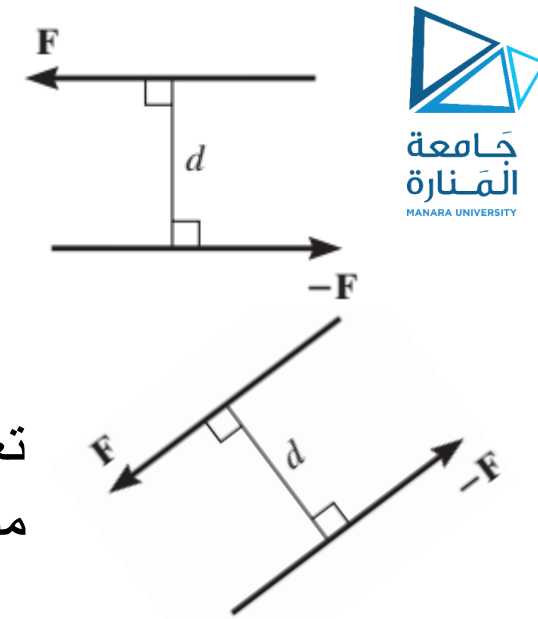
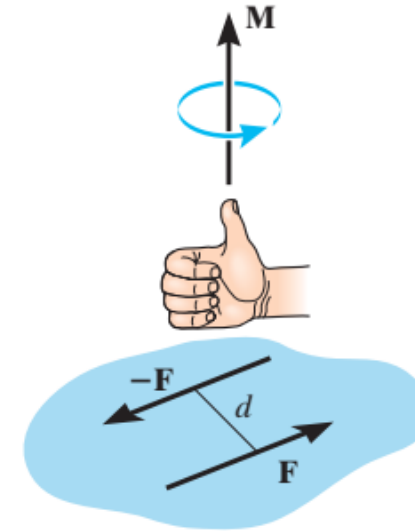
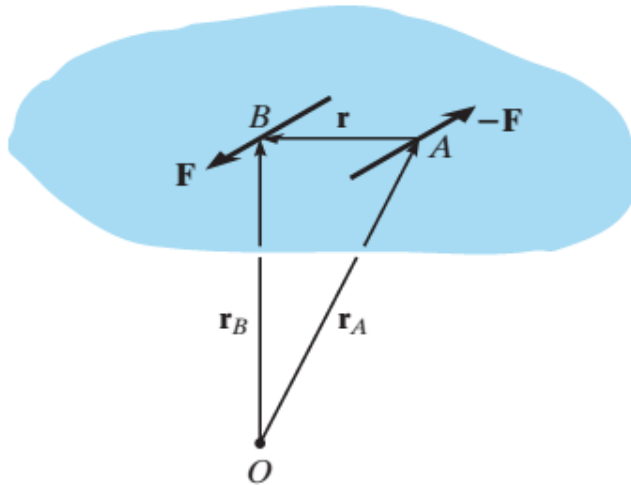


عزم المزدوجة Moment of a Couple

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.

