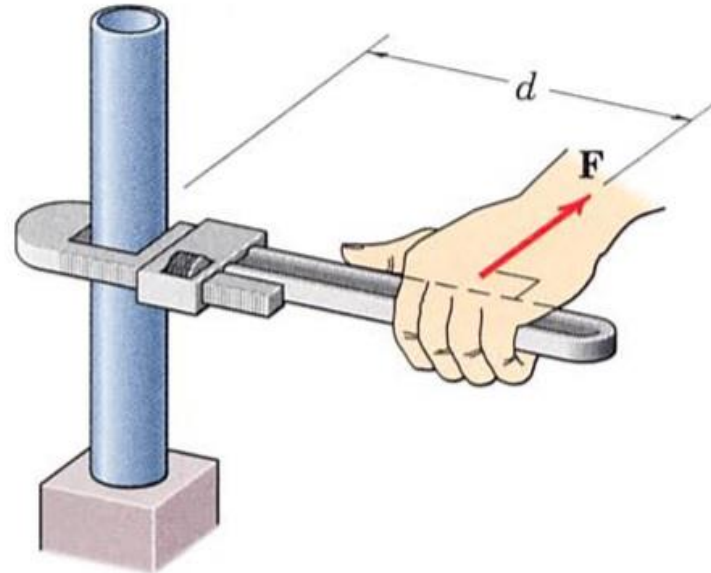
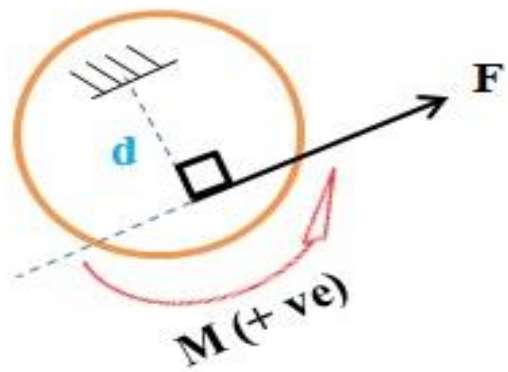


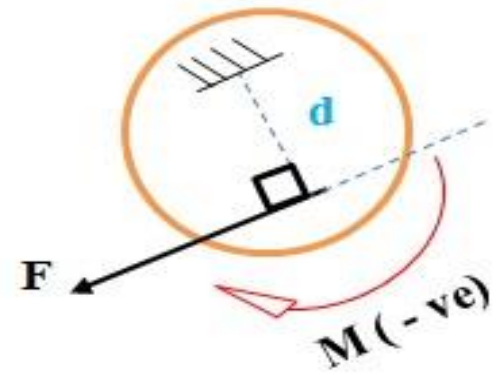
Moment

$$M = F \cdot d$$

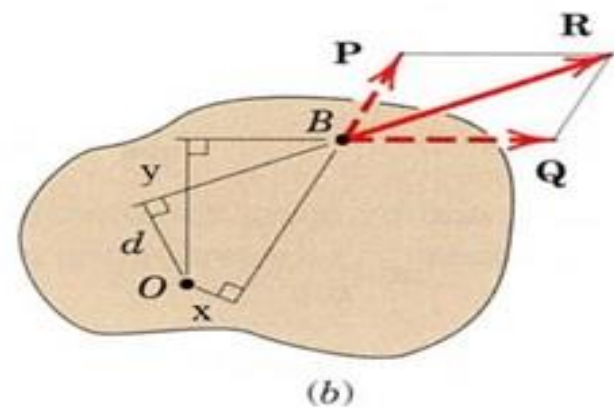
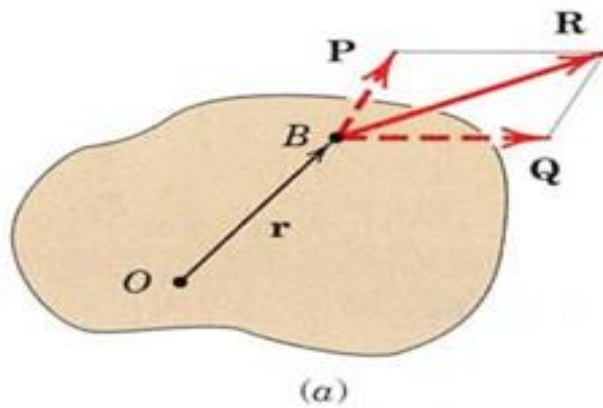




