ENGINEERING MECHANICS: STATICS

COLLEGE OF
ENGINEERING, ARCHITECTURE AND TECHNOLOGY

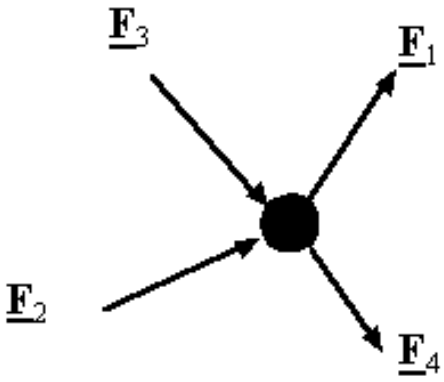
西南交通大學
Southwest Jiaotong University

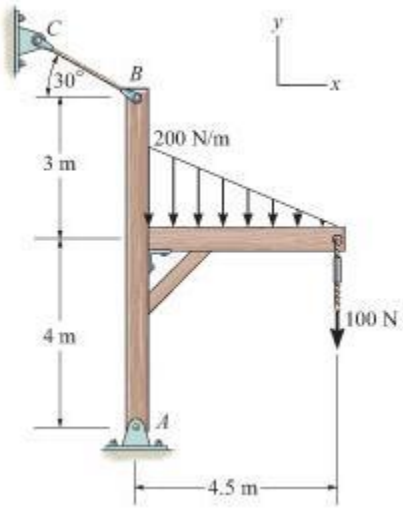
Idealizations in Mechanics:

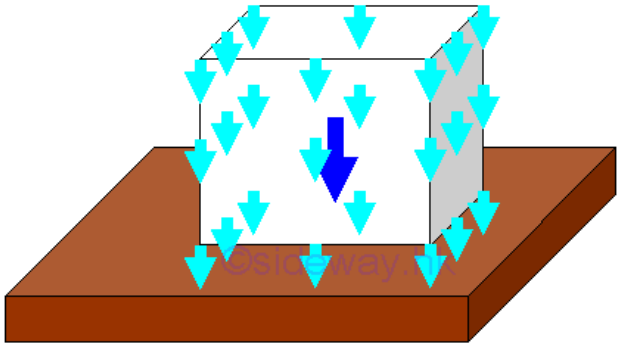
Models are used to simplify theory application

Models include:

- Particles
- Rigid Bodies
- Concentrated Forces





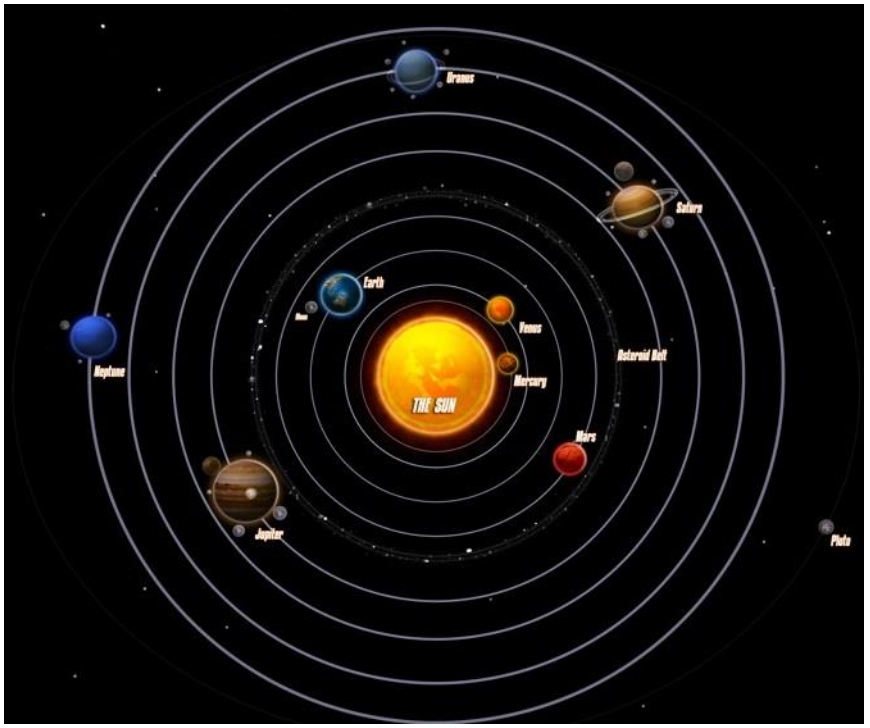


Models:

