Course Code: ESC106A
Course Title: Construction Materials and Engineering Mechanics

Lecture No. 10:
Moment of a Force and Couple

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Lecture Intended Learning Outcomes

At the end of this lecture, student will be able to:

- Define a moment and couple
- Describe the characteristics of a couple
- Explain the concepts of moment of a force, couple and moment of a couple

Contents

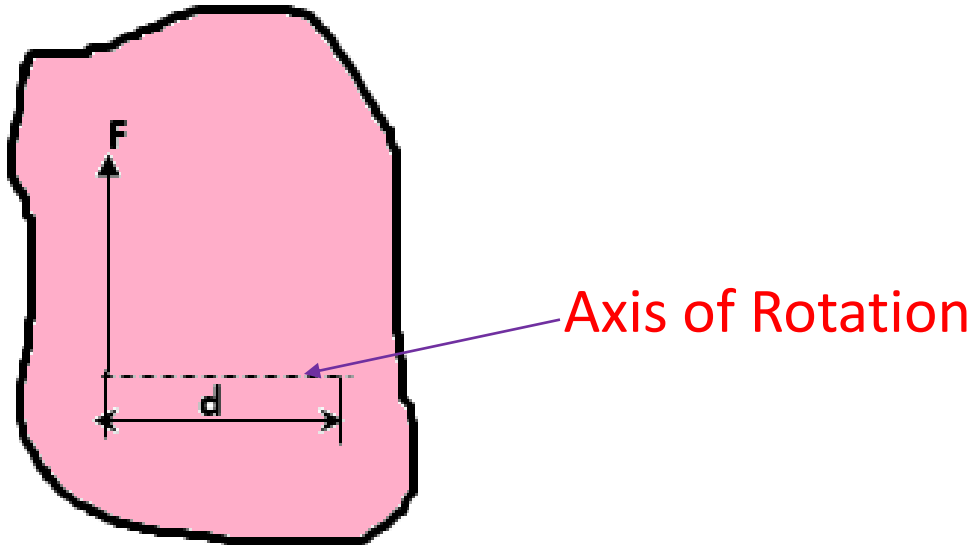
- **Engineering Mechanics**

  Moment of a force, couple

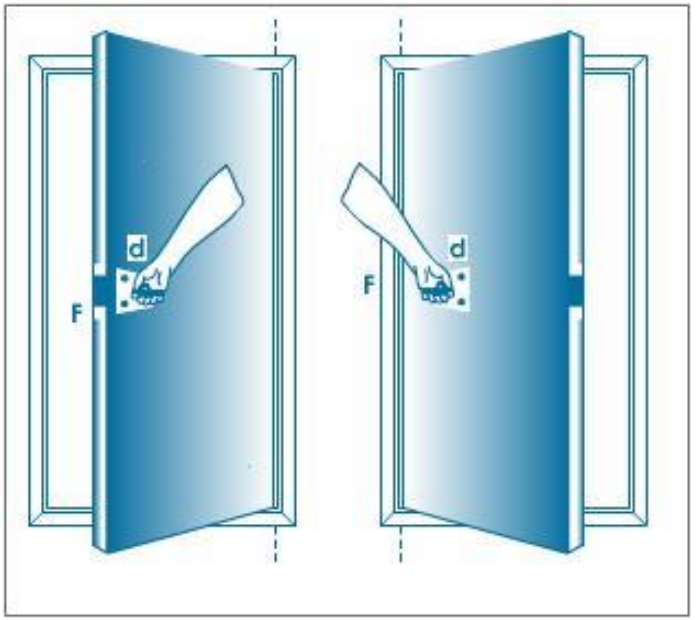
Moment of a Force

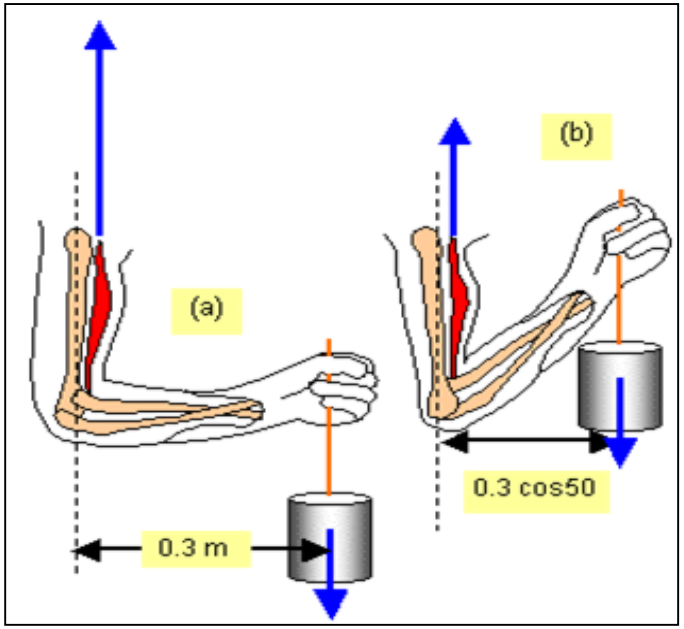
