2025-2026 Spring
AE104 PH-1

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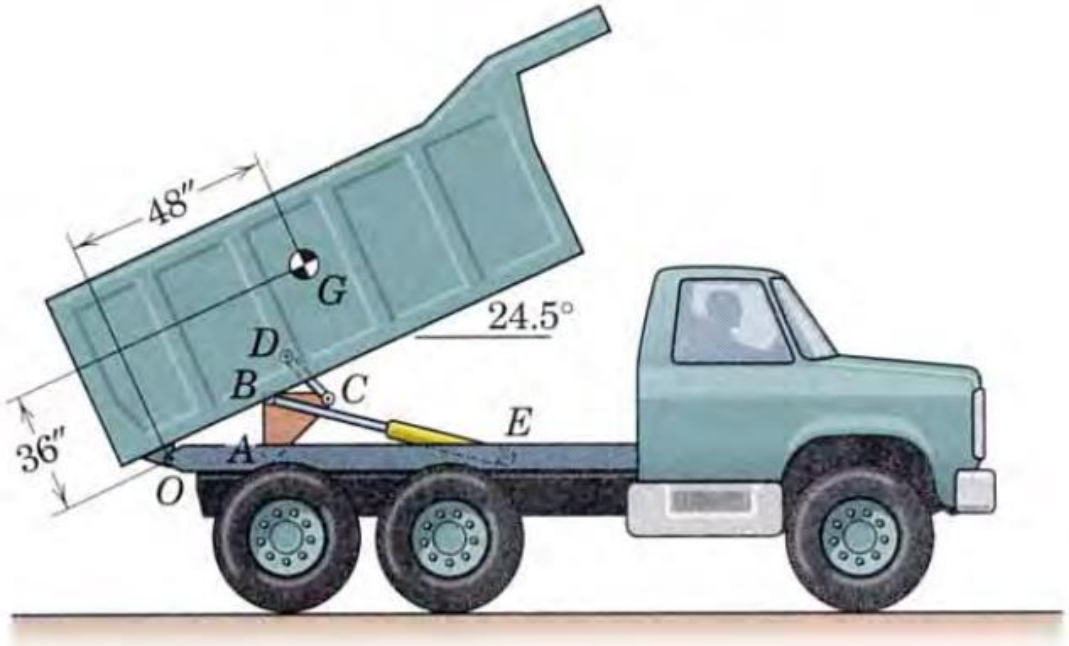
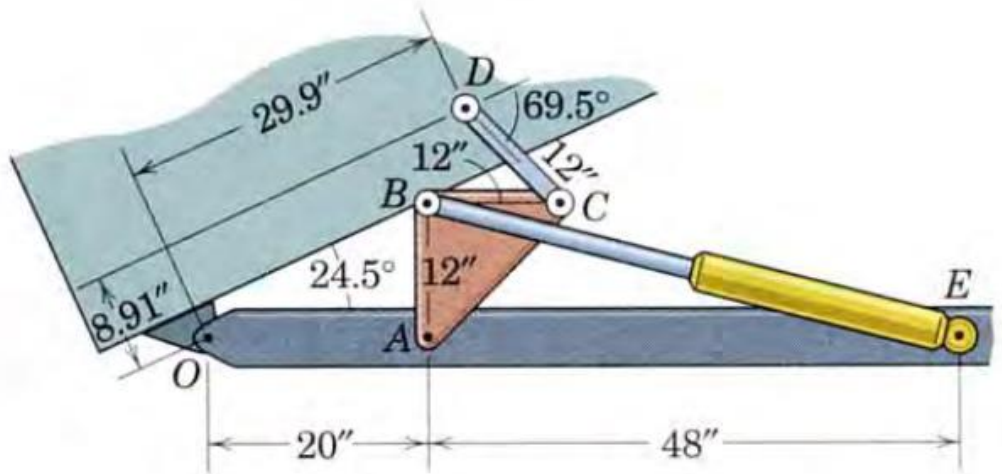
The design of a hoisting mechanism for the dump truck is shown in the enlarged view. Determine the compression P in the hydraulic cylinder BE and the magnitude of the force supported by the pin at A for the particular position shown, where BA is perpendicular to OAE and link DC is perpendicular to AC. The dump and its load together weigh 20,000 lb with center of mass at G. All dimensions for the indicated geometry are given on the figure.