Particle:

Size (and sometimes mass) are neglected

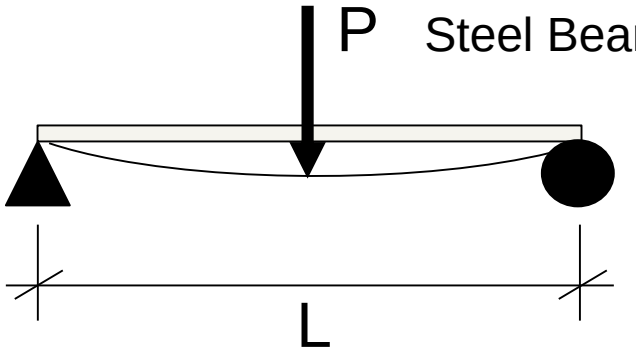
For example, Earth is very large, yet insignificant when compared to the size of orbit. Therefore, Earth can be modeled as a particle.



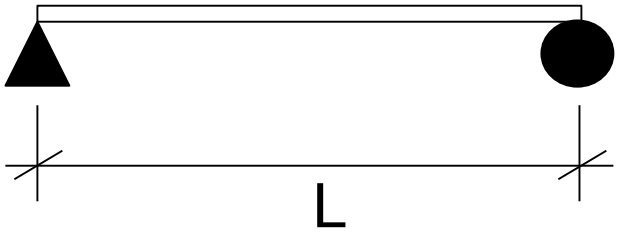
Models:

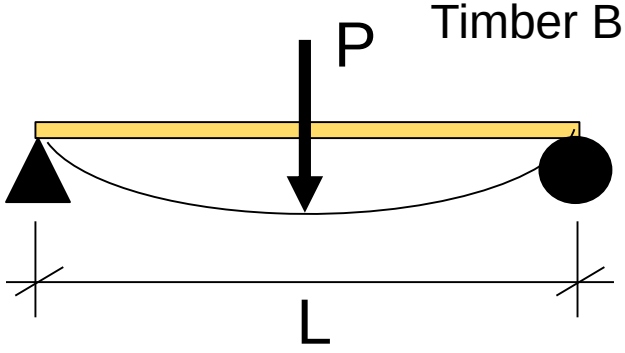
Rigid Body:

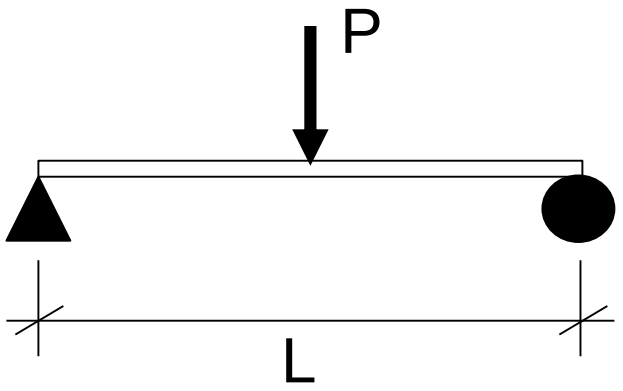
A combination of a large number of particles that stay at a fixed distance from one another before and after applying load.



