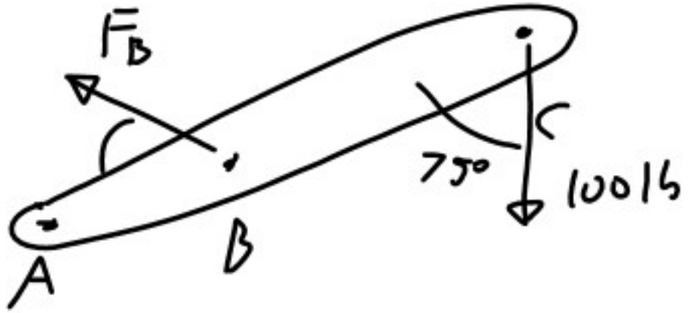
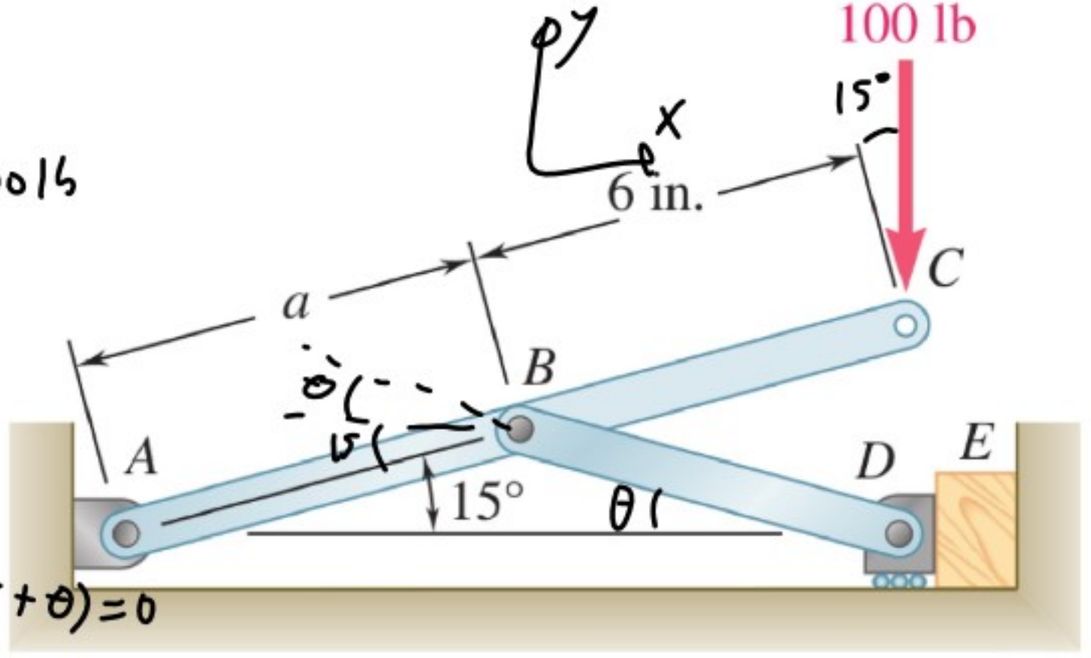
6.123 A 100-lb force directed vertically downward is applied to the toggle vise at C. Knowing that link BD is 6 in. long and that $a = 4$ in., determine the horizontal force exerted on block E.