Ans. $P = 26{,}900$ lb, $A = 14{,}600$ lb

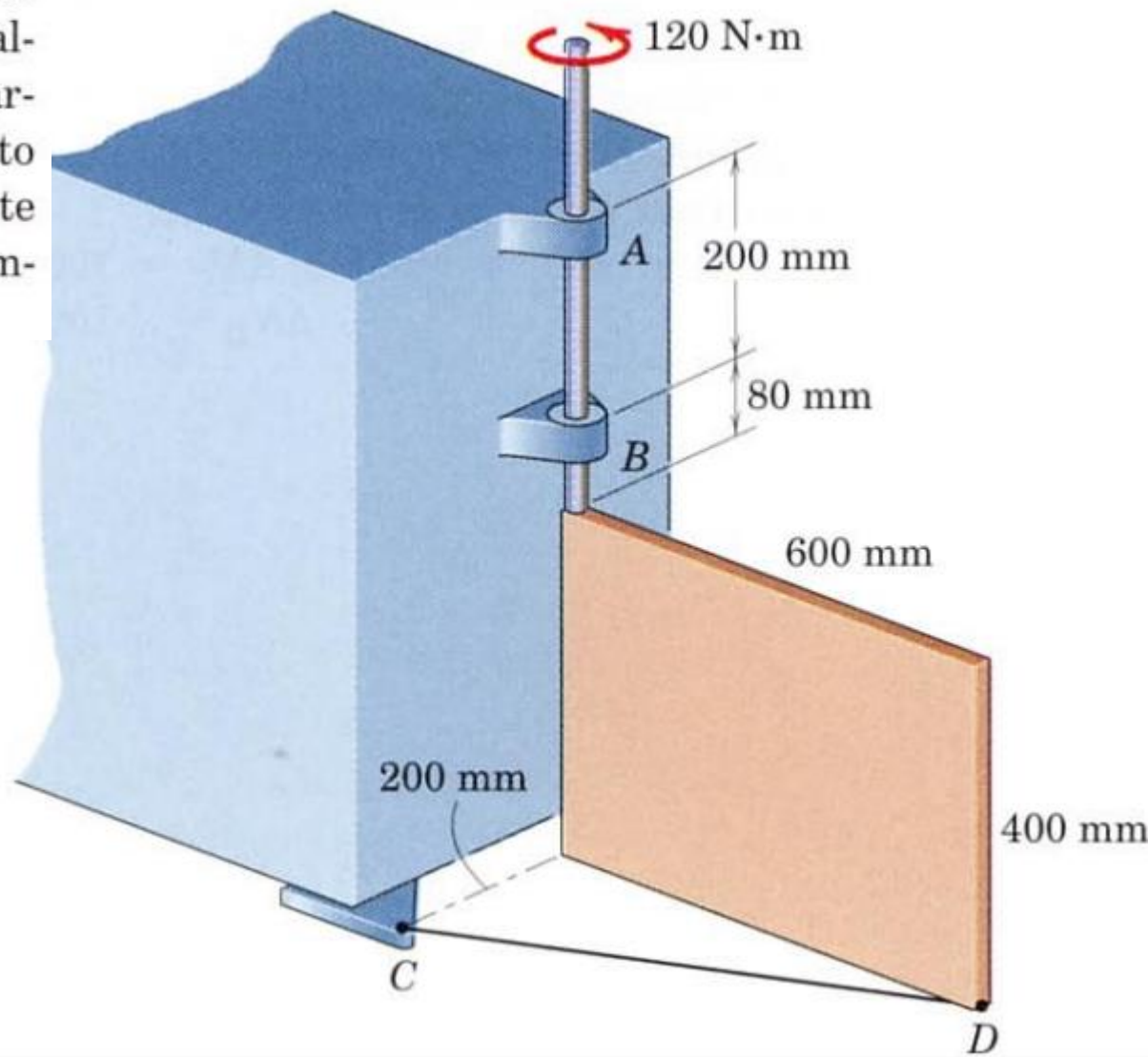




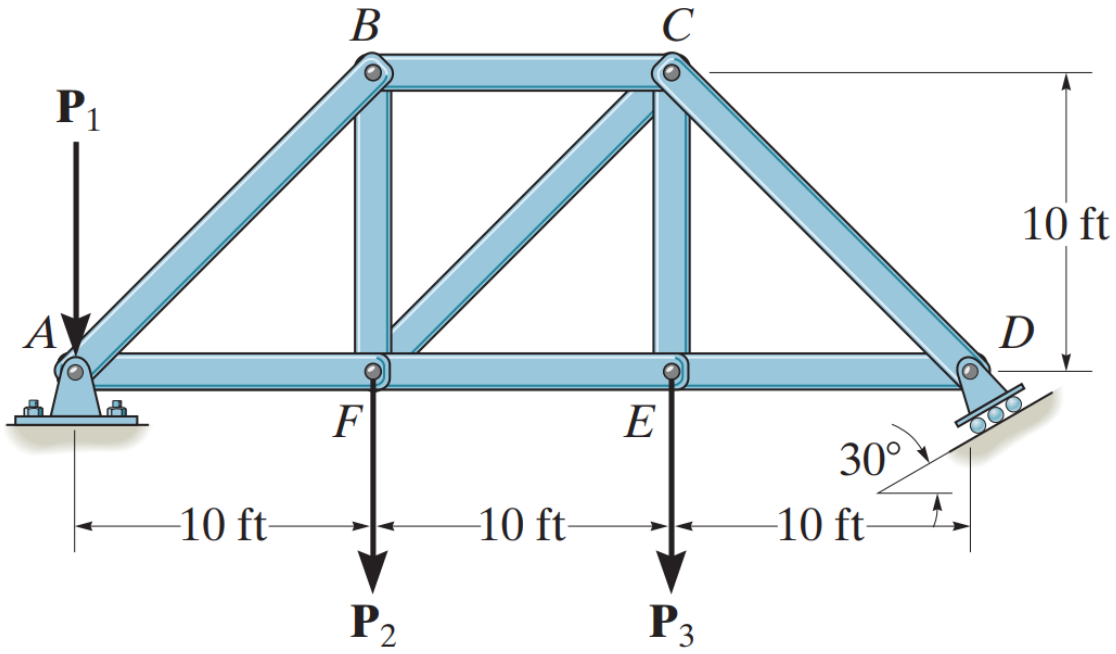
Detail of hoisting mechanism

The uniform 15-kg plate is welded to the vertical shaft, which is supported by bearings A and B. Calculate the magnitude of the force supported by bearing B during application of the 120-N·m couple to the shaft. The cable from C to D prevents the plate and shaft from turning, and the weight of the assembly is carried entirely by bearing A.

Ans. $|\mathbf{B}| = 2360.7$ N



Determine the force in each member of the truss and state if the members are in tension or compression. Set P_1 = 100 lb, P_2 = 200 lb, P_3 = 300 lb.

