

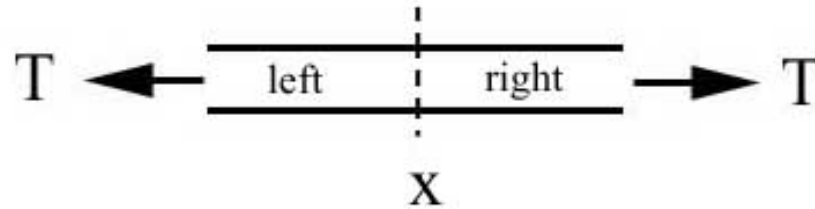
# Newton's Third Law

- To every action there is always opposed an equal reaction: or, the mutual action of two bodies upon each other are always equal, and directed to contrary parts.

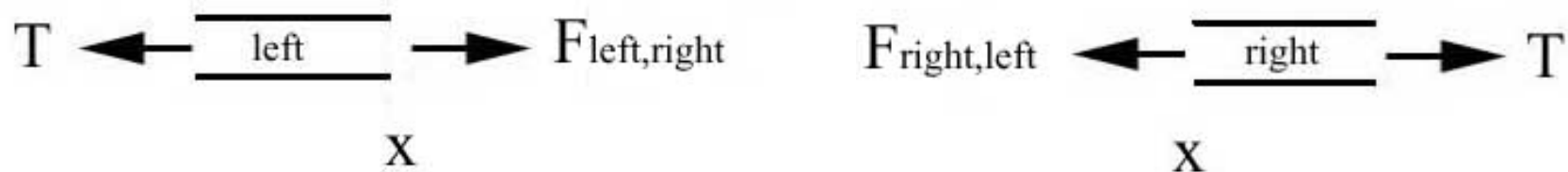
$$\vec{\mathbf{F}}_{1,2} = -\vec{\mathbf{F}}_{2,1}$$

- Action-reaction pair of forces cannot act on same body; they act on different bodies.

# Tension in a Rope



The *tension* in a rope at a distance  $x$  from one end of the rope is the magnitude of the action -reaction pair of forces acting at that point ,



$$T(x) = \left| \vec{F}_{\text{left,right}}(x) \right| = \left| \vec{F}_{\text{right,left}}(x) \right|$$

# Free Body Force Diagram

- Isolate each object
- Represent each force that is acting on the object by an arrow that indicates the direction of the force.

$$\vec{\mathbf{F}}^{total} = \vec{\mathbf{F}}_1 + \vec{\mathbf{F}}_2 + \dots$$

- Use free body force diagram to make these vector decompositions of the individual forces.

$$\vec{\mathbf{F}}^{total} = F_x^{total} \hat{\mathbf{i}} + F_y^{total} \hat{\mathbf{j}} + F_z^{total} \hat{\mathbf{k}}$$