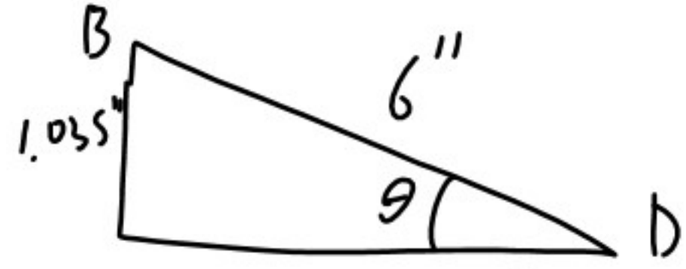
$$\Sigma M_A = 0$$

$$-16 \cdot 100 \sin(75) + 4 F_B \sin(15+\theta) = 0$$

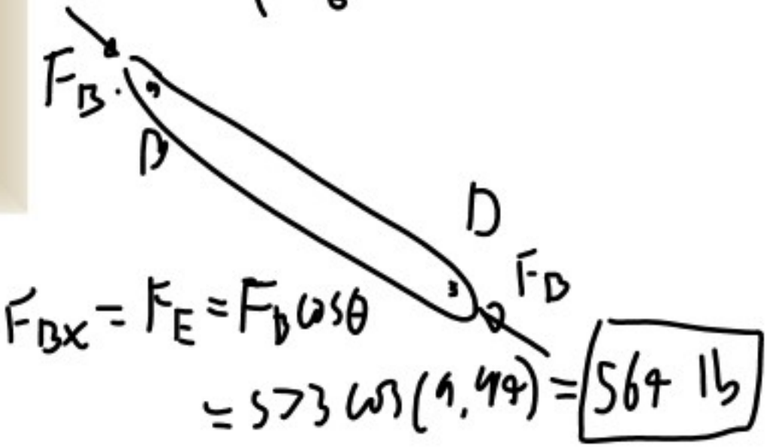
$$1000 \cdot 0.966 = 4 F_B \, 0.422$$

