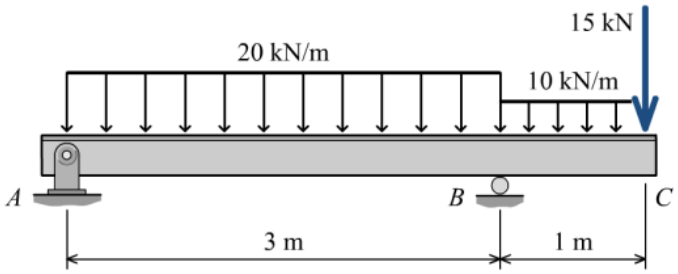
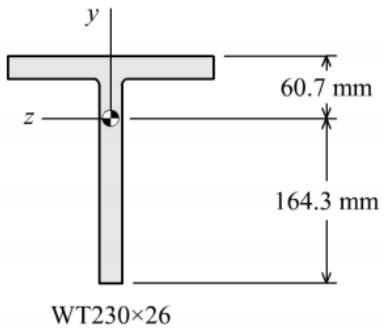
SFD, BMD and Deflection of beams question sheet

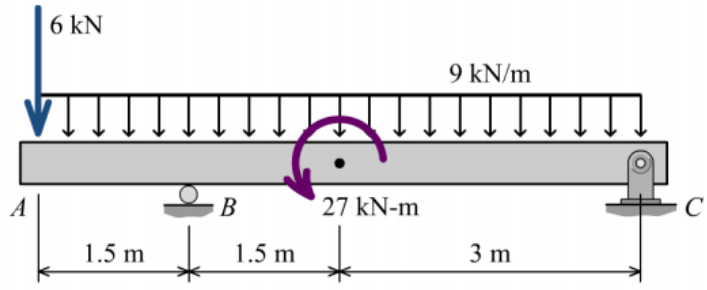
Q1. A WT230 × 26 standard steel shape is used to support the loads shown on the beam in Fig. The dimensions from the top and bottom of the shape to the centroidal axis are shown on the sketch of the cross section. Consider the entire 4-m length of the beam and determine: (a) the maximum tension bending stress at any location along the beam, and (b) the maximum compression bending stress at any location along the beam.

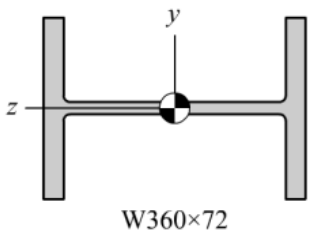




Ans: 133.9 MPa (T), 196.8 MPa (C)

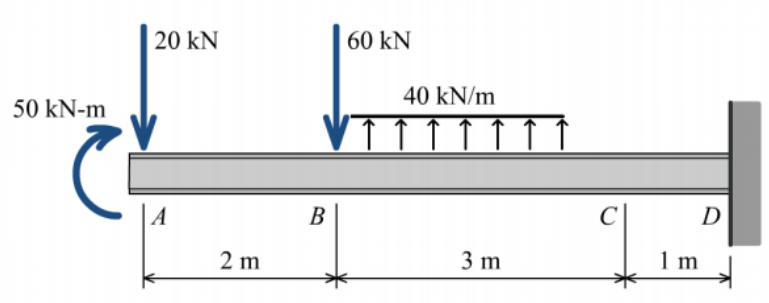
Q2. A W360 × 72 standard steel shape is used to support the loads shown on the beam in Fig. The shape is oriented so that bending occurs about the weak axis as shown in Fig. Consider the entire 6-m length of the beam and determine: (a) the maximum tension bending stress at any location along the beam, and (b) the maximum compression bending stress at any location along the beam.





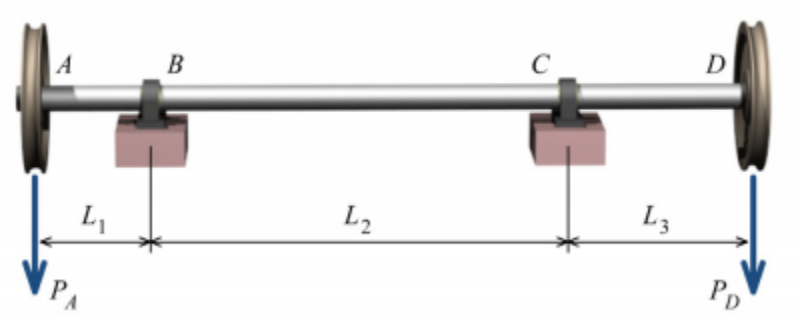
Ans: 91.1 MPa (T), 91.1 MPa (C)

Q3. A W410 × 60 standard steel shape is used to support the loads shown on the beam in Fig. The shape is oriented so that bending occurs about the strong axis. Determine the magnitude and location of the maximum bending stress in the beam.