Rigid Bodies



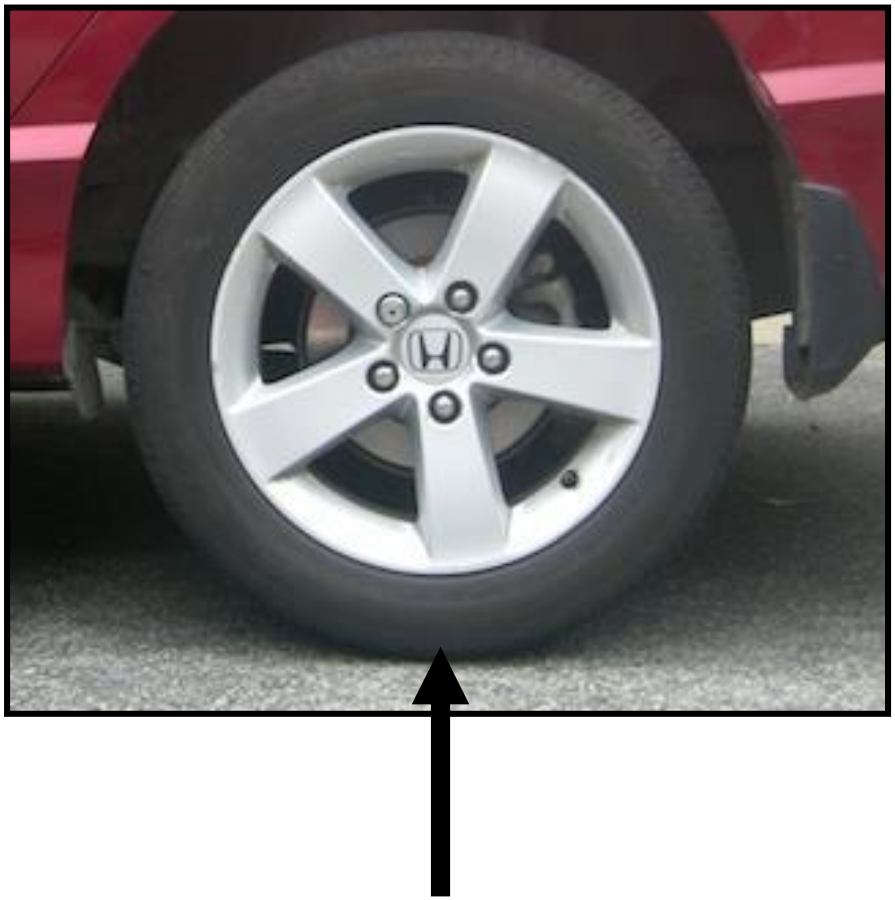




Models:

Concentrated Force:

Represents the effect of a loading which is assumed to act at a point on a body when the area over which the load is applied is small compared to the body.



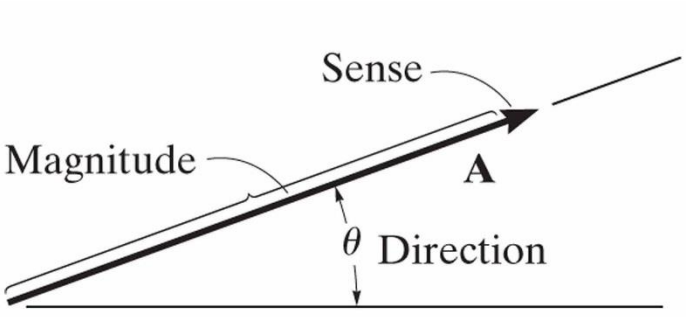
2.1: Scalars and Vectors

Scalar: Quantity w/ magnitude (+ or -)

$$|F| = scalar$$

Vector: Quantity w/ magnitude & direction

$$\vec{F} = vector$$



Unit Vector: Vector w/ magnitude of ONE.

Since a force has both magnitude & direction, it can be represented as a vector.