$$F_B = \frac{1000 \cdot 0.966}{4 \cdot 0.422} = 573 \text{ lb}$$

$$AB_y = 4 \sin(15) = 1.035''$$

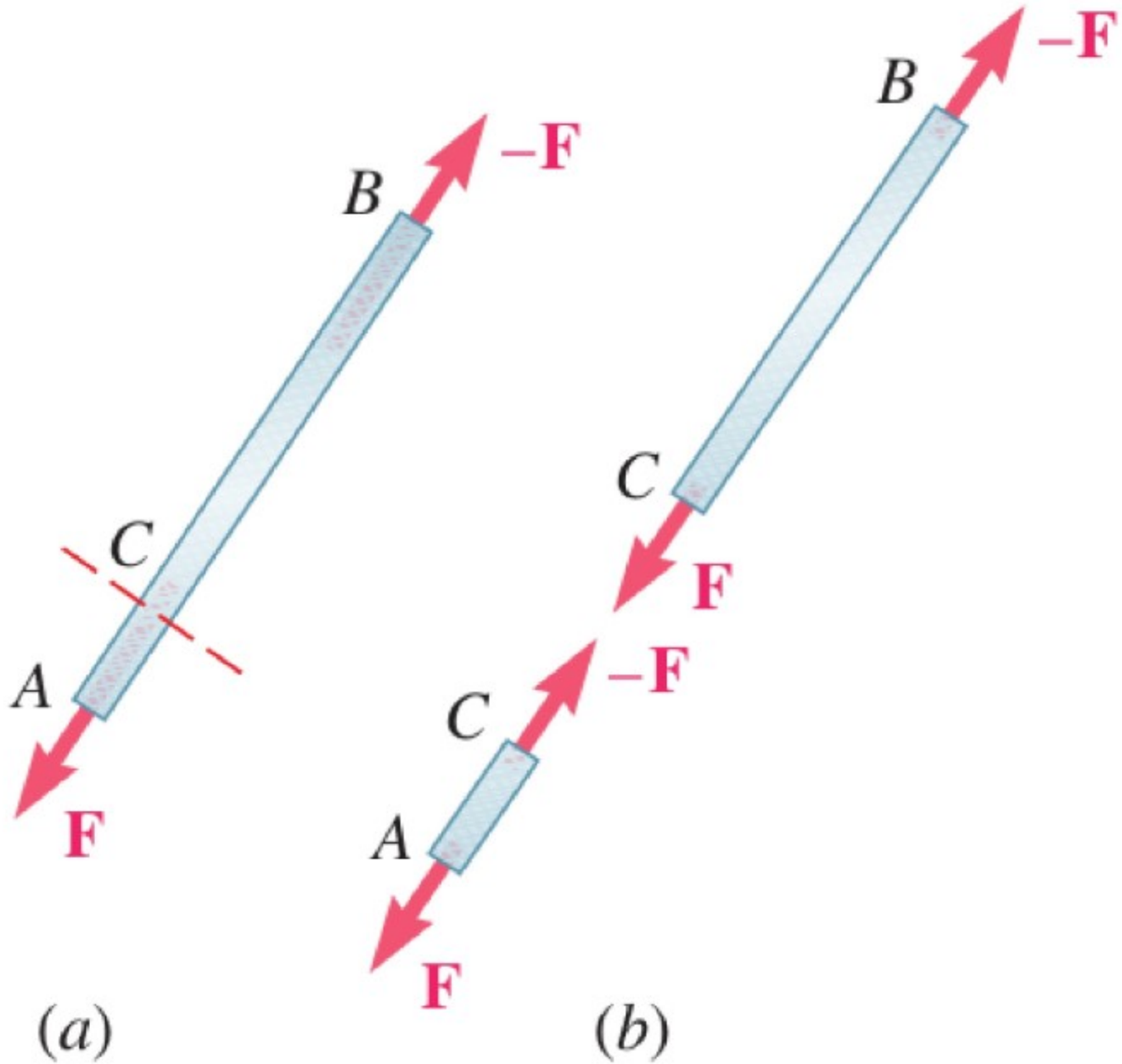


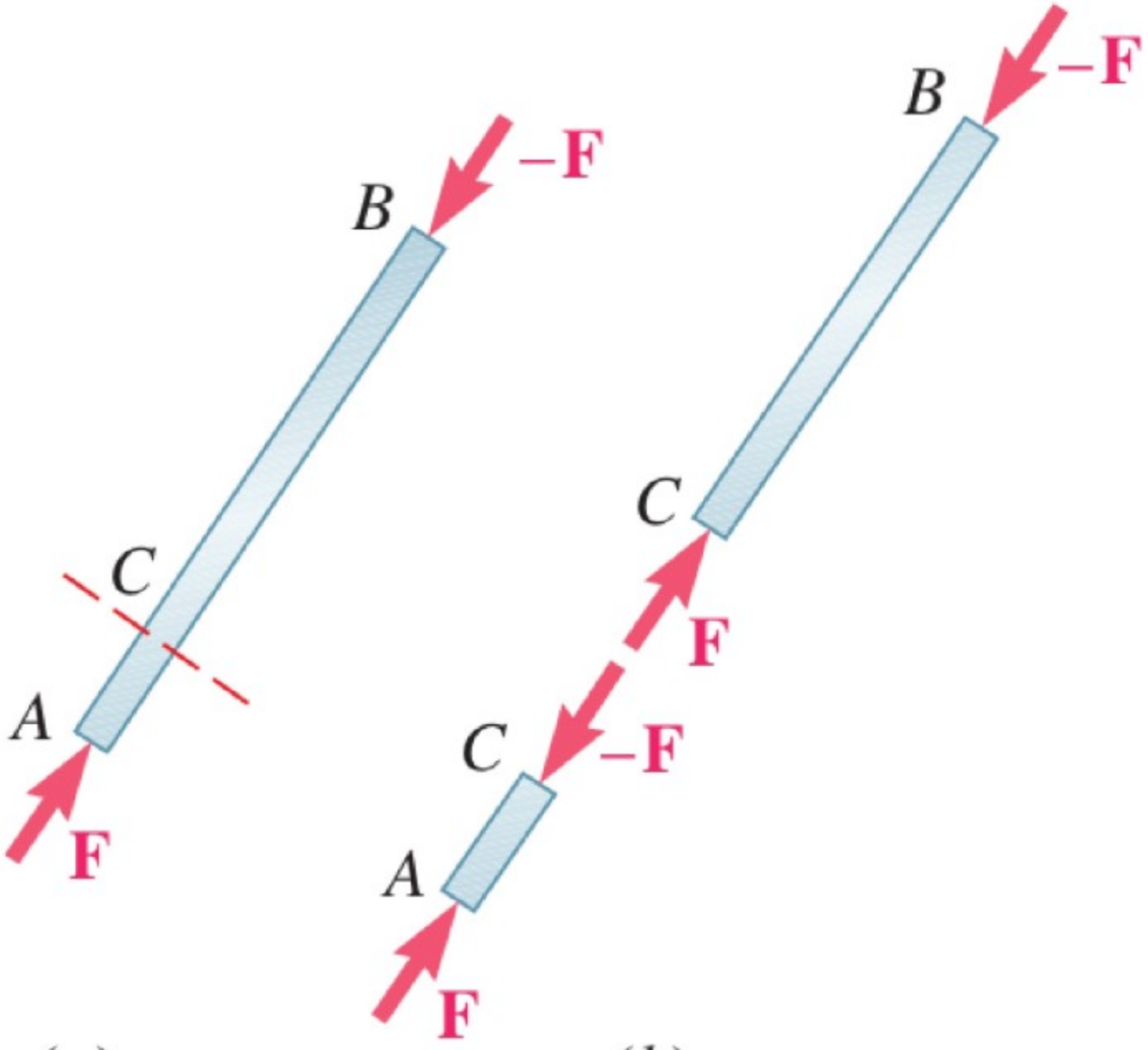
$$\theta = \sin^{-1}\left(\frac{1.035}{6}\right) = 9.94^\circ$$