anticlockwise



clockwise



$$M = R \cdot d = -Q \cdot y + P \cdot x$$

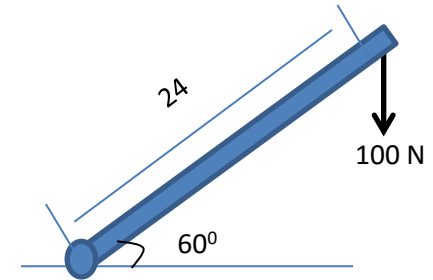
Ex: given rod as shown find.

A- The moment about O

B- The horizontal force given the same moment

C- The smallest force giving the same moment

D- The distance along the rod for a 240 N vertical force to give the same moment.



Solution

A) $M = F \cdot d = -100 \cdot 24 \cos 60$
 $= -1200 \text{ N}$

B) $M = -1200 = -F_h \cdot 24 \sin 60$
 $F_h = 57.7 \text{ N}$

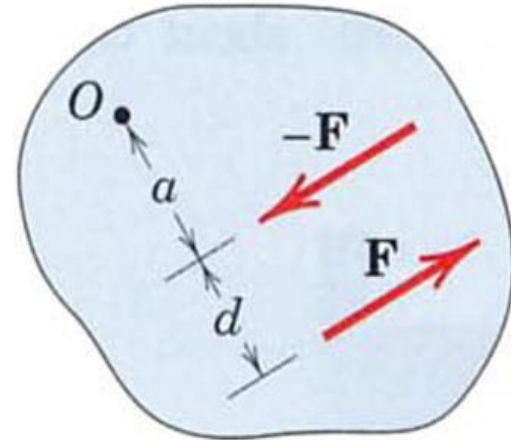
C) $1200 = -F_y \cdot 24$
 $F_y = 50 \text{ N}$

D) $-1200 = -240 \cdot d$
 $1200 = 240 \cdot r \cos 60$ then $r = 10 \text{ m}$

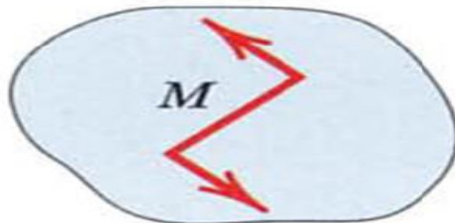
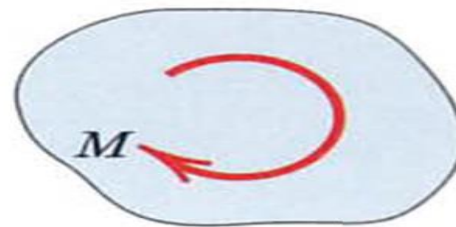
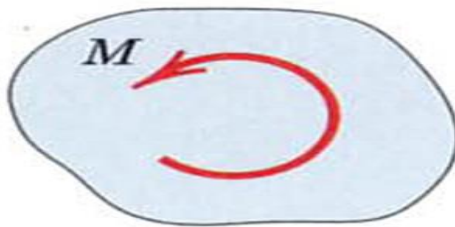
Couple