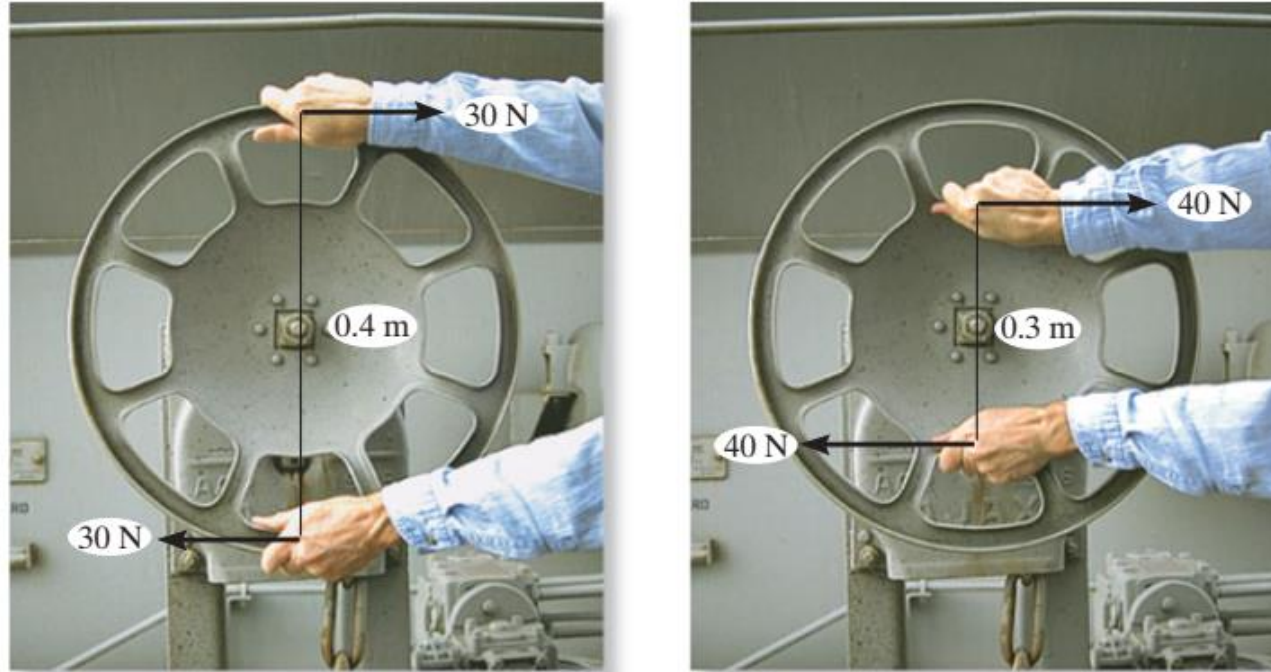


$$\vec{M} = \vec{r}_B \times \vec{F} + \vec{r}_A \times (-\vec{F}) = (\vec{r}_B - \vec{r}_A) \times \vec{F} = \vec{r} \times \vec{F}$$

$$M = Fd$$

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.



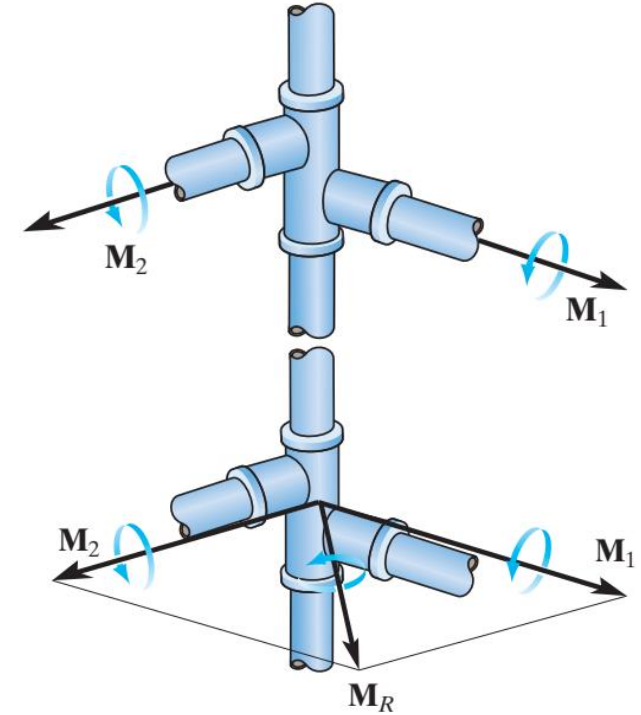
$$M = -30 \text{ N}(0.4 \text{ m}) = -40 \text{ N}(0.3 \text{ m}) = -12 \text{ N.m}$$

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

Resultant Couple Moment.