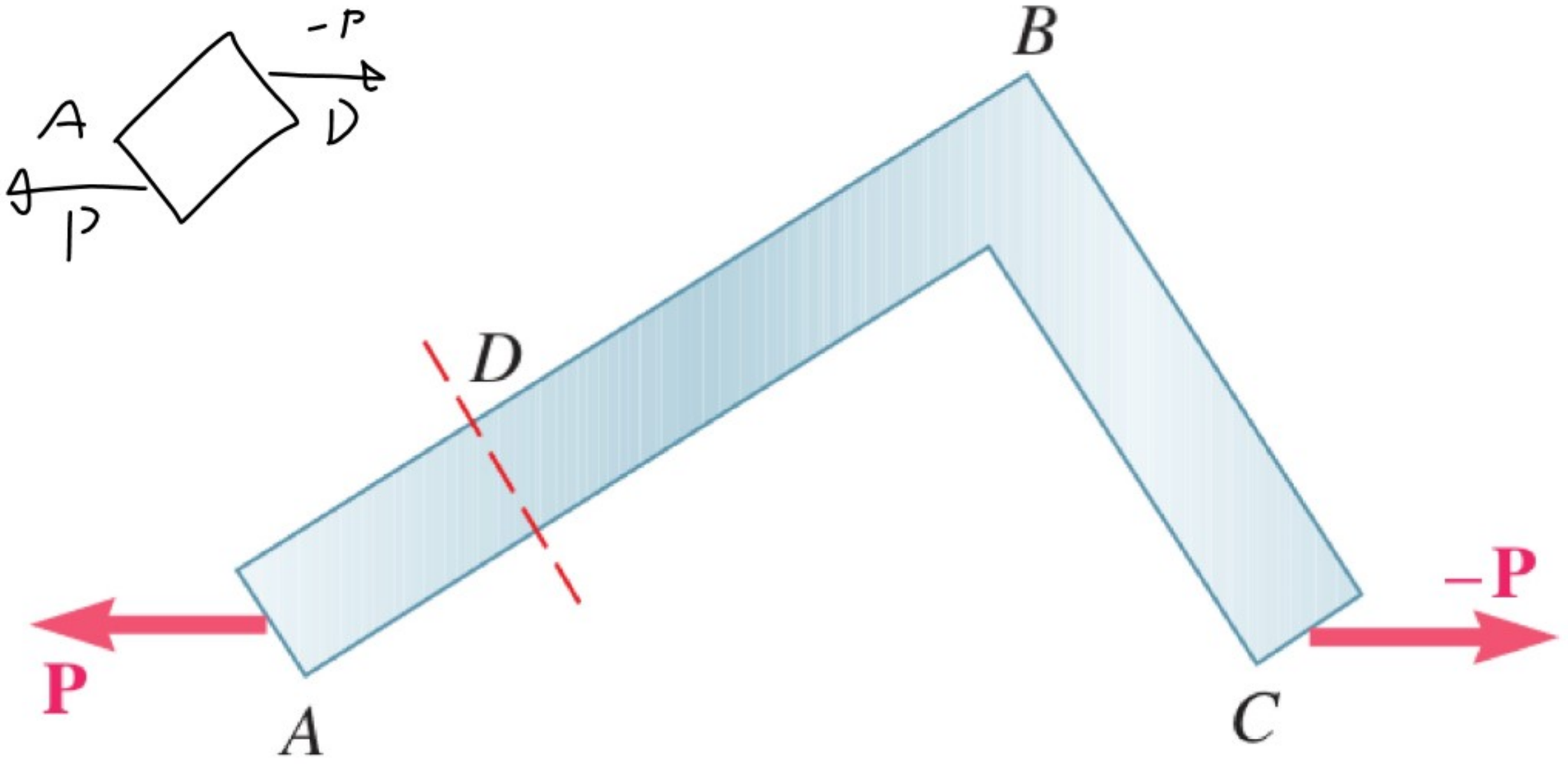


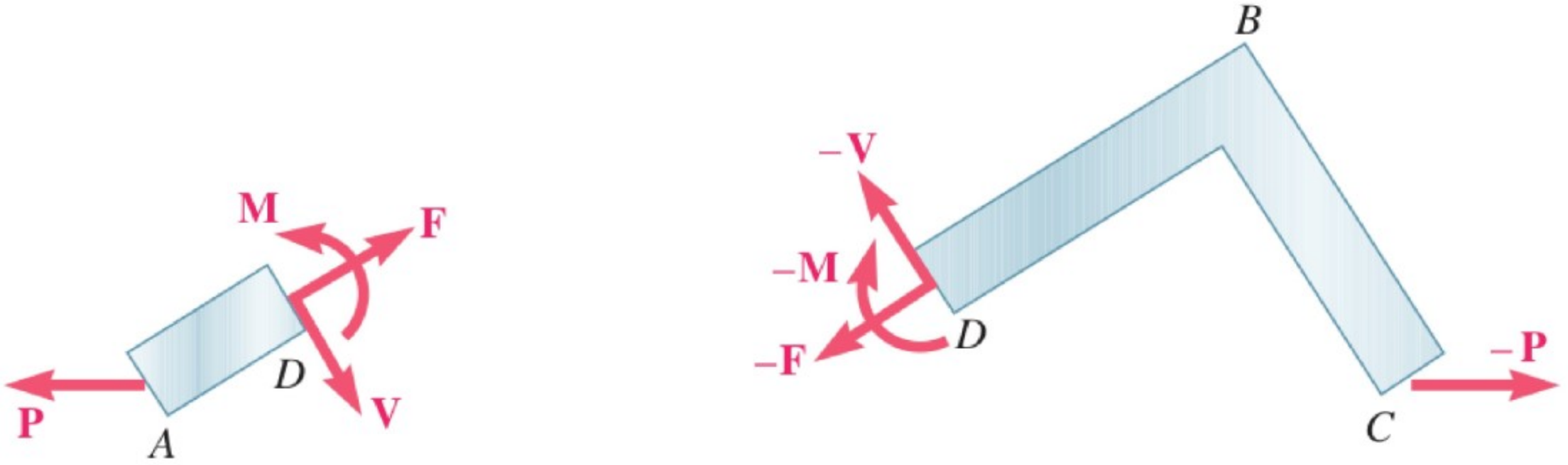
$$F_{BX} = F_E = F_B \cos\theta$$

$$= 573 \cos(9.94) = \boxed{564 \text{ lb}}$$

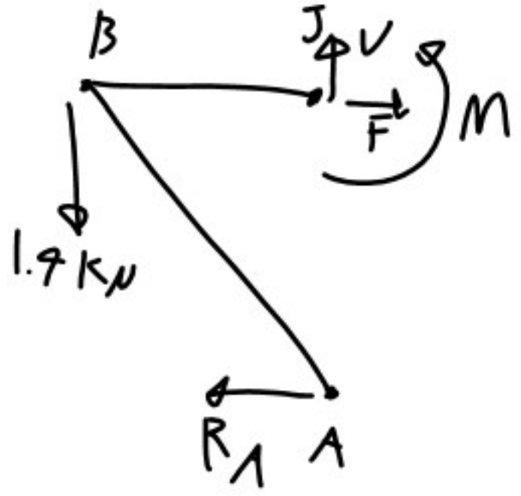

B
−F
C
A
F
(a)
B
−F
C
F
C
−F
A
F
(b)