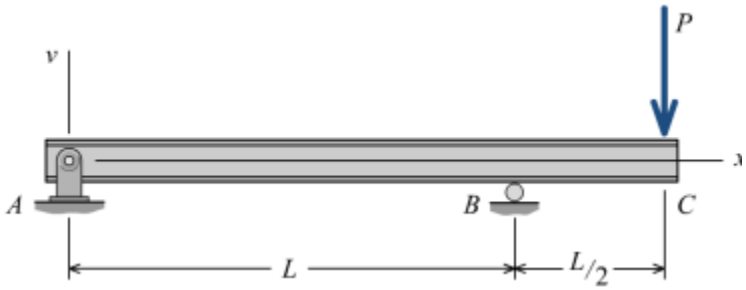
Ans: 65.8 MPa

Q4. A solid steel shaft supports loads P_A = 500 N and P_D = 400 N as shown in Fig. Assume L_1 = 200 mm, L_2 = 660 mm, and L_3 = 340 mm. The bearing at B can be idealized as a roller support and the bearing at C can be idealized as a pin support. If the allowable bending stress is 25 MPa, determine the minimum diameter that can be used for the shaft.

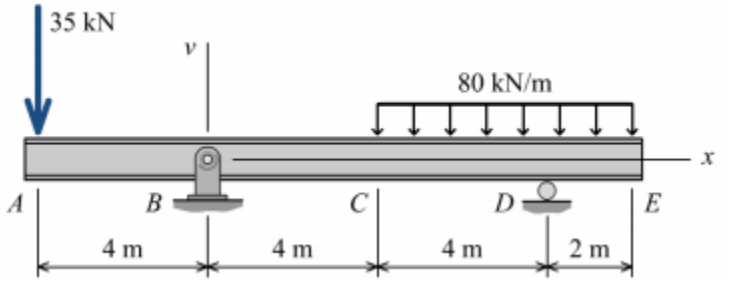


Ans: 38.1 mm

Q5. For the beam and loading shown in Fig., use the double-integration method to determine (a) the equation of the elastic curve for segment AB of the beam, (b) the deflection midway between the two supports, (c) the slope at A, and (d) the slope at B. Assume that EI is constant for the beam.

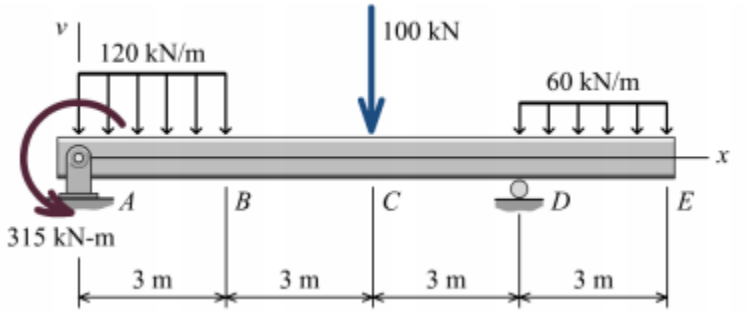


Q6. The simply supported beam shown in Fig. consists of a W530 × 66 structural steel wide-flange shape [E = 200 GPa; I = 351 × 10^6 mm^4]. For the loading shown, determine: (a) the beam deflection at point A. (b) the beam deflection at point C. (c) the beam deflection at point E.



Ans: (a) 1.520 mm (b) 13.30 mm (c) -7.60 mm

Q7. The simply supported beam shown in Fig. consists of a rectangular structural steel tube shape [E = 200 GPa; I = 350 × 10^6 mm^4]. For the loading shown, determine: (a) the beam deflection at point B. (b) the beam deflection at point C. (c) the beam deflection at point E.



Ans: (a) 11.79 mm (b) 8.79 mm (c) 9.43 mm

Q8. A block of m kg is moving with a velocity v hits squarely the prismatic beam AB at its mid point C. Ignoring the changes in the PE, determine the deflection of point C of the beam.