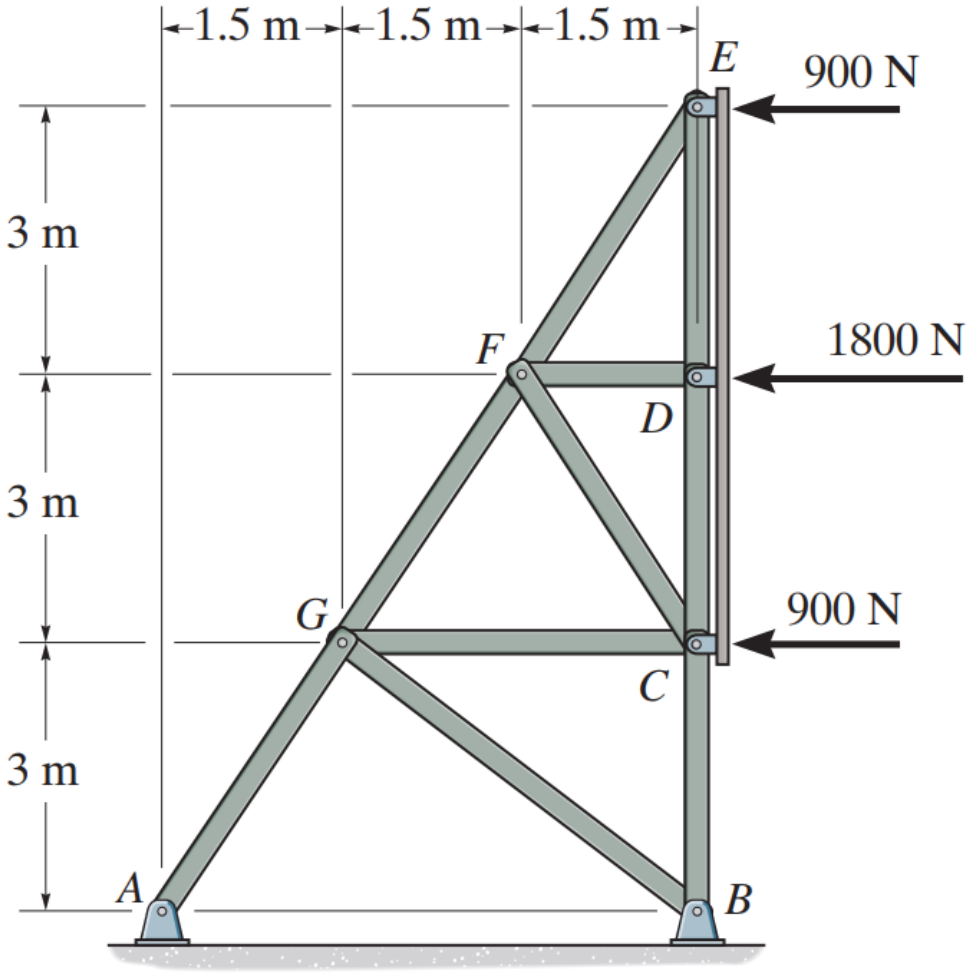


Ans.

Member	Force (lb)	T/C
AB	330	C
AF	79.4	T
BC	233.3	C
BF	233.3	T
CF	47.1	C
EF	112.7	T
DE	112.7	T
CE	300	T
CD	377.2	C

Determine the force in members *FG*, *GC* and *CB* of the truss used to support the sign, and state if the members are in tension or compression.

Ans. CB = 3600 N (T), FG = 4024.92 N (C), GC = 1800 N (C)