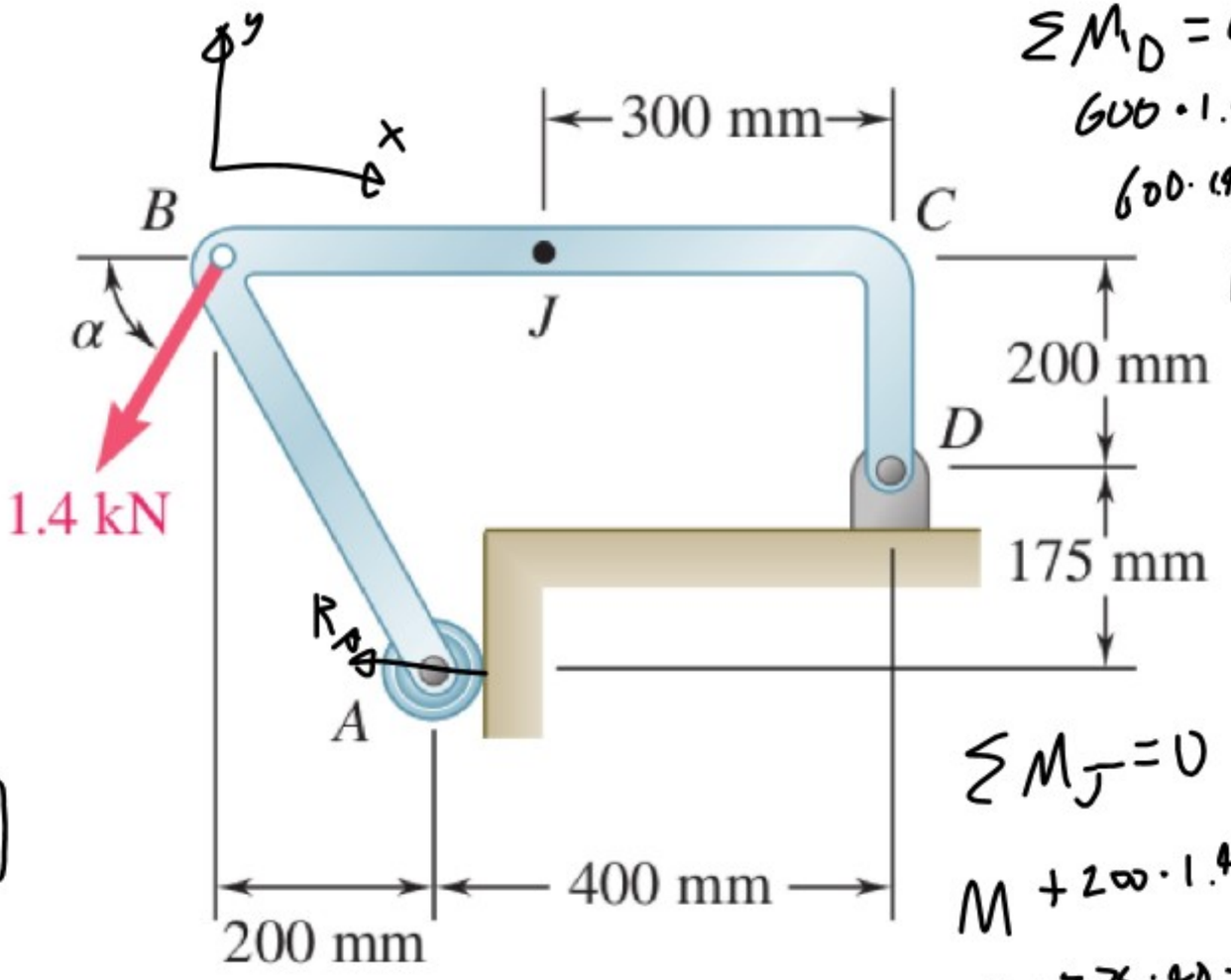

B
−F
C
A
F
(a)
B
−F
C
F
C
−F
A
F
(b)


