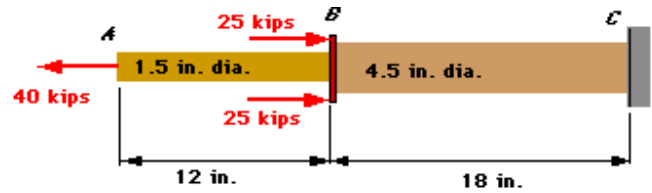1)

Two solid circular rods are welded
together at *B* as shown. Determine
the normal stress at the midpoint of
each rod.


25 kips
40 kips
1.5 in. dia.
25 kips
4.5 in. dia.
A   *B*   *C*
12 in.   18 in.

2)

For the loading condition shown, determine
the average shear stress in each pin and the
bearing stress in the support brackets at *C*
and *D*. The pins at *B* and *D* each has a
diameter of 7/16 (0.4375) in. The pin at *C* has
a diameter of 5/16 (0.3125) in. All stresses
are measured in ksi.

80 lb
8 ft
3 ft
4 ft
$\frac{7}{16}$ in.
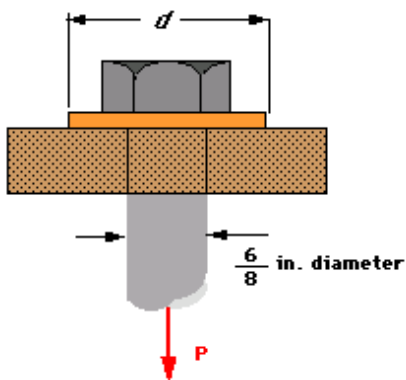$\frac{7}{16}$ in.

3)


26 kN
A
L
14 mm   100 mm
B
26 kN
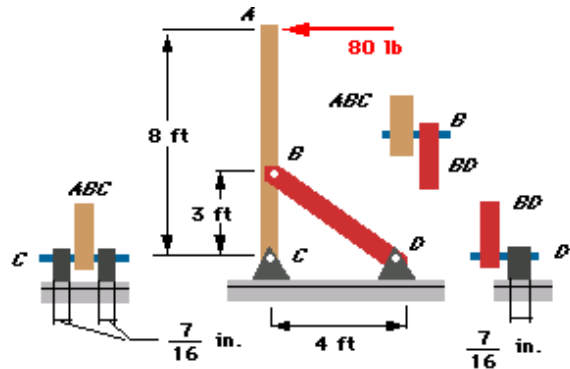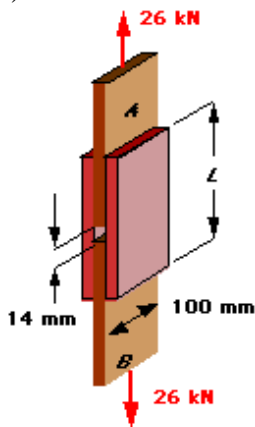
Two 100-mm-wide wooden members are joined by plywood splice
plates that are fully glued on the surfaces of contact. The two
members are separated by a 14-mm gap. Determine the length *L*
(in millimeters) for which the average shearing stress in the glue
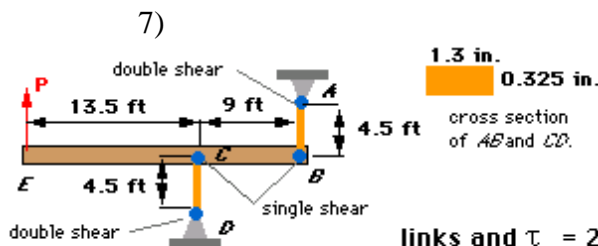is 750 MPa.

4)

d
$\frac{6}{8}$ in. diameter
P

The load **P** applied to a steel rod is distributed to a
timber support by an annular washer of inside diameter
0.85 in. and outside diameter *d*. The axial normal stress
in the steel rod is 5.5 ksi, and the average bearing
stress is 725 psi. Determine the required washer
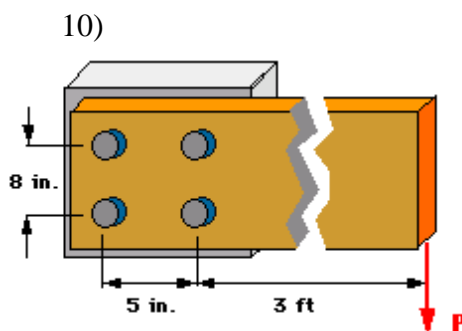diameter *d*.

6)

12 kN

30 mm
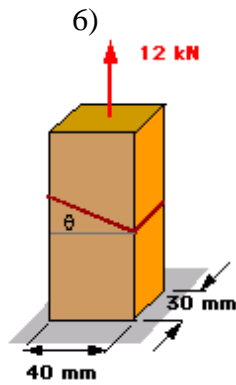
40 mm

Two members with a uniform cross section of 30 × 40 mm are joined by a glued scarf splice at an angle θ. The ultimate stresses for the glued joint are σ_U = 21 MPa and τ_U = 10.5 MPa. Determine the range of values of θ for which the factors of safety in shear and normal stresses are 2.12 and 2.8, respectively.

7)

double shear

P

13.5 ft   **9 ft**

4.5 ft

E   **4.5 ft**

double shear

single shear

1.3 in.

0.325 in.

cross section of AB and CD.

Links *AB* and *CD* are connected at a support and to beam *BCE* by 0.425-in.-diameter pins. The attachments at *A* and *D* are double shear, while those at *B* and *C* are single shear. It is known that σ_U = 65 ksi for the links and τ_U = 26 ksi for the pins. Determine the largest load P that can be applied if the factor of safety is 3.4.

8)

450 lb   **450 lb**

C

0.475 in. diameter

d

0.75 in.   3 in.

A

900 lb
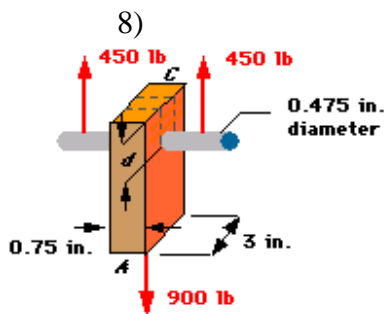
Wooden member *AC* is supported by a 0.475-in.-diameter pin fitted into a round hole near end *C*. For this member, determine (*a*) the maximum normal stress in the wood, (*b*) the average bearing stress in the wood, and (*c*) the distance *d* required for which the average shearing stress is 90 psi along the surfaces indicated by the dashed lines.

10)

8 in.

5 in.   3 ft

P

A component is attached to a wall with four 0.75-in.-diameter bolts (each acting in single shear). A load **P** is applied to the component as shown. The ultimate shearing stress for each bolt is 30 ksi. If the factor of safety is 2.5, determine the largest load **P** that can be applied to the component. *Hint*: Assume each bolt reacts the same shear force.