REVIEW PROBLEMS

BEAMS

1) For the beam shown in Figure 1:

a) What are the reactions at each support? (Support A is a pin and B is a roller support.)
b) Draw the shear diagram due to the given loading.
c) Draw the moment diagram due to the given loading.
d) Propose a rectangular cross-section for this beam in timber, so that the maximum bending stress in the beam is less than 1,000 psi and the maximum height of the beam is no more than 20 inches.
e) If the location of the 5^k load applied at point C is variable, and can move anywhere *between* supports A and B on the beam, would the maximum design moment for the beam increase, decrease, or stay the same?
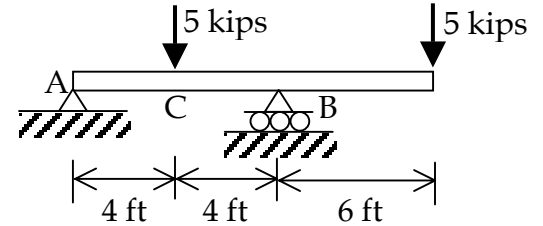

Figure 1.

2) For the vertical cantilever beam shown in Figure 2:

a) What are the support reactions at point A?
b) Draw the shear diagram due to the given loading.
c) Draw the moment diagram due to the given loading.
d) If the beam is made of a hollow steel pipe with an outside diameter of 12 inches and a constant wall thickness of ½", what is the moment of inertia of the section?
e) What is the maximum bending stress at support A due to the moment caused by the horizontal force of 10 kips?
f) Considering the influence of the 10 kips axial force, what is the final stress state at point A for combined axial force and bending? Clearly label the location of maximum compression stress.
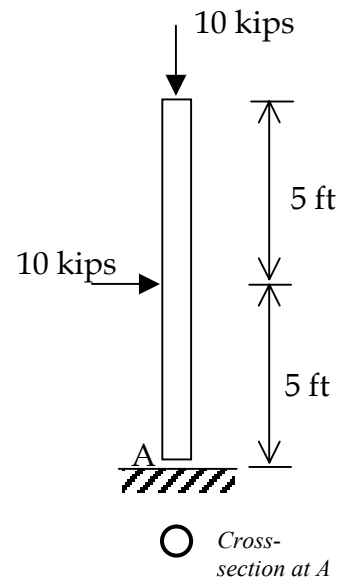

Figure 2.

TRUSSES

3) The truss illustrated in Figure 3 is composed
entirely of 60 degree angles. Neglect the self-weight of
the truss and make the usual assumptions for truss
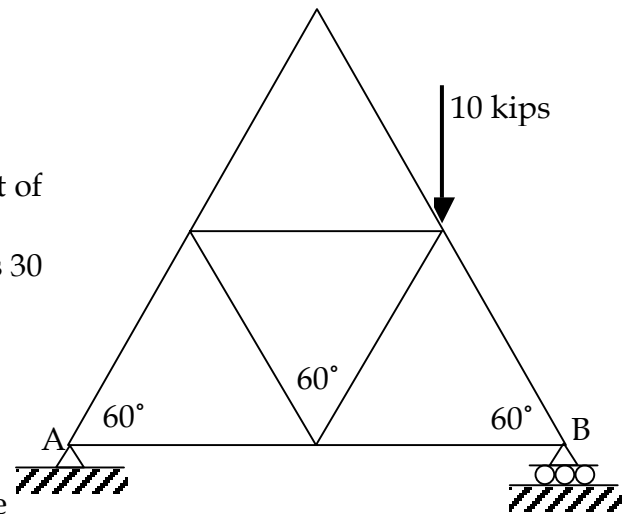analysis. The total span of the truss (distance AB) is 30
feet.

a) What are the support reactions at A and B?
b) Using either graphical or numerical methods,
calculate the internal forces in all members of the
truss. Present your solution as a sketch showing the
internal bar forces. Label each force as tension or
compression.
c) If the tension elements in the truss are circular steel
rods which are ½" in diameter, what is the maximum
tensile stress in the truss?
d) What is the maximum change in length (in inches)
of a tension element due to the applied load of 10
kips?

Figure 3.

4) The truss illustrated in Figure 4 spans 30 feet
between points A and B.
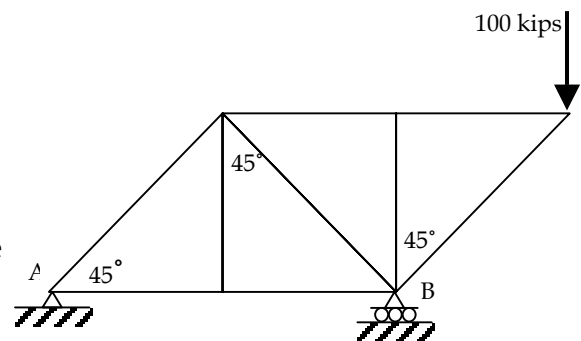
a) What are the support reactions at A and B?
b) Using either graphical or numerical methods,
calculate the internal forces in all members of the
truss. Present your solution as a sketch showing the
internal bar forces. Label each force as tension or
compression.
c) If the compression elements in the truss are
composed of 10" x 10" hollow square steel box
sections with a wall thickness of ½", what is the
moment of inertia of the section?
d) If the total span of the truss (distance AB) is 30 feet,
what is the safety factor against buckling for the
element with the highest force in compression?
(Assume that each end of the element is pinned, as
usual for truss analysis.)

Figure 4.