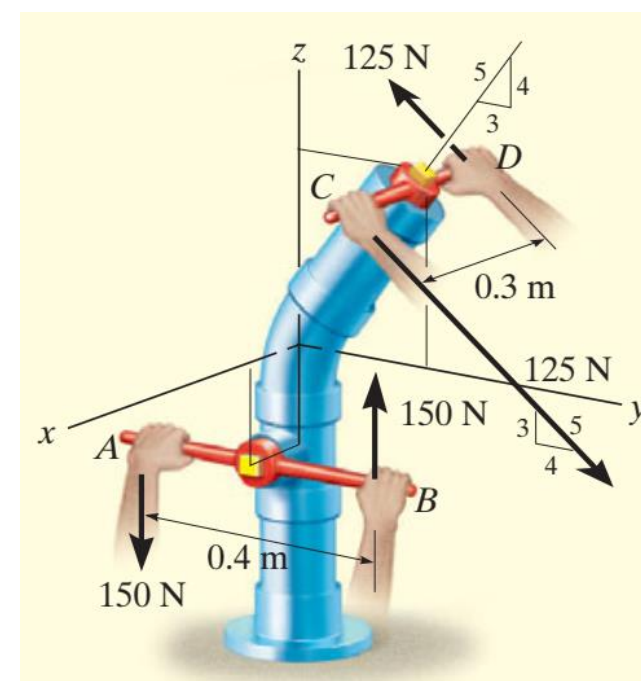
Since couple moments are vectors, their resultant can be determined by vector addition.

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



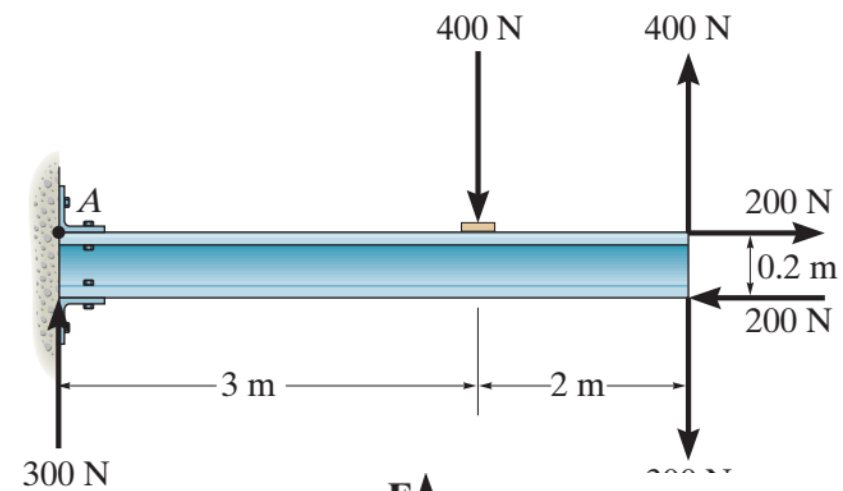
EXAMPLE 1.

Replace the two couples acting on the pipe column in Fig. by a resultant couple moment.



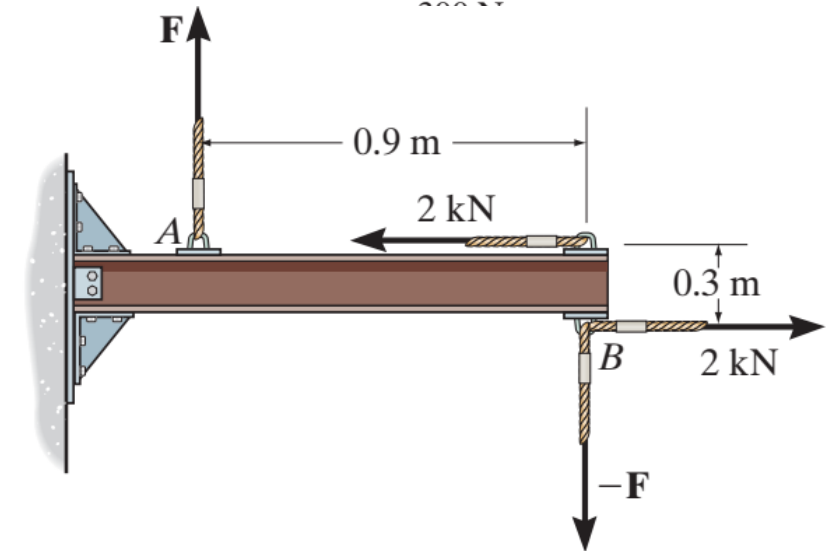
EXAMPLE 2.