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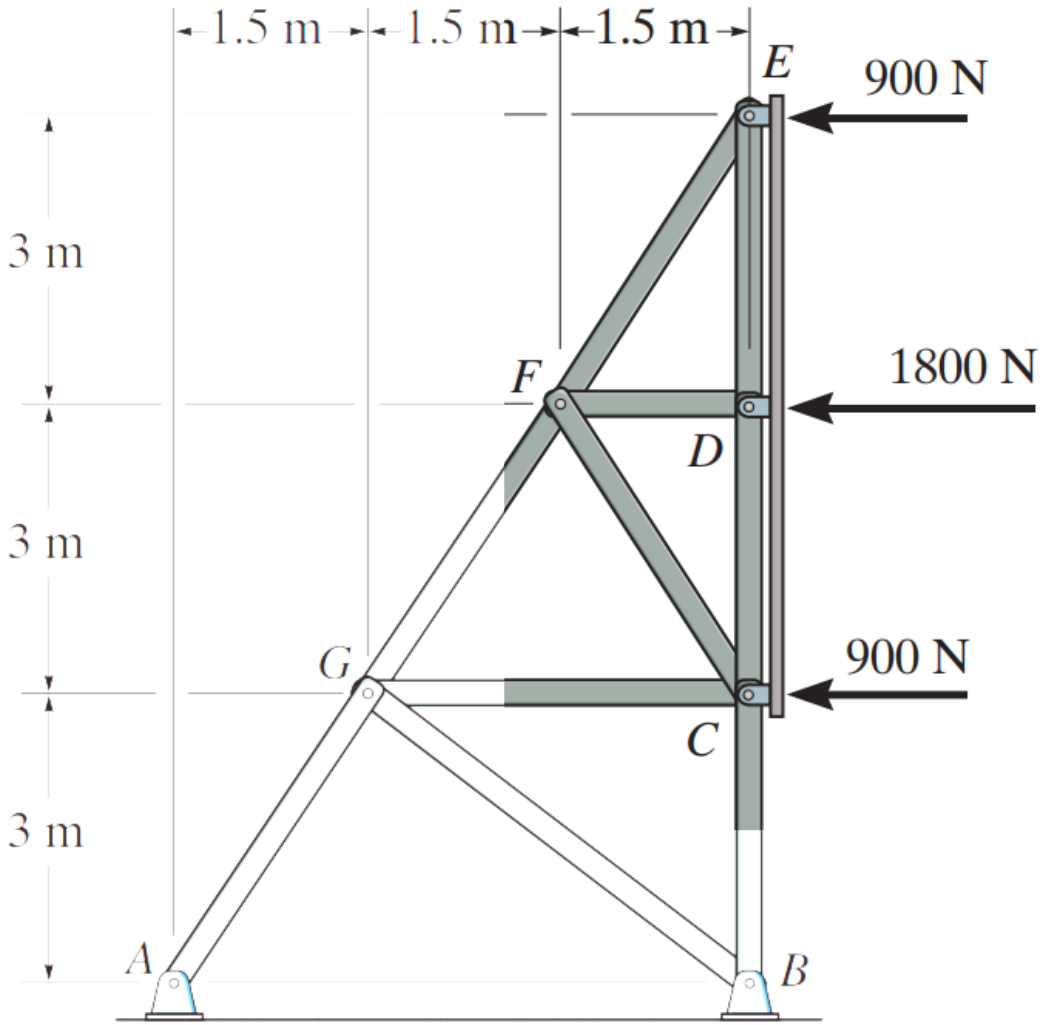