$$M = F(a + d) - F \cdot a$$

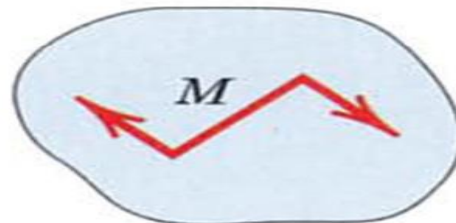
$$\text{Then } M = F \cdot d$$



* Any moment can be replaced by a couple



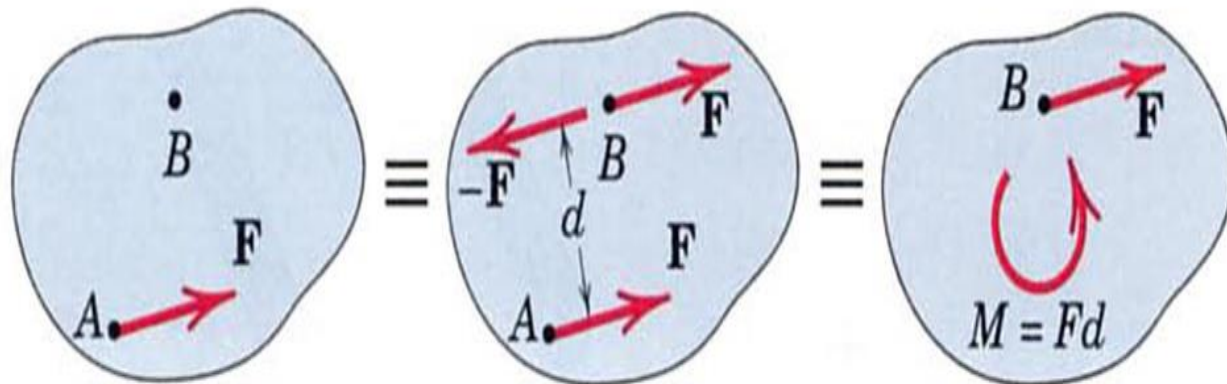
anticlockwise
couple (-)



Clockwise
couple (+)

* The moment of a couple does not depend on the moment center

Force – Couple Systems



* تنقل القوة من نقطة الى اخرى بقوة بنفس المقدار و الاتجاه مضافا لها عزم مزدوج
يساوي عزم القوة حول النقطة الجديدة

Ex: Determine the distance from the shaft point of application to the equivalent force

$$d = 60 + 60 = 120 \text{ mm}$$

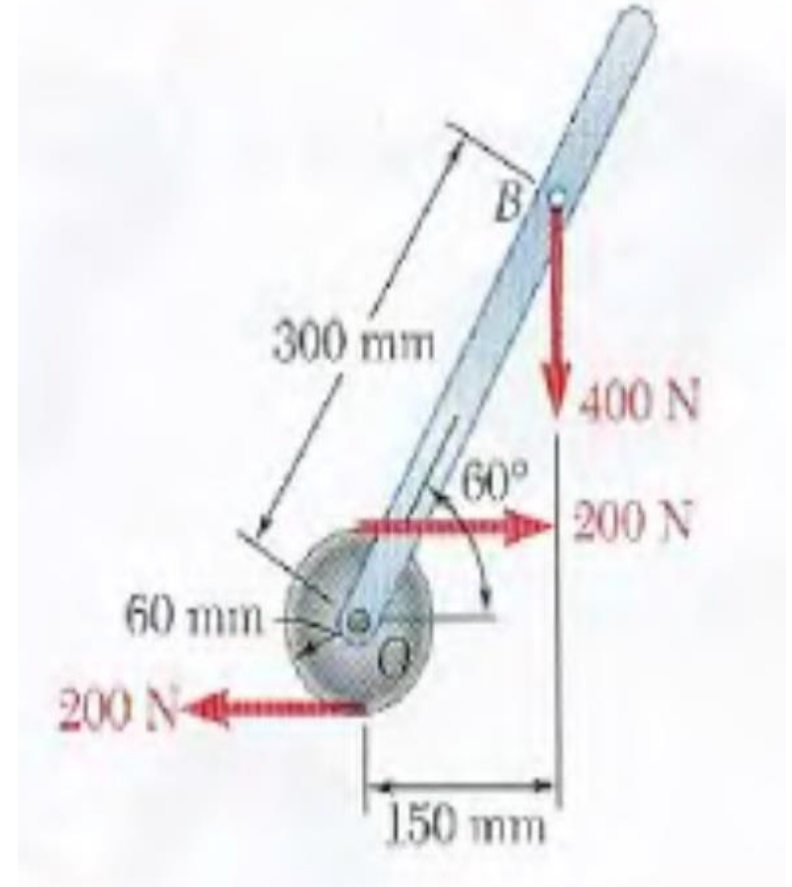
$$\text{then } d = 0.12 \text{ m}$$

moment of couple

$$M = F \cdot d$$

$$= 200 * 0.12$$

$$\text{Then } M = -24 \text{ N.m}$$



The moment about the new point C

$$\begin{aligned} -24 &= BC \cdot F \\ &= -BC \cos 60^\circ \cdot 400 \end{aligned}$$

$$\text{Then } BC \cos 60^\circ = 0.06$$

$$BC = 120 \text{ mm}$$

$$OC = OB + BC$$

$$= 300 + 120$$

$$\text{Then } OC = 420 \text{ mm}$$

