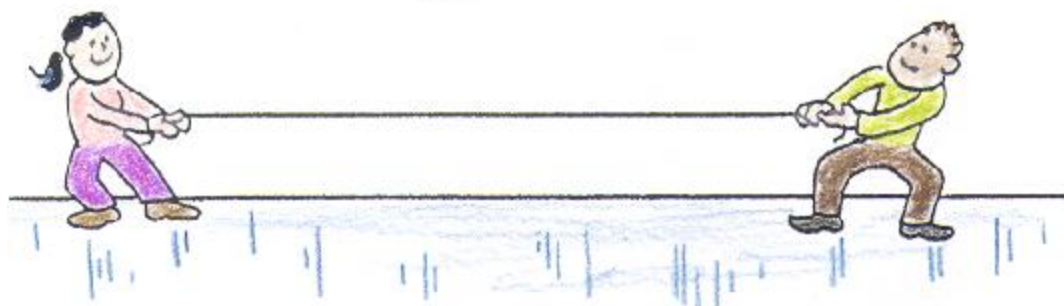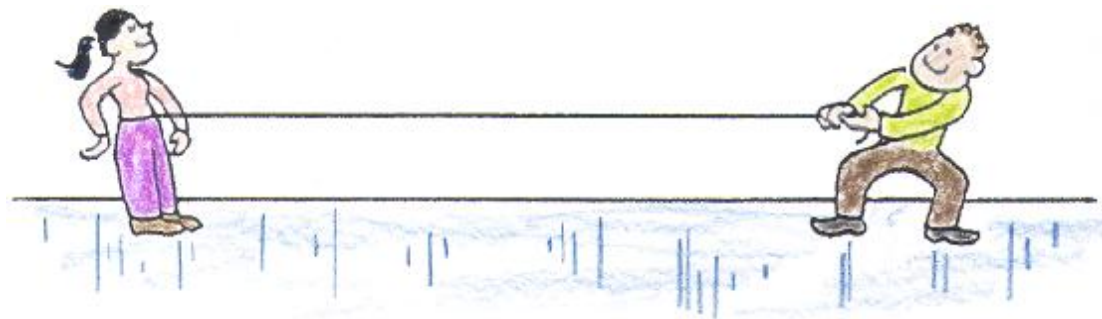# NEXT-TIME QUESTION

Two people of equal mass, 6 meters apart, attempt a tug of war on frictionless ice. If they pull on opposite ends of the rope with equal forces, each slides 3 meters to a point midway between them. Suppose instead that only one person pulls and the other fastens the rope around his or her waist. How far does each person slide?

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Suppose instead that only one person pulls and the other fastens the rope around his or her waist. How far does each person slide?

## Answer:

Each slides 3 meters, whether or not the pull is intentional. At each end of the rope is an interaction governed by Newton's third law. If the first person pulls on the rope with a certain force, the rope pulls back on that person with the same force, causing that person to accelerate. The force exerted by this person on the rope is transmitted by the rope to become the force exerted on the second person. So the second person is acted on by the same magnitude of force as the first person, and they accelerate equally (in opposite directions.)

Another way to see this is to think of the center of mass of the whole system of the two persons and the rope. This center of mass is midway between the two persons. Since no external net force acts on this system, its center of mass will remain fixed, and that is where the two persons will meet.

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