5.4 Internal forces

Preparatory Problems

5.4.1 For the bar shown which ones of the following statements are true? *

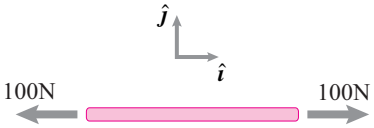
a) The two forces cancel so the tension is zero.

b) The two forces add so the tension is 200 N.

c) The tension is 100 N$\hat{\imath}$.

d) The tension is −100 N$\hat{\imath}$.

e) The tension is 100 N$\hat{\imath}$ on the right end and −100 N$\hat{\imath}$ on the left end.



Problem 5.4.1

5.4.2 What letters and case (upper or lower) are used in this book for tension, shear force, and bending moment?

5.4.3 Mechanics depends on free-body diagrams. And free-body diagrams only show the external forces on an object. So how can mechanical sense be made of the concept of "internal" force?

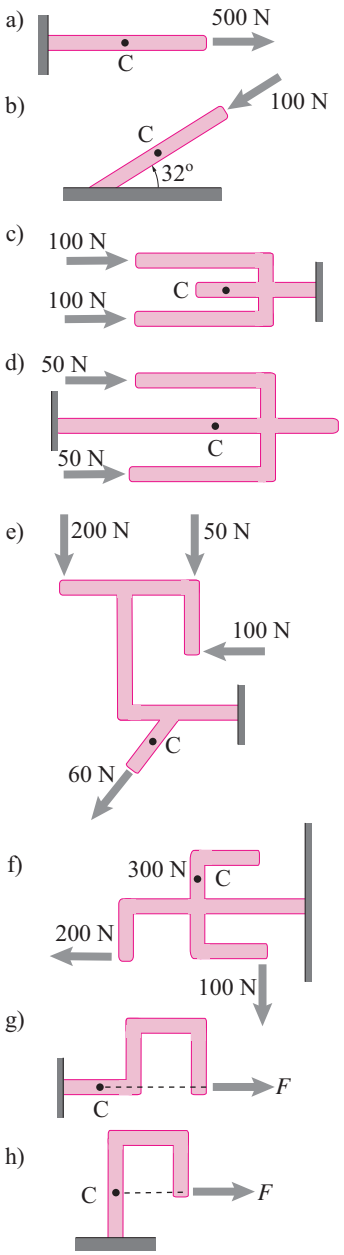
5.4.4 A string is conceptually cut in half by making free-body diagrams of the left and right halves of the string. At the cut on the left half of the string acts the force 50 N$\hat{\imath}$. At the cut on the right half of the string acts the force −50 N$\hat{\imath}$. With two different forces acting on the two halves how can one define a single 'tension'?

5.4.5 Define as precisely as you can:

a) Shear force

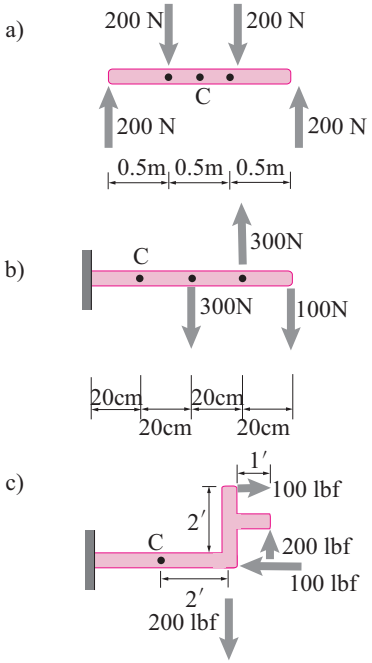
b) Bending moment

5.4.6 Find the tension, shear force and bending moment at C for each of the structures below. Neglect gravity. Assume dimensions as needed.



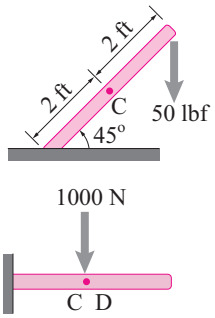
Problem 5.4.6

5.4.7 Find the tension, shear force and bending moment at C for each of the structures below. There is no gravity. Assume dimensions if needed.

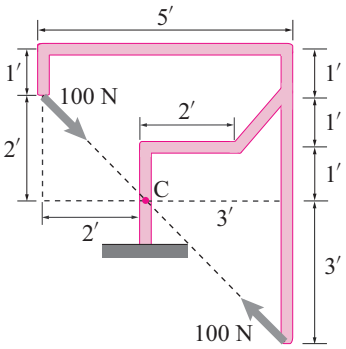


Problem 5.4.7

5.4.8 Find the tension, shear and bending moment at section C for each of the structures below. And also at D, if marked. Assume reasonable dimensions as needed.

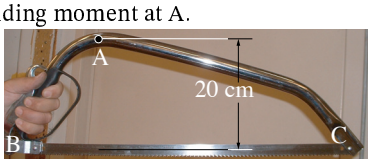


C&D are just to the sides of the point of force application



Problem 5.4.8

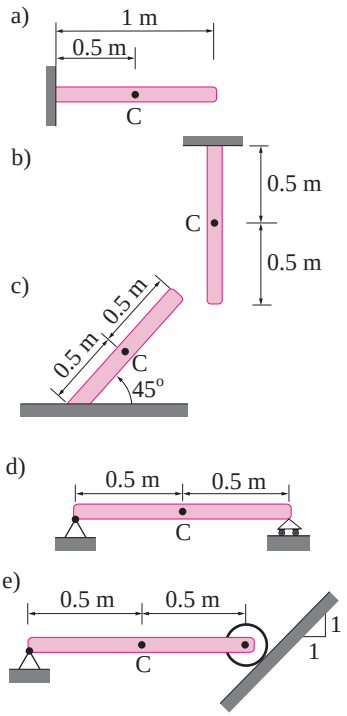
5.4.9 The tension in the bow-saw blade BC is 250 N. Find the tension, shear, and bending moment at A.



Problem 5.4.9

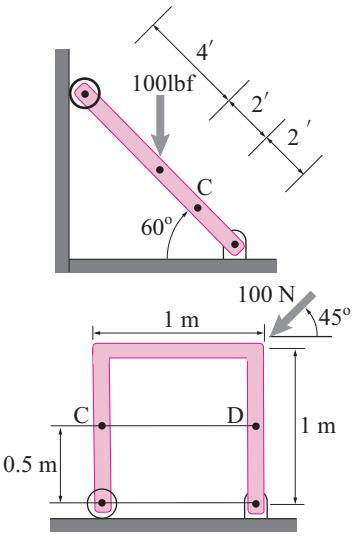
More-Involved Problems

5.4.10 Find the tension, shear and bending moment at section C for each of the structures below. And also at D, if marked. Include gravity, assume all bars are uniform with density of (100 N/m). Assume reasonable dimensions as needed.



Problem 5.4.10

5.4.11 Find the tension, shear and bending moment at section C for each of the structures below. And also at D, if marked. Neglect gravity. Assume reasonable dimensions as needed.



Problem 5.4.11