Determine the resultant couple moment acting on the beam.



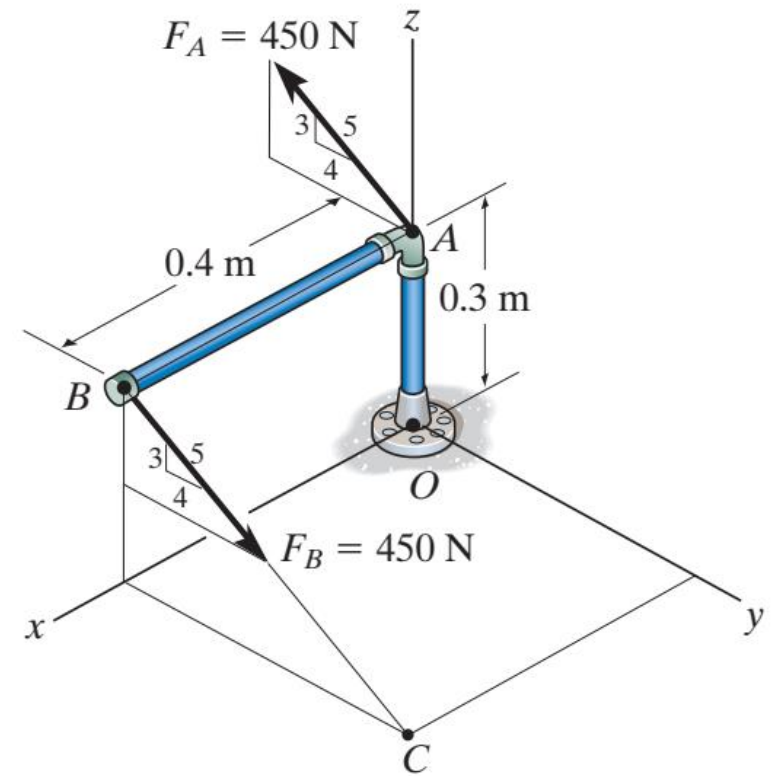
EXAMPLE 3.

Determine the magnitude of F so that the resultant couple moment acting on the beam is $-1.5 \text{ kN}\cdot\text{m}$ (clockwise).



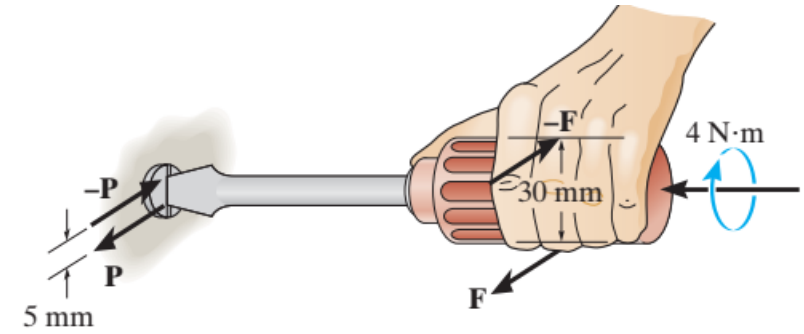
EXAMPLE 4.

Determine the couple moment acting on the pipe assembly and express the result as a Cartesian vector



EXAMPLE 5.

A twist of $4 \text{ N}\cdot\text{m}$ is applied to the handle of the screwdriver. Resolve this couple moment into a pair of couple forces F exerted on the handle and P exerted on the blade.



EXAMPLE 6.

The ends of the triangular plate are subjected to three couples.

Determine the plate dimension d , so that the resultant couple is 350 N.m clockwise.