- The turning effect produced by a force on a body is known as the moment of the force

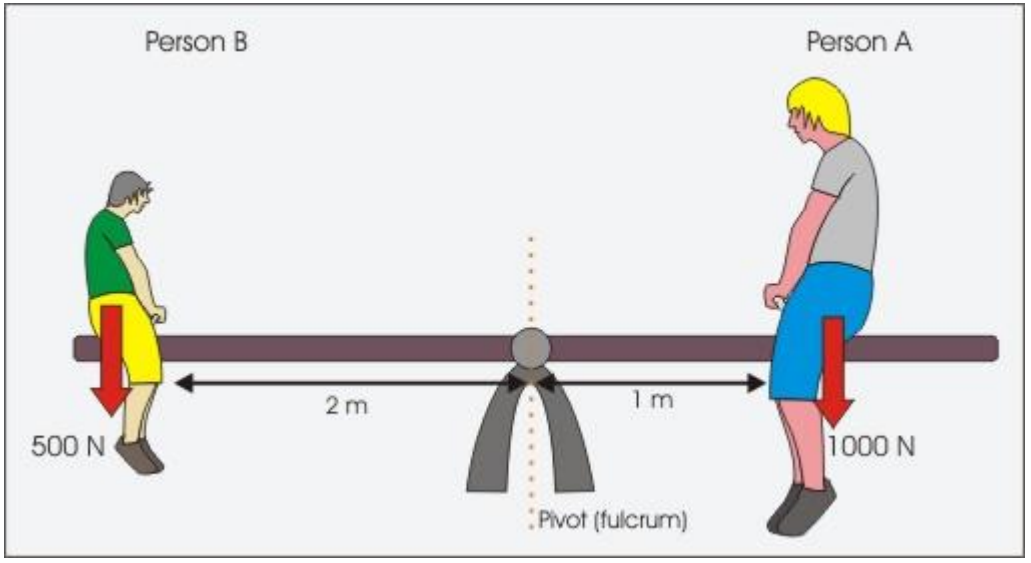
- The magnitude of the moment is given by the product of the magnitude of the force and the perpendicular distance between the line of action of the force and the point or axis of rotation



Examples for Moment of a force

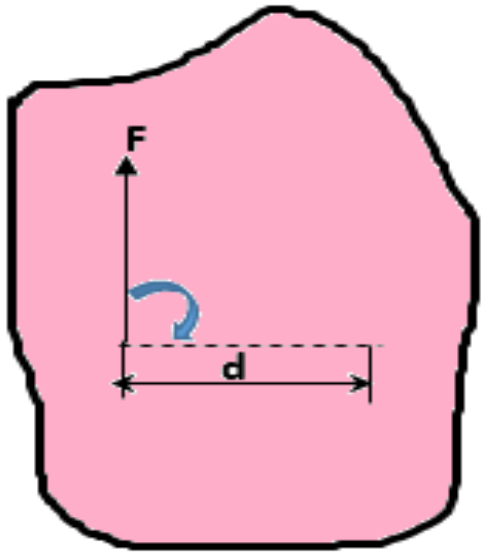






Types of Moments

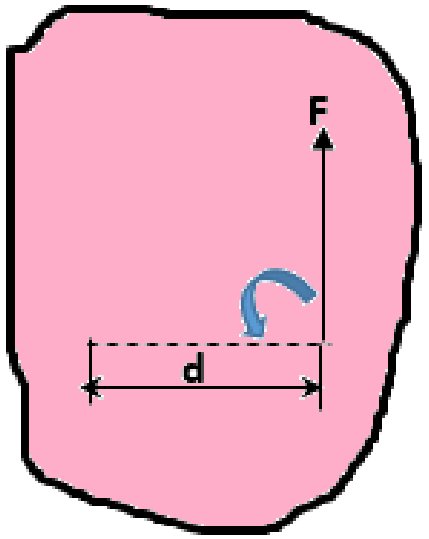
- If the tendency of a force is to rotate the body in the clockwise direction, it is said to be a clockwise moment and is taken positive



