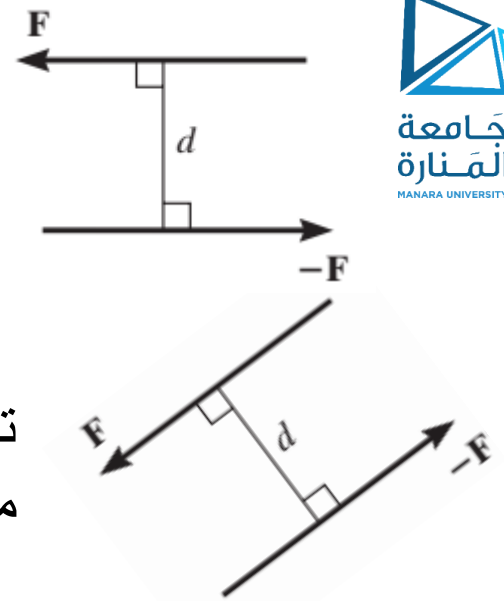
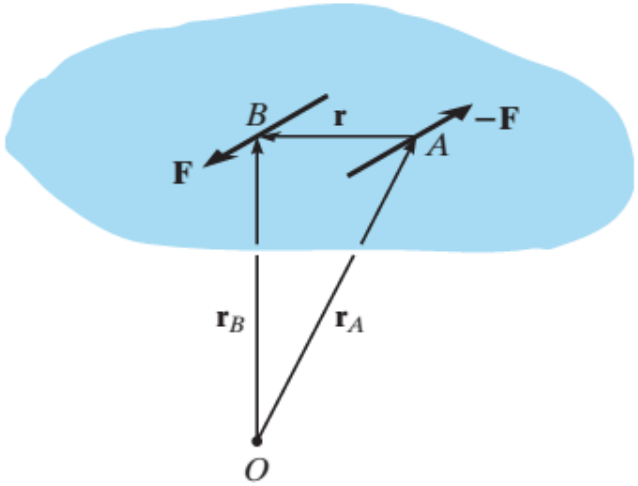
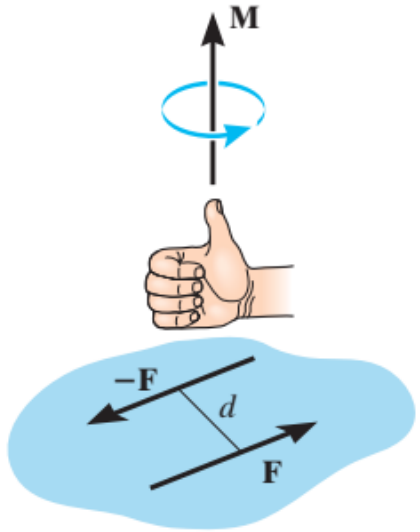
Moment of a Couple عزم المزدوجة

A *couple* is defined as two parallel forces that have the same magnitude, but opposite directions, and are separated by a perpendicular distance *d*, arm of the couple.



تعرف المزدوجة كقوتين متوازيتين لهما الشدة نفسها، لكن اتجاهيهما متعكسان وتفصل بينهما مسافة عمودية قدرها *d* ندعوها ذراع المزدوجة.



