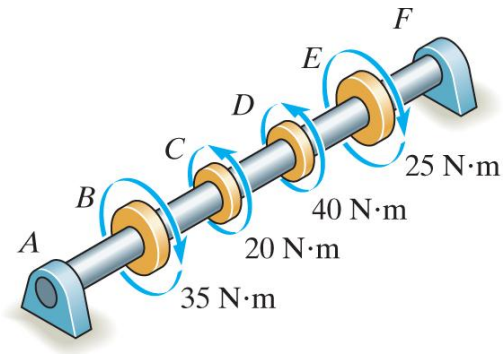
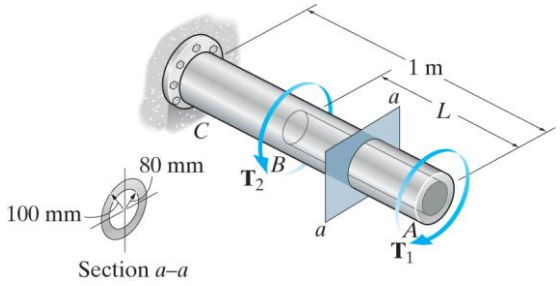
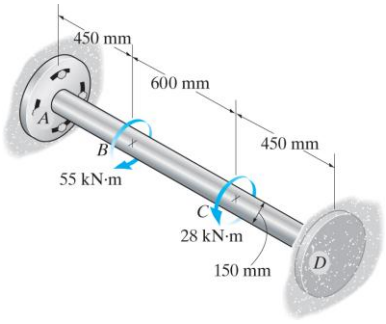
1. The solid shaft has a diameter of 16 mm. If it is subjected to the torques shown, determine the <u>maximum shear stress</u> developed in regions *BC*, *CD*, *DE*, and *EF* of the shaft. The bearings at A and F allow free rotation of the shaft. [15%] Ans: 43.5, 18.65, 31.1, 0 MPa



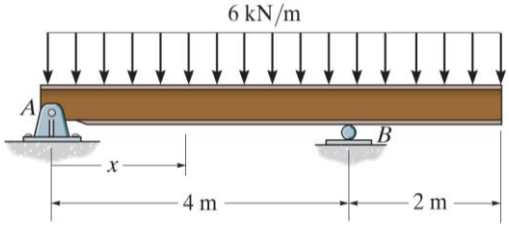
2. If the shaft is made of red brass C83400 copper and is subjected to torques T_1=20 kN•m and T_2=50 kN•m, determine the <u>distance *L*</u> so that the angle of twist at end *A* is zero. $G_{br} = 37\,\text{GPa}$. [15%] Ans: 470 mm



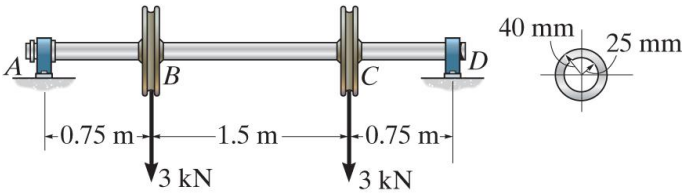
3. The shaft is made of A-36 steel and is fixed at end *D*, while end *A* is allowed to rotate 0.005 rad when the torque is applied. Determine the torsional reactions at these supports. Take $G_{st} = 77\,\text{GPa}$. [20%] Ans: 17.7, 9.4 kN•m



4. Draw the shear and moment diagrams for the beam. You must show the values of the shear force and moment at all the transition points.[15%] Ans: V:9,-15,12,0, M:0, 6.75, -12, 0



5. The shaft is supported by a smooth thrust bearing at *A* and smooth journal bearing at *D*. If the shaft has the cross section shown, determine the absolute maximum bending stress in the shaft. [15%] Ans: 52.8 MPa



6. If the concentrated force *P*=2 kN is applied at the free end of the overhanging beam, determine the absolute maximum tensile and compressive stress developed in the beam. [20%] Ans: 2.77, 3.84 MPa