## Moment couple



O is an arbitrary point in space
$\overrightarrow{\mathrm{F}} \quad$ The two $\vec{F}$ forces are located in the same plane and are of equal magnitude.
$\overrightarrow{M o}=\overrightarrow{r_{A}} \times(-\vec{F})+\overrightarrow{r_{B}} \times \vec{F}$ (summation of cross products)
$\overrightarrow{M O}=\left(\overrightarrow{r_{B}}-\overrightarrow{r_{A}}\right) \times \vec{F}$
Since $\left(\overrightarrow{r_{B}}-\overrightarrow{r_{A}}\right)=\vec{r}$,
$\overrightarrow{M O}=\vec{r} \times \vec{F}$ where $\vec{F}$ is one of the forces and $\vec{r}$ is the distance between the couple.

For most problems, $\vec{r}$ can be expressed simply as d, the perpendicular distance between the couple.

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\mathrm{M}_{\mathrm{o}}=\mathrm{Fd}
$$



The shaft pictured below could be anywhere on the wheel and would have the same moment about its axis (as long as it is perpendicular to the wheel). The moment would be less than Fd for an axis not perpendicular to the wheel.