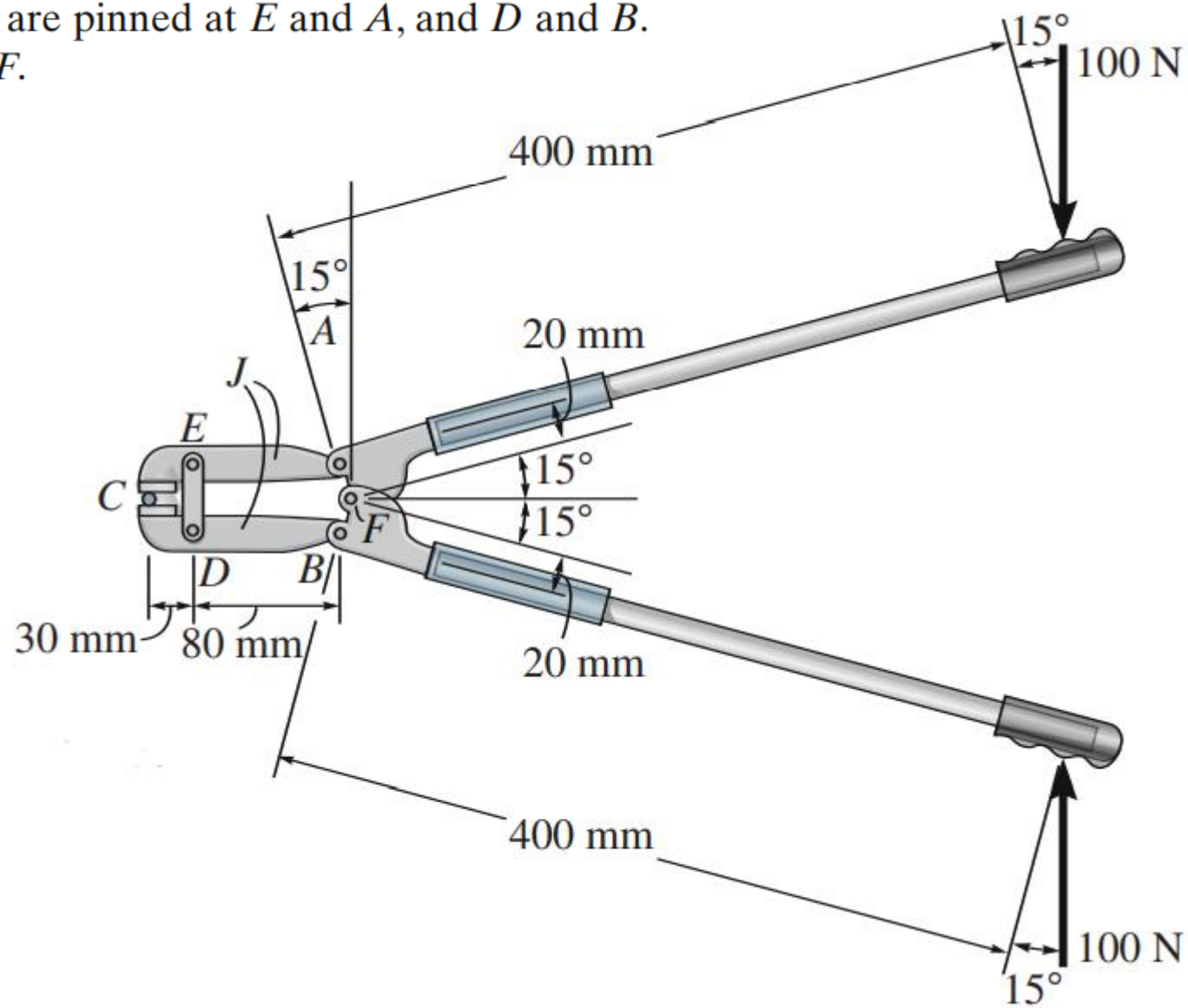
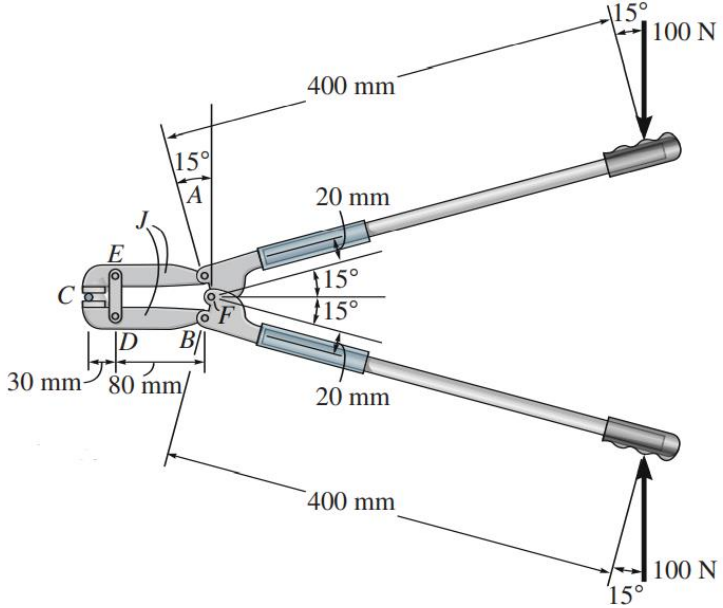
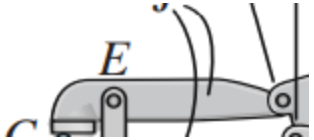