 - Clockwise Moment

Types of Moments

- If the tendency of a force is to rotate the body in the anticlockwise direction, it is said to be anticlockwise moment and is taken negative

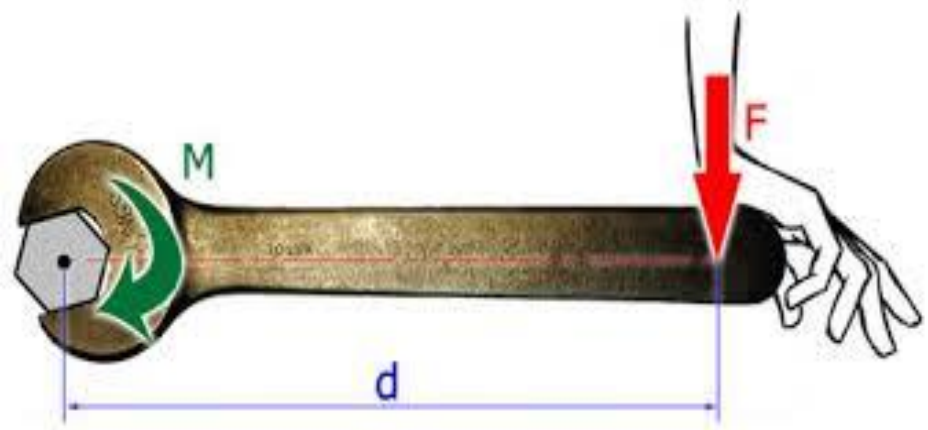


 - Anticlockwise Moment

Moment of a Force

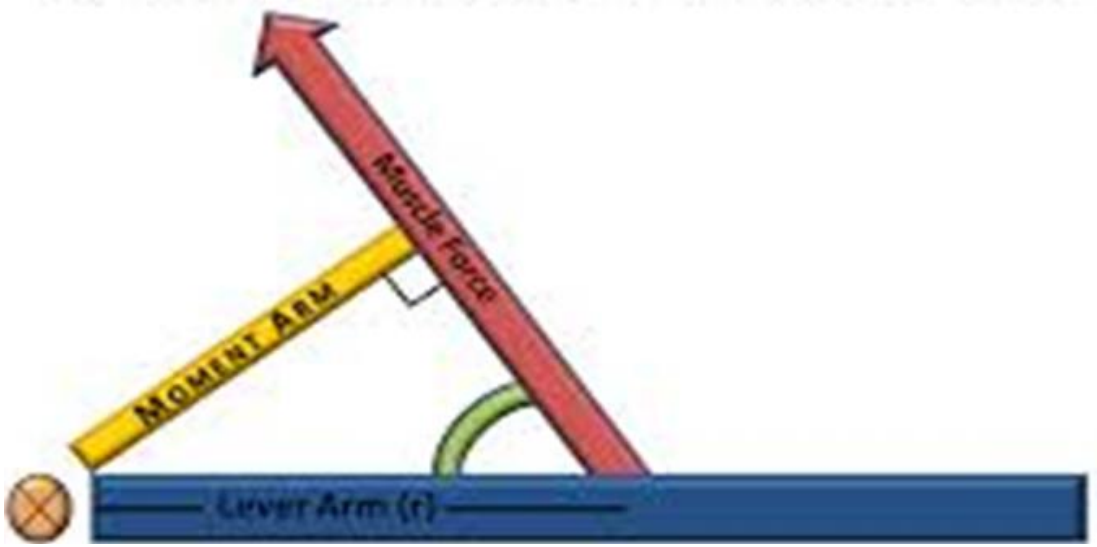
- A measure of its tendency to cause a body to rotate about a specific point or axis.

