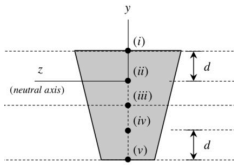
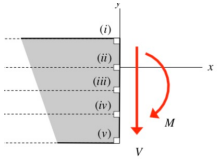
Quiz 4 solutions

Problem 2

The correct state of stress for each of the five points on the cross-section.

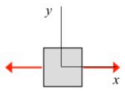


cross section of beam

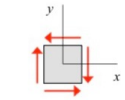


SIDE view of beam

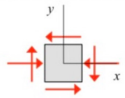
point (i)



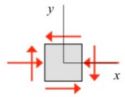
point (ii)



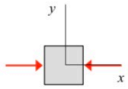
point (iii)



point (iv)

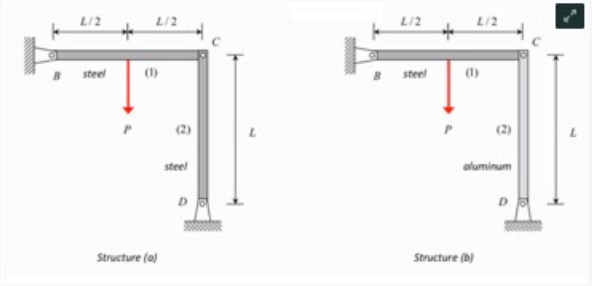


point (v)



Q3 Material properties

2 Points



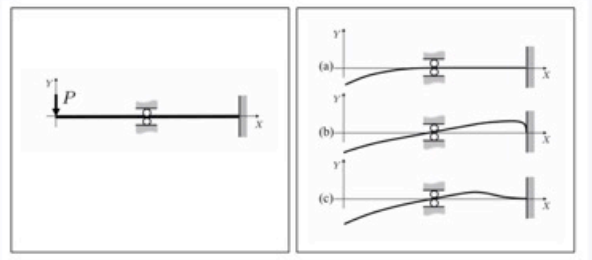
Consider structures (a) and (b) shown above. The two structures and their loadings are identical except that in Structure (b), Member (2) is made from aluminum. Note that aluminum has a smaller Young's modulus than does steel. Let σ_{2a} and σ_{2b} represent the normal stress in Member (2) for Structures (a) and (b), respectively. Choose the correct response below:

- $|\sigma_{2a}| > |\sigma_{2b}|$
- ⊙ $|\sigma_{2a}| = |\sigma_{2b}|$
- $|\sigma_{2a}| < |\sigma_{2b}|$

DETERMINATE structure. Internal loads do NOT depend on material properties.

Q4 Beam deflection

2 Points



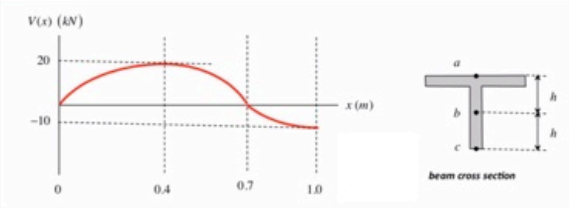
The propped-cantilevered beam experiences a downward point load at the left end. Choose the deflection plot above right that most closely represents the deflection of this beam.

- deflection (a)
- deflection (b)
- ⊙ deflection (c)
- none of the above

Beam must have zero deflection and zero slope at wall. Also, the deflection between the roller and the wall is NOT zero.

Q5 Shear stress

2 Points



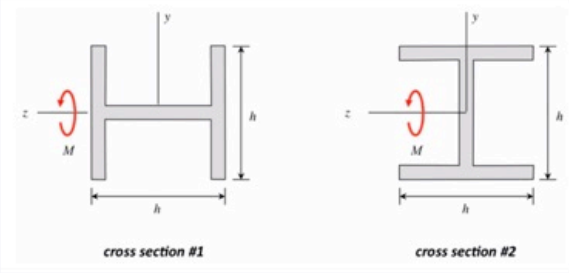
The loading on a beam having a T-shaped cross-section produces the shear force diagram shown above. Among points a, b and c on the cross-section, which has the larger magnitude shear stress?

- ○ Point "a" has the larger magnitude shear stress.
- ◉ Point "b" has the larger magnitude shear stress.
- ○ Point "c" has the larger magnitude shear stress.

Points “a” and “c” are on shear-free surfaces. Therefore, the shear stress there is zero.

Q6 Second area moments

2 Points



At a particular location along the length of a beam, the bending moment about the z-axis is known to be M. Consider the two possible cross-sections of the beam, Cross-section #1 and Cross-section #2 which have second area moments of I_1 and I_2, respectively. If the normal stress at that location is to be calculated using $\sigma = -My/I$, which cross-section has the larger value of I?

- ○ $I_1 > I_2$
- ○ $I_1 = I_2$
- ◉ $I_1 < I_2$

The areas of the two are the same. Cross-section #2 has area distributed further away from the neutral surface. Hence, its value of I is larger.