-P
A
D
P
B
D
P
A
C
–P


M
F
D
V
P
A
B
–V
–M
–F
D
–P
C

7.3 Determine the internal forces at point J when $\alpha = 90°$.





$\Sigma F_x = 0$

$-9.8 + F = 0$

$F = 9.8$ kN

$\Sigma F_y = 0$

$-1.4 + V = 0$

$V = 1.4$ kN

$\Sigma M_D = 0$

$600 \cdot 1.4 - 175 R_A = 0$

$600 \cdot 1.4 = 175 R_A$

$R_A = \frac{600 \cdot 1.4}{175} = 4.8$ kN

$\Sigma M_J = 0$

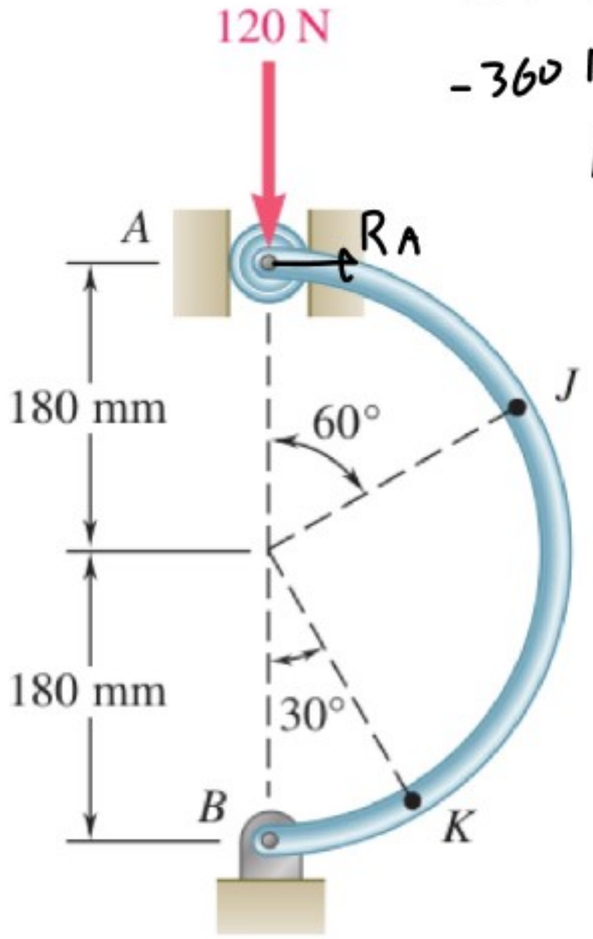
$M + 200 \cdot 1.4 - 375 \cdot 4.8 = 0$

$M = 375 \cdot 4.8 - 200 \cdot 1.4 = 1520$ kN-mm

$M = 1520$ kN-mm $\left(\frac{1000 \text{ N}}{1 \text{ kN}}\right)\left(\frac{1 \text{ m}}{1000 \text{ mm}}\right)$

$M = 1520$ N-m

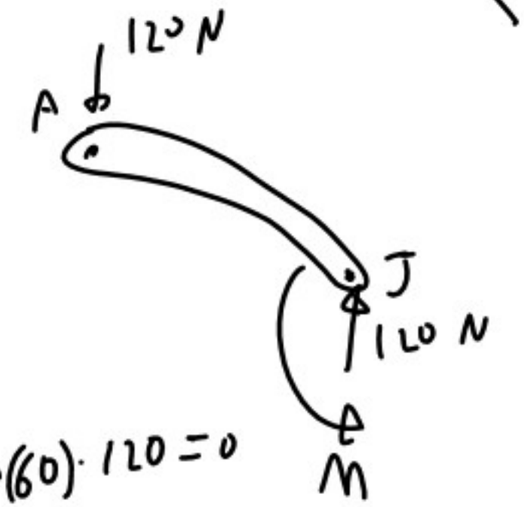
7.9 A semicircular rod is loaded as shown. Determine the internal forces at point *J*.



$\Sigma M_B = 0$

$-360\, R_A = 0$

$R_A = 0$



$\Sigma M_J = 0$

$M + 180 \sin(60) \cdot 120 = 0$

$M = -180 \cdot 120 \cdot \sin(60)$

$= 18706\ \text{N-mm} \left(\frac{1\text{ m}}{1000\text{ mm}}\right)$

$M = 18.7\ \text{N-m}$