- Here d is moment arm



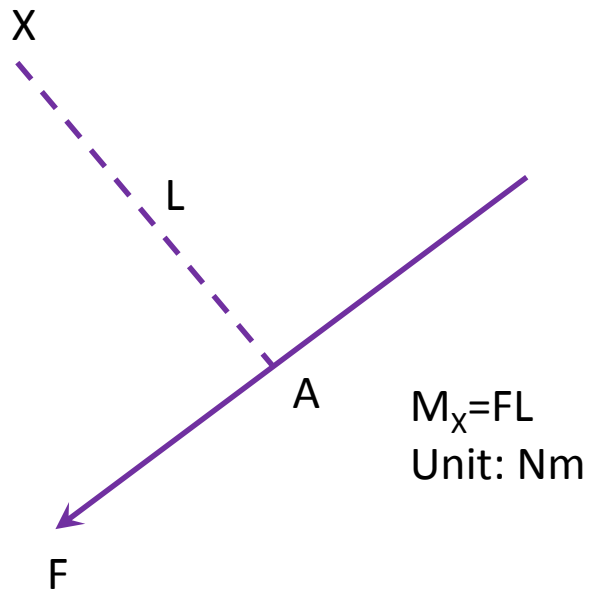
Moment Arm

- Moment Arm is the perpendicular distance from an axis to the line of action of a force



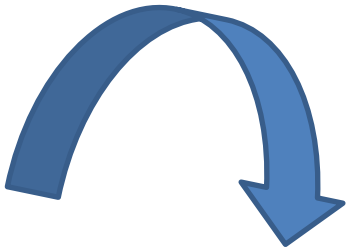
Calculation of Moment of a Force about a Point

- Moment of a force about any point is given by the product of magnitude of force and perpendicular distance between the line of action of a force and the point about which moment is considered

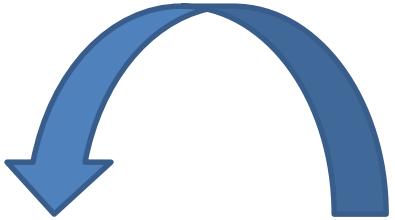


Sign Convention for Moment of a Force

- Clockwise moment is taken to be positive and anticlockwise moment is taken to be negative.