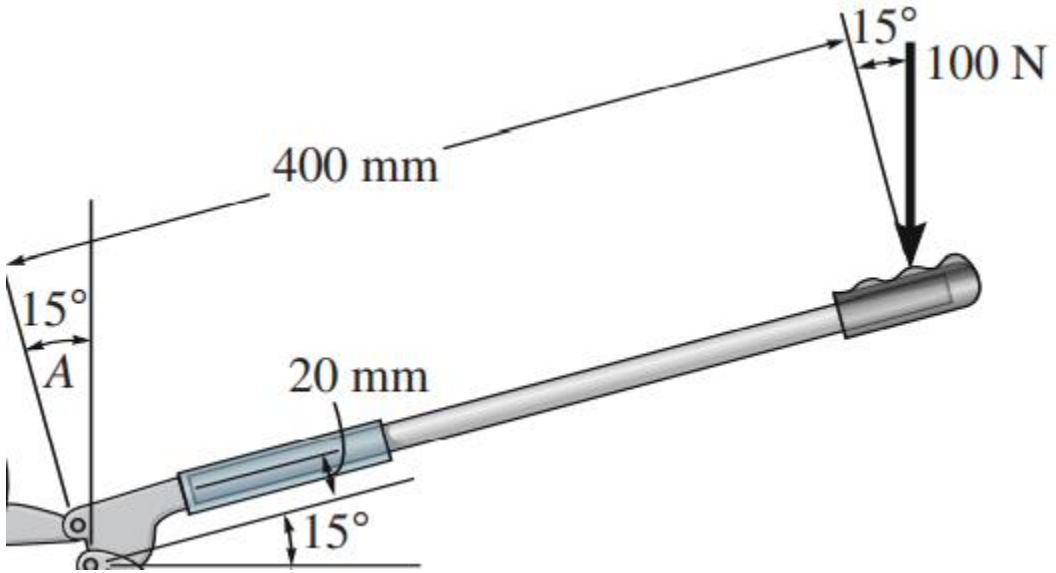
Determine the force that the jaws J of the metal cutters exert on the smooth cable C if 100-N forces are applied to the handles. The jaws are pinned at E and A, and D and B. There is also a pin at F.

