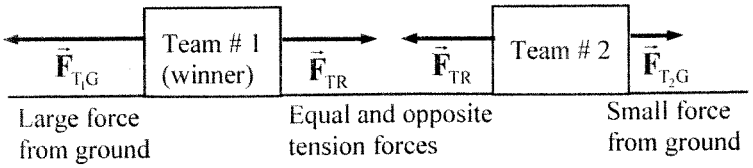
The free body diagram below illustrates this. The forces are $\vec{\mathbf{F}}_{T_1G}$, the force on team 1 from the ground, $\vec{\mathbf{F}}_{T_2G}$, the force on team 2 from the ground, and $\vec{\mathbf{F}}_{TR}$, the force on each team from the rope.

Thus the net force on the winning team $\left(\vec{\mathbf{F}}_{T_1G} - \vec{\mathbf{F}}_{TR}\right)$ is in the winning direction.



16. (*a*) The magnitude is 40 N.
(*b*) The direction is downward.
(*c*) It is exerted on the person.
(*d*) It is exerted by the bag of groceries