








2.1 Combining Forces

LESSON Vocabulary

-  force
-  contact force
-  noncontact force
-  net force
-  unbalanced forces
-  balanced forces
-  Newton's first law of motion

Force

- When more than one force acts on an object, the combined effect is caused by the sum of all applied forces.
- A push or a pull on an object is a **force**.



Contact and Noncontact Forces

- A **contact force** is exerted only when two objects are touching.
- A **noncontact force** is exerted when two objects are not touching.
- Magnets exert a noncontact force on each other.



Force is a Vector

- Vectors have magnitude and direction.
- Force has a direction and a magnitude.
- Force is measured in Newtons.



Combining Forces

- When more than one force acts on an object, the forces combine.
- ◀ • The combination of all the forces acting on an object is called the **net force**.



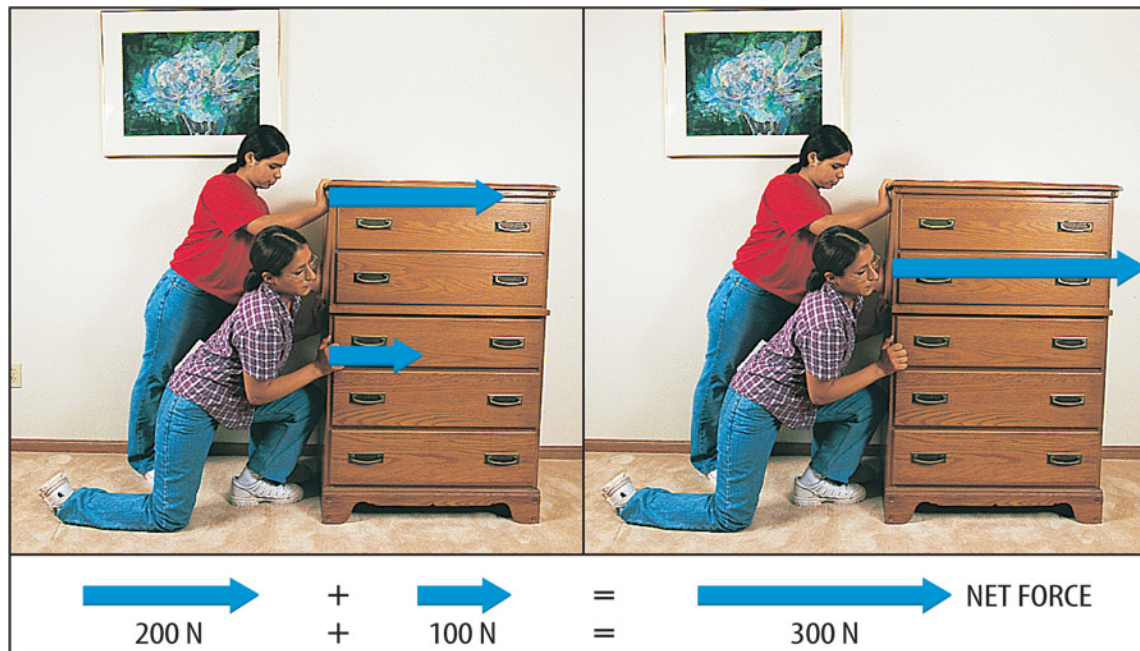
Combining Forces in the Same Direction

- Forces are vectors and require a reference direction.
- When forces in the same direction combine, the net force is in the same direction and the size of the force is the sum of the forces.



Combining Forces in the Same Direction (cont.)

- If two people push the dresser to the right, the forces are added together.



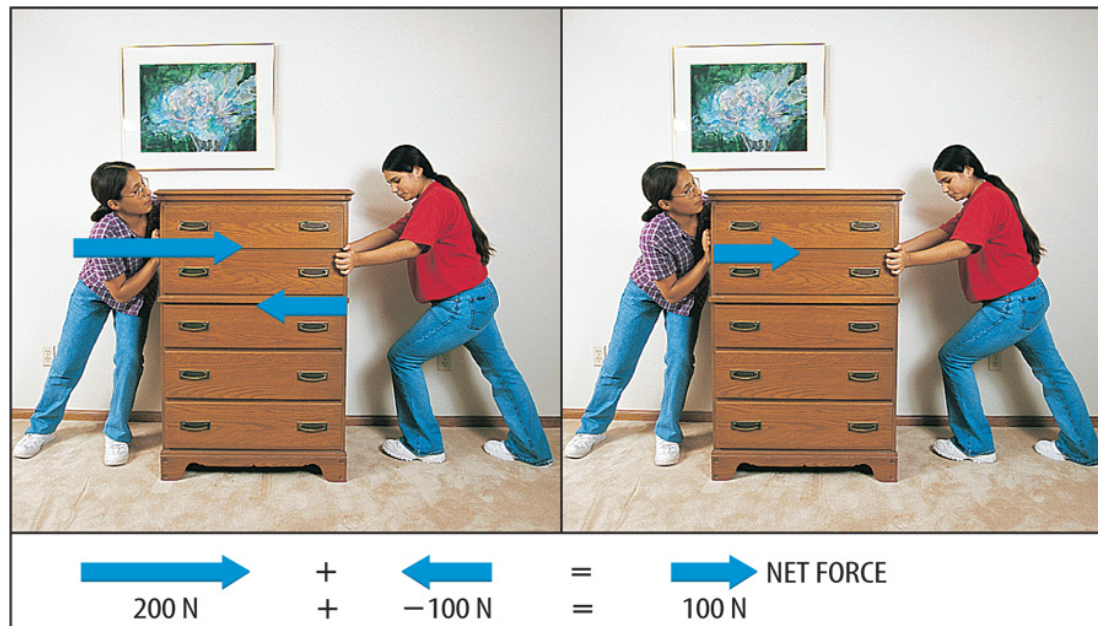
Combining Forces in Opposite Directions

- When forces in opposite directions combine, the net force is in the direction of the larger force.
- The size of the net force is the difference between the two forces.



Combining Forces in Opposite Directions (cont.)

- Two people exerting a force in opposite directions show how vectors combine to create net force.



Unbalanced and Balanced Forces

- If the net force on an object is not zero, it is an **unbalanced force**.
- If the net force on an object does equal zero, it is a **balanced force**.



Balanced Forces



$$\begin{array}{ccccccc} \text{—————} \rightarrow & + & \leftarrow \text{—————} & = & & & \text{0 NET FORCE} \\ 200 \text{ N} & + & -200 \text{ N} & = & & & 0 \text{ N} \end{array}$$



Resources



Balanced Forces and Motion

- If two people push with the same force, the door does not move.
- The forces have the same magnitude.
- The forces are in opposite directions.
- The net force on the door is zero and the forces are balanced.
- The motion of the door does not change.



Unbalanced Forces and Motion

- Unbalanced forces change motion.
- If two people push with different force, the door moves.
- The forces have a different magnitude and are in opposite directions.
- The net force on the door is not zero and the forces are unbalanced.
- The door moves in the direction of the larger force.



Newton's First Law of Motion

- If the net force on an object is zero, the velocity of the object does not change.
- If the net force is zero and the object is at rest, it remains at rest.
- If the net force is zero and the object is moving, it continues to move in a straight line with constant speed.

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Newton's Laws
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Inertia and Mass

- Mass is the amount of matter in an object.
- The size of the net force needed to cause a certain change in motion depends on the object's mass.
- A bicycle is easier to push than a car because it has less mass.