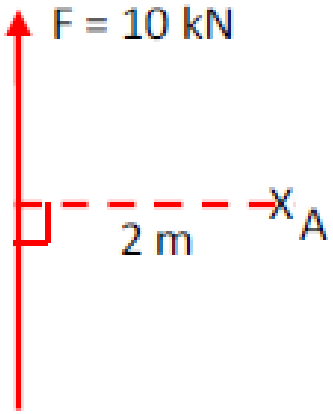
Positive



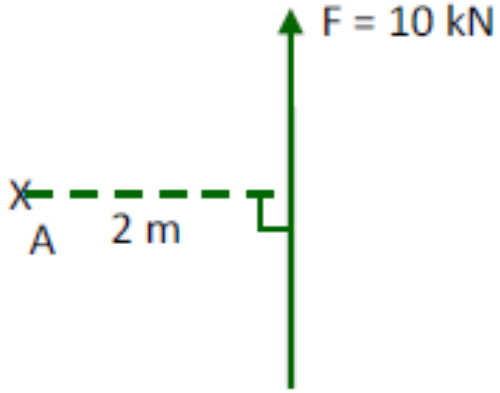
Negative

Example Problems

Find moment of force ‘F’ about ‘A’ in the following cases



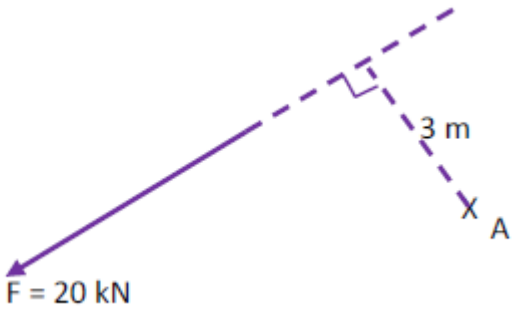
$M_A = 10 * 2 = +20kNm$



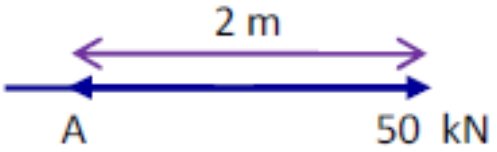
$M_A = -10 * 2 = -20kNm$

Example Problems

Find moment of force ‘F’ about ‘A’ in the following cases



$$M_A = -20 * 3 = -60kNm$$

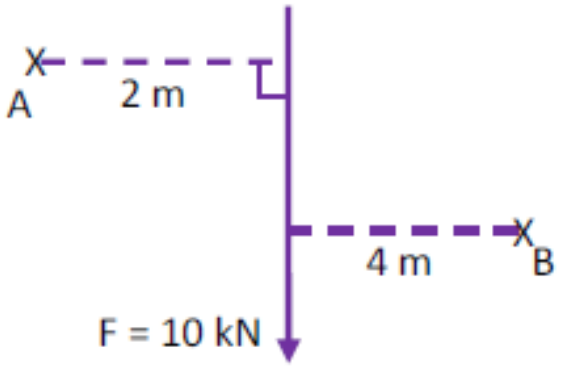


$$M_A = 50 * 0 = 0$$

Example Problems

Find moment of the force about A and B in the following figure

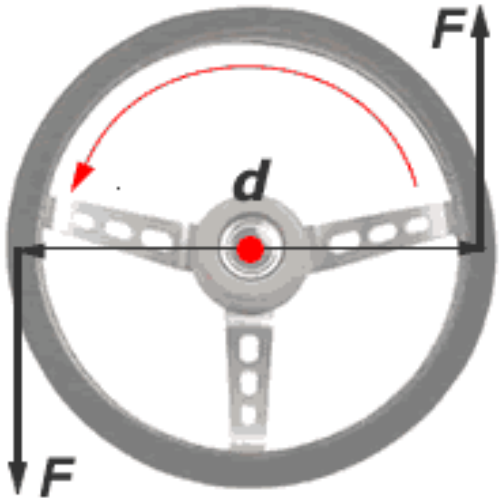
$$M_A = 10 * 2 = +20kNm$$

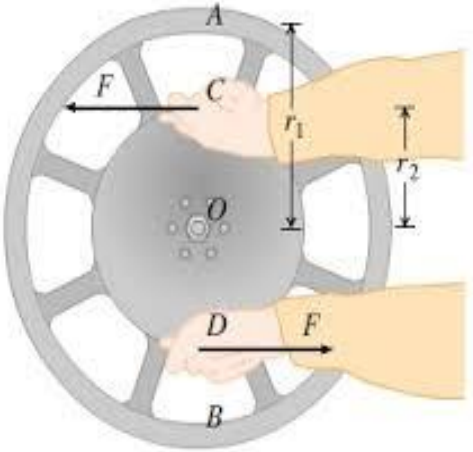


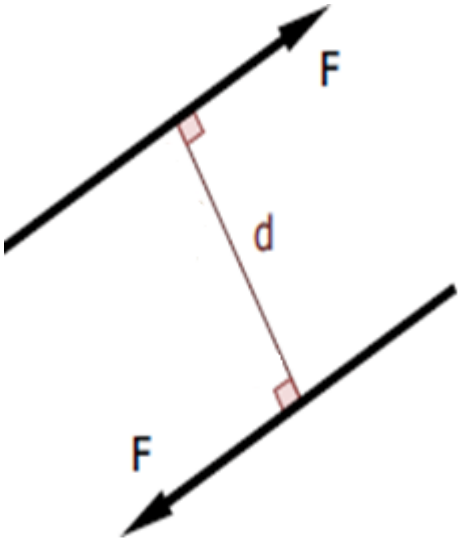
$$M_B = -10 * 4 = -40kNm$$

Couple

- A pair of equal unlike parallel forces separated by a distance







Couple

Rotation of a key to lock and unlock is the moment of couple

Couple

Opening or closing of tap is the moment of couple

Opening

Closing

Characteristics of a Couple

- A couple consists of a pair of equal and unlike parallel forces separated by a distance
- A couple does not produce translation(Resultant =0)
- A couple produces only rotation or moment
- The moment of a couple is given by the product of one of the forces of the couple and the distance between them
- The moment of a couple is always constant irrespective of the moment centre and moment arm

Summary

- Moment of a force is a measure of its tendency to cause a body to rotate about a specific point or axis
- Moment arm is the perpendicular distance from an axis to the line of action of a force
- A pair of equal unlike parallel forces separated by a distance is known as a couple
- A couple produces rotation or moment