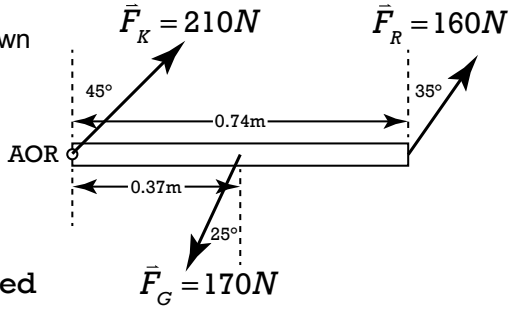
Flipping Physics Lecture Notes:

Net Torque on a Door

Example: Kate, Geneve, and Ryan all push on a door as shown in the figure. Assuming the hinge is the axis of rotation of the door, determine the net torque caused by these three forces.



$\vec{\tau}_{net} = ?; \vec{F}_K = 210N; \vec{F}_G = 170N; \vec{F}_R = 160N;$

$\vec{\tau} = \vec{r}\vec{F}\sin\theta; \vec{r}_R = 0.74m; \vec{r}_G = 0.37m; \vec{r}_K = 0;$

$\theta_R = 90 - 35 = 55°; \theta_G = 90 + 25 = 115°; \theta_K = \text{undefined}$

$\vec{\tau}_K = \vec{r}_K\vec{F}_K\sin\theta_K = (0)(210)\sin\theta_K = 0$

$\vec{\tau}_G = \vec{r}_G\vec{F}_G\sin\theta_G = (0.37)(170)\sin(115) = 57.0068N \cdot m$

$\vec{\tau}_R = \vec{r}_R\vec{F}_R\sin\theta_R = (0.74)(160)\sin(55) = 96.9876N \cdot m$

$\vec{\tau}_{net} = ? = \vec{\tau}_K - \vec{\tau}_G + \vec{\tau}_R = 0 - 57.0068 + 96.9876 = 39.9808 \approx \boxed{4.0 \times 10^1 N \cdot m}$

According to the Right Hand Rule, Geneve's torque is negative and Ryan's torque is positive.