moment about point O of the three forces shown above?

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  $\theta_x = 45^\circ$ ,  $2P$  at  $\theta_x = 180^\circ$ , and  $P$  at  $\theta_x = 270^\circ$ . Find the equivalent resultant force. [See Figure 2.59(Q4).]

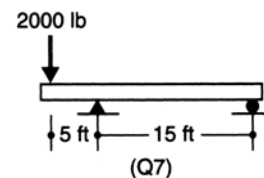
Answer:  $1.33P$  at  $192.8^\circ$ .



5. Complete text problem 2.7 on page 85.

2.7 Determine the reactions for the structure shown in Figure 2.59(Q7).

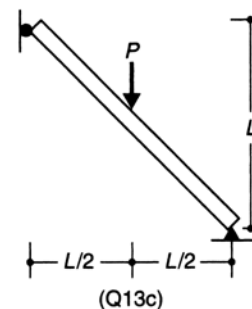
Answer:  $R_A = 2667 \text{ lb } \uparrow$  and  $R_B = 667 \text{ lb } \downarrow$ .



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:  $R_{Ax} = P/2 \rightarrow$ ,  $R_{Bx} = P/2 \leftarrow$ ,  $R_{By} = P \uparrow$ .



**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.<sup>2</sup>? Assume that  $E_a = 11.3 \times 10^6$  lb/in.<sup>2</sup>  
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<sup>2</sup>.  
Answer: 1.56 mm.