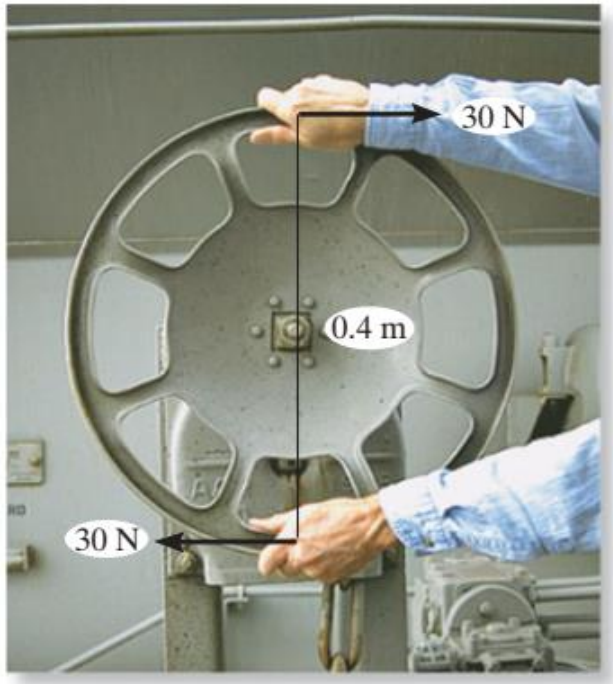


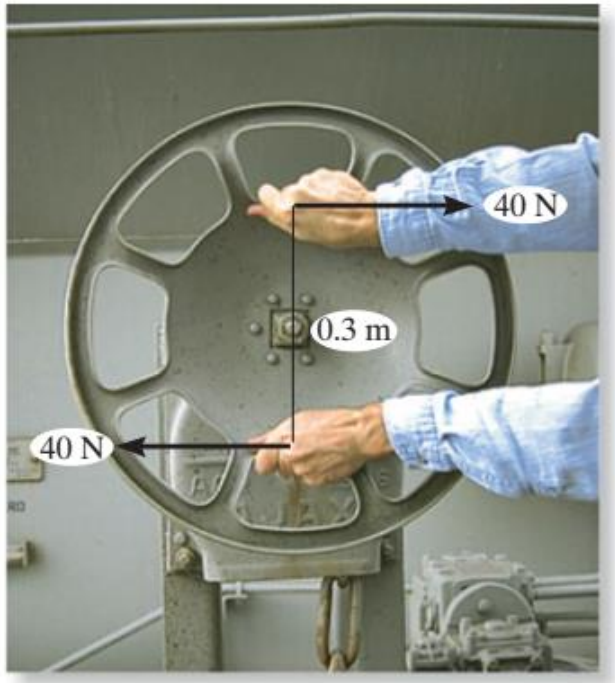
$$\vec{M} = \vec{r}_B \times \vec{F} + \vec{r}_A \times (-\vec{F}) = (\vec{r}_B - \vec{r}_A) \times \vec{F} = \vec{r} \times \vec{F}$$

$$M = Fd$$

Equivalent Couples

Two couples are equivalent if they produce the same moment. Their forces lie on the same plane or planes parallel to one another.





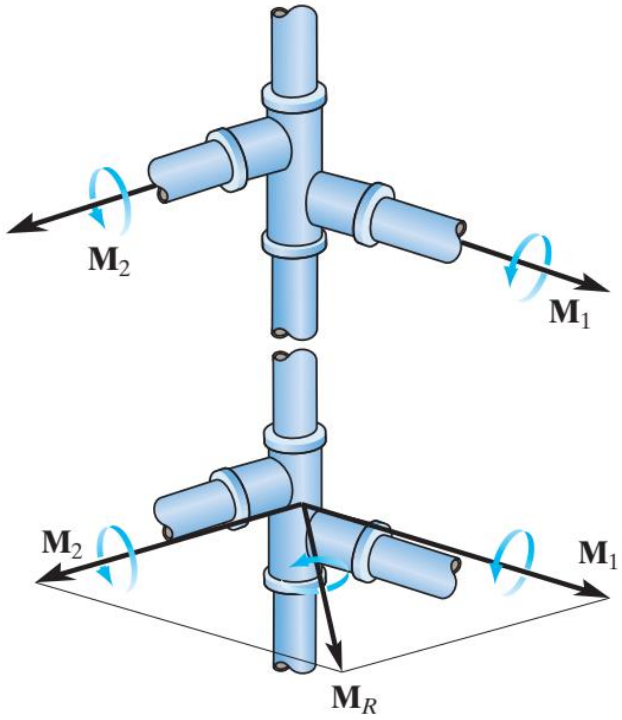
$$M = -30\ \text{N}(0.4\ \text{m}) = -40\ \text{N}(0.3\ \text{m}) = -12\ \text{N.m}$$

تجمع عزوم المزدوجات الواقعة في مستوي واحد أو في مستويات متوازية جبرياً. لكن..

