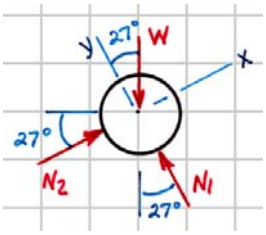
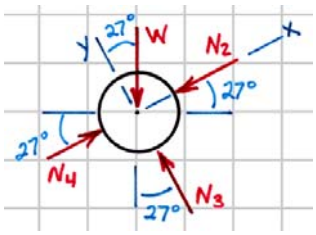
1-60*

The weights of the two cylinders are the same

$$W = 50(9.81) = 490.5 \text{ N}$$



First draw a free-body diagram of the upper cylinder, and write the equations of equilibrium



$$Z \quad \Sigma F_x = 0: \qquad N_2 - W\sin 27° = 0$$

$$\wedge \quad \Sigma F_y = 0: \qquad N_1 - W\cos 27° = 0$$

$$N_1 = 437.0387 \text{ N}$$

$$N_2 = 222.6823 \text{ N}$$

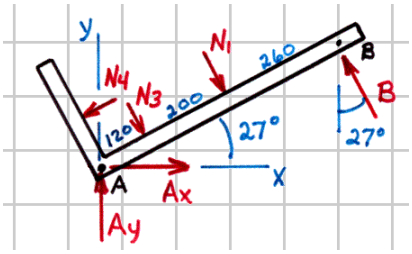
Next, from a free-body diagram of the lower cylinder, the equations of equilibrium give

$$Z \quad \Sigma F_x = 0: \qquad N_4 - N_2 - W\sin 27° = 0$$

$$\wedge \quad \Sigma F_y = 0: \qquad N_3 - W\cos 27° = 0$$

$$N_3 = 437.0387 \text{ N} \qquad N_4 = 445.3647 \text{ N}$$

Next, from a free-body diagram of the rack, the equations of equilibrium give



$$\rightarrow \Sigma F_x = 0: \quad A_x - N_4\cos 27° + (N_1 + N_3)\sin 27° - B\sin 27° = 0$$

$$\uparrow \Sigma F_y = 0: \quad A_y - N_4\sin 27° - (N_1 + N_3)\cos 27° + B\cos 27° = 0$$

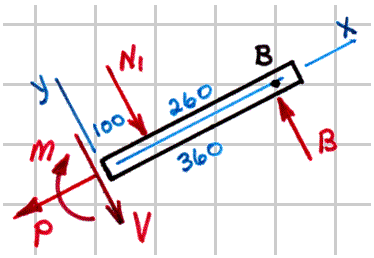
$$\circlearrowleft \Sigma M_A = 0: \quad 120(445.3647) - 320(437.0387)$$

$$-120(437.0387) + 580B = 0$$

$$B = 239.4022 \text{ N}$$

$$A_x = 902.3320 \text{ N} \qquad A_y = 767.6911 \text{ N}$$

Finally, from a free-body diagram of the upper portion of the rack (between section *a* and the roller support *B*), the equations of equilibrium give



$$Z \quad \Sigma F_x = 0: \qquad -P = 0$$

$$\wedge \quad \Sigma F_y = 0: \qquad B - V - N_1 = 0$$

$$\circlearrowleft \Sigma M_{cut} = 0: \qquad 0.360B - M - 0.100N_1 = 0$$

$P = 0$ N ..... **Ans.**

$V = -197.6$ N ..... **Ans.**

$M = 42.5$ N·m ..... **Ans.**