Resultant of Vectors: Combining two or more vectors into a single vector.

$$\vec{F} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + ... + \vec{F}_n$$

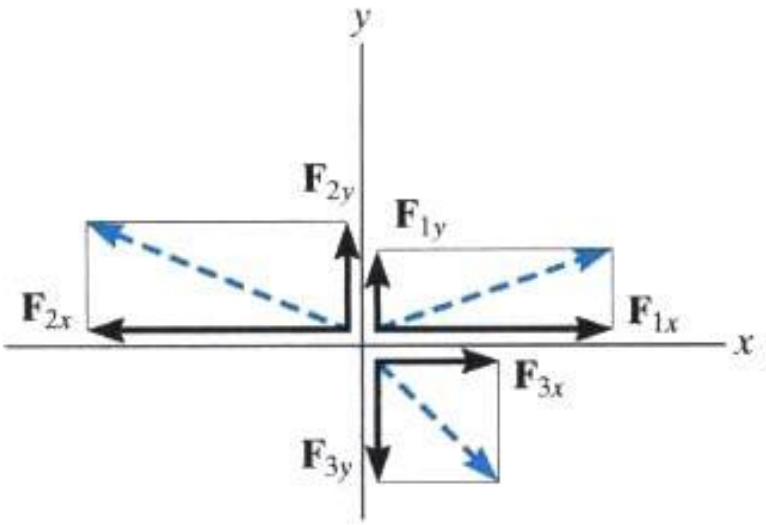
Resolution of a vector: To describe a single vector as two or more vectors, called "*component form*"

$$\overline{F} = \overline{F_x}\hat{i} + \overline{F_y}\hat{j}$$

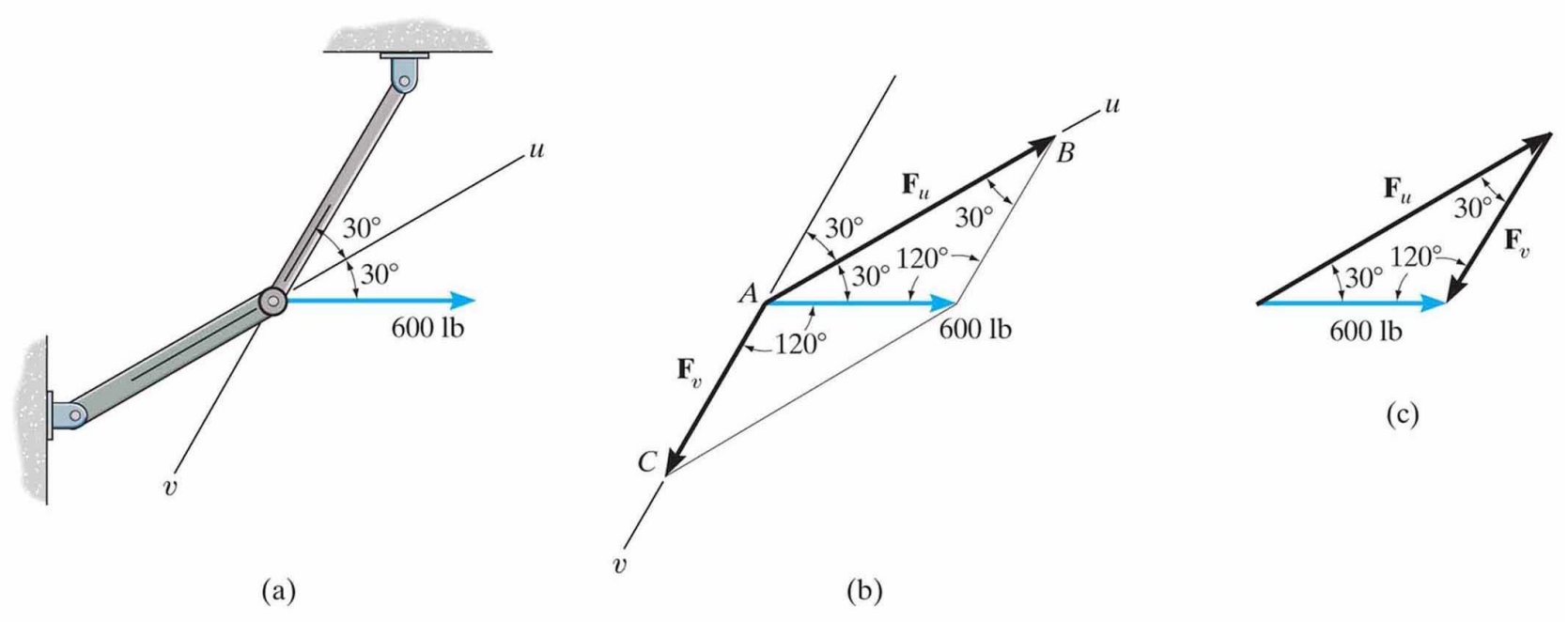
Important components include:

Rectangular Components

Orthogonal Components



Parallelogram Law: This method may also be used to find component of force and is useful when the axes are not at a right angle.



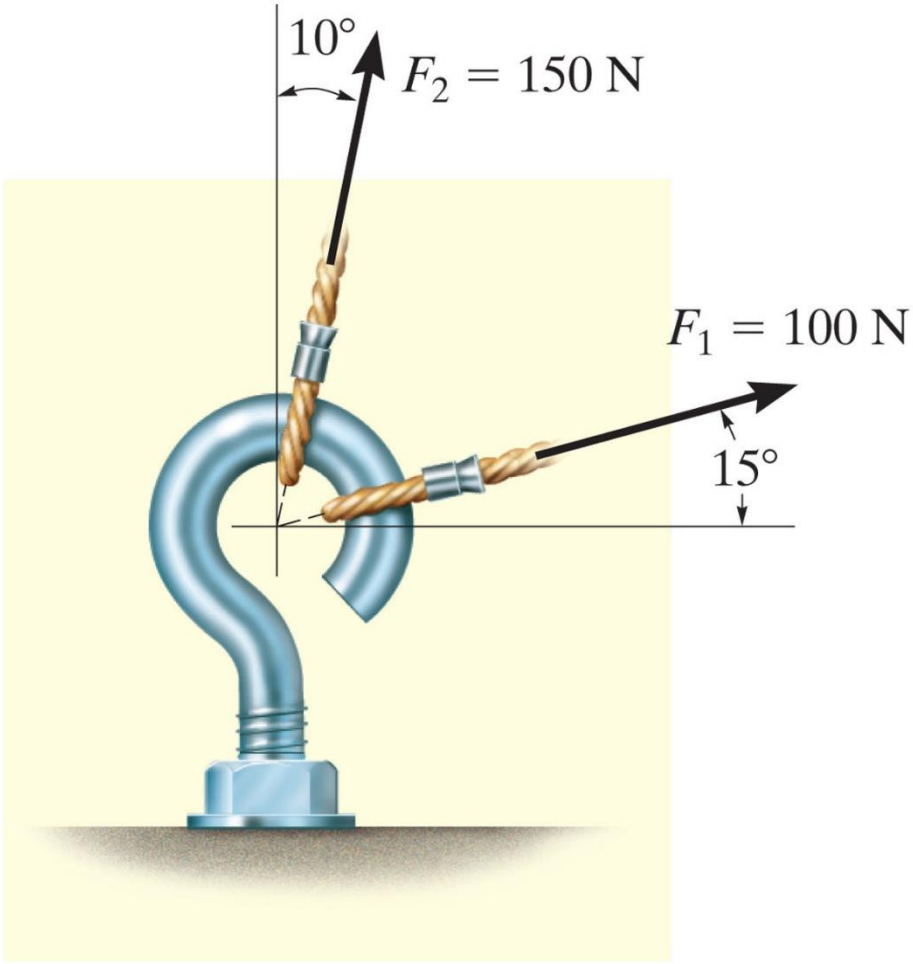
Sine Law:

$$\frac{A}{\sin a} = \frac{B}{\sin b} = \frac{C}{\sin c}$$

Cosine Law:

$$C = \sqrt{A^2 + B^2 - 2AB\cos c}$$

Example: Write each of the forces in Cartesian Vector form and determine the resultant force. Refer to Video



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