Ans. $N_C = 19637.6$ N



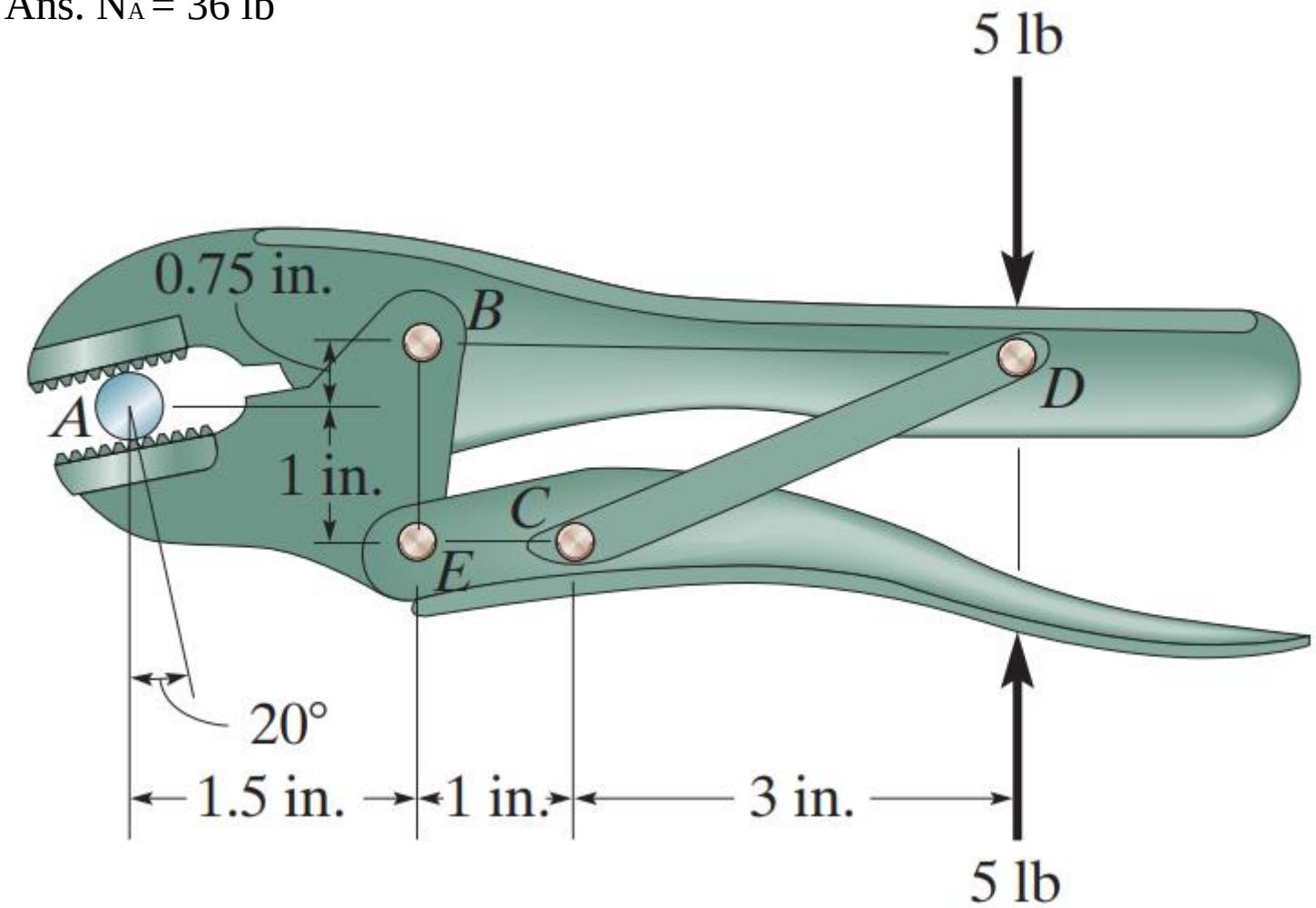

15°
100 N
400 mm
15°
A
20 mm
J
E
C
15°
15°
F
D
B
30 mm
80 mm
20 mm
400 mm
100 N
15°

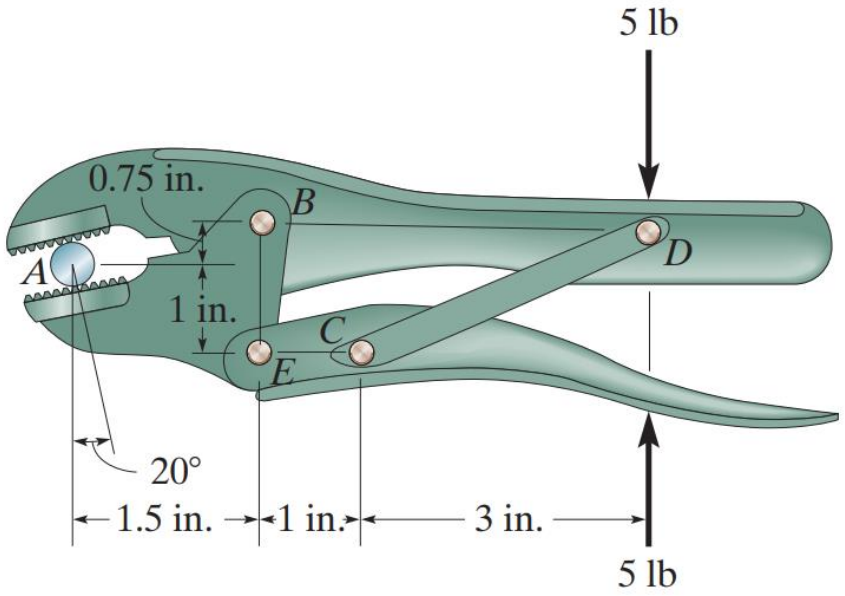

E

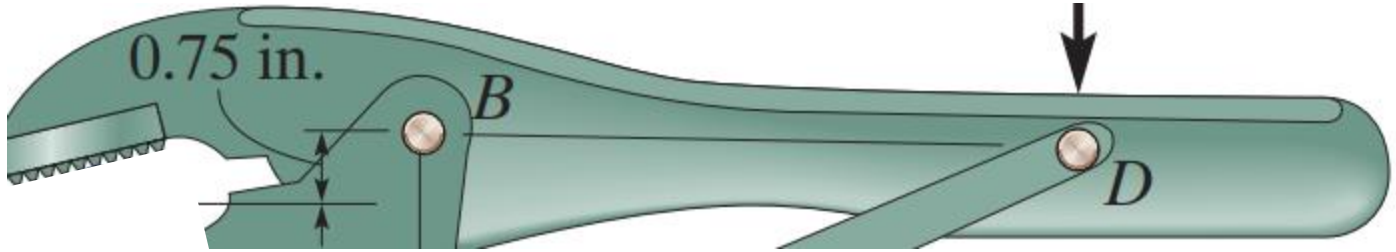

15°
100 N
400 mm
15°
A
20 mm
15°

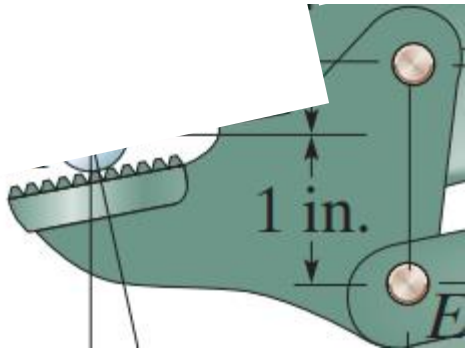
A 5-lb force is applied to the handles of the vise grip. Determine the compressive force developed on the smooth bolt shank A at the jaws.

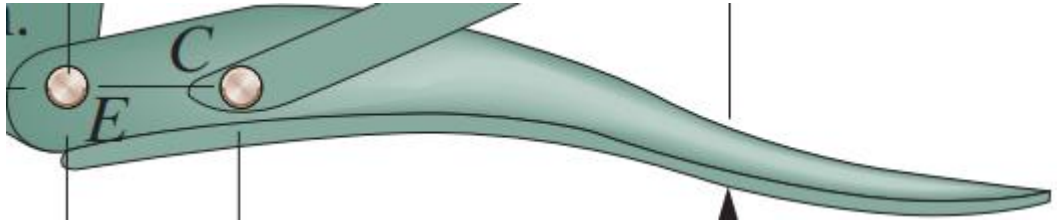
Ans. $N_A = 36$ lb




5 lb
0.75 in.
B
D
A
1 in.
C
E
20°
1.5 in.
1 in.
3 in.
5 lb


0.75 in.
B
D


1 in.
E


C
E