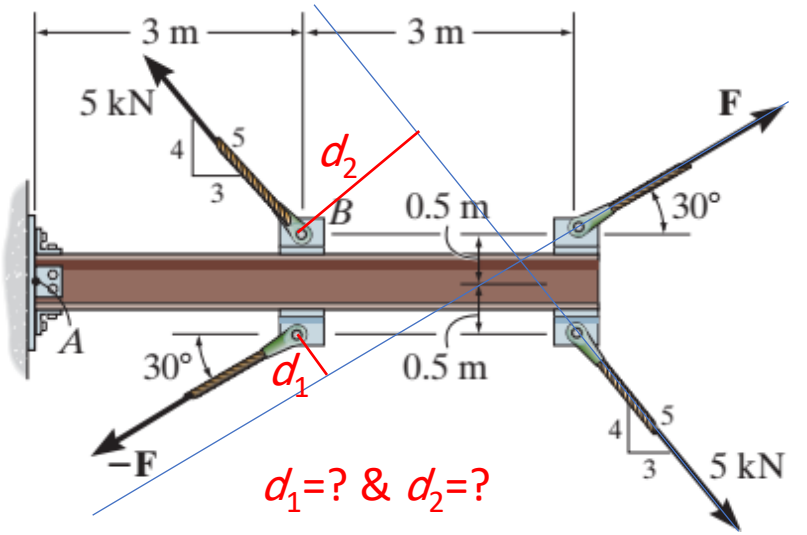
Resultant Couple Moment.

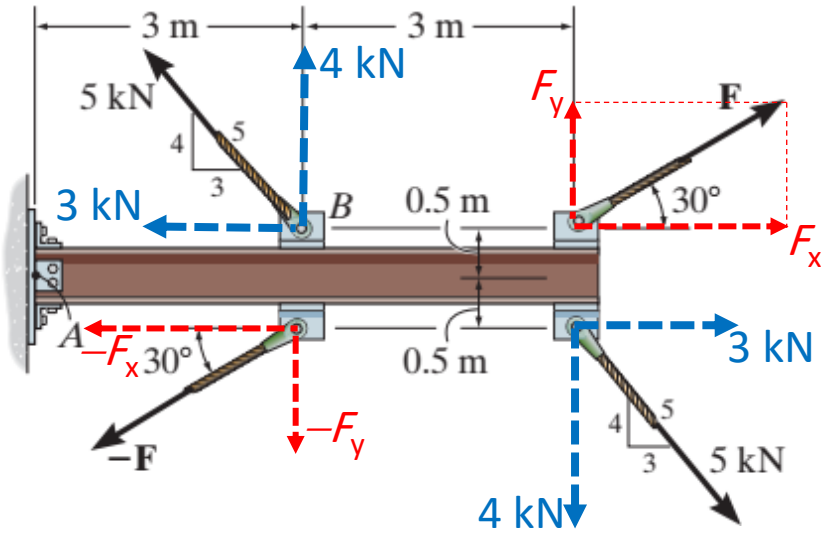
Since couple moments are vectors, their resultant can be determined by vector addition.

$$\vec{M}_R = \vec{M}_1 + \vec{M}_2$$

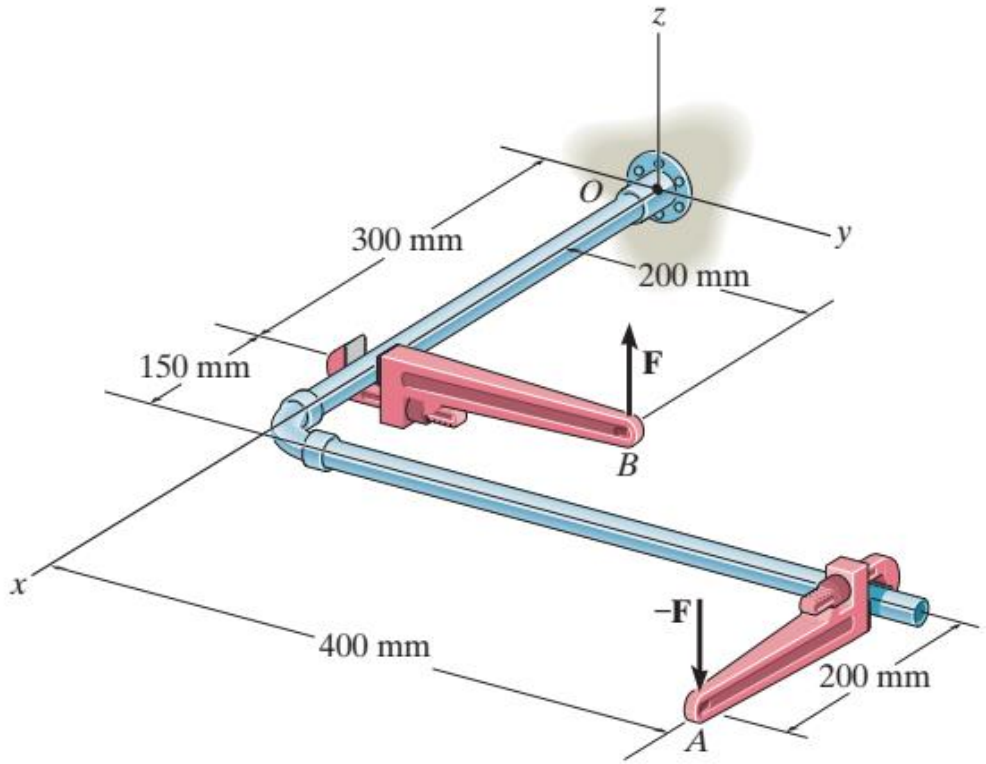


Ex. 1 . Determine the required magnitude of force *F*, if the resultant couple moment on the beam is to be zero.

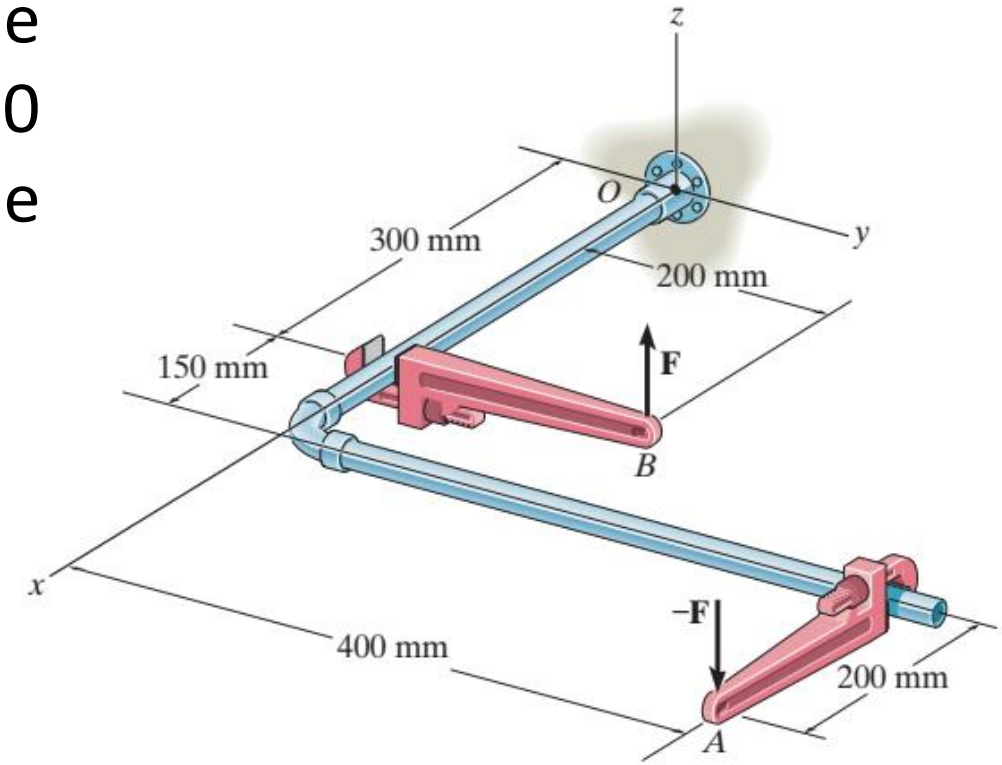




Ex. 2. Express the moment of the couple acting on the pipe assembly in Cartesian vector form. Solve the problem (a) using $\vec{M} = \overrightarrow{AB} \times \vec{F}$, and (b) summing the moment of each force about point O. Take *F* = {25k} N



Ex. 3. If the couple moment acting on the pipe assembly has a magnitude of 400 N.m, determine the magnitude *F* of the vertical force applied to each wrench.



Ex. 4. If the magnitude of the couple moment acting on the pipe assembly is 50 N.m, determine the magnitude of the couple forces applied to each wrench. The pipe assembly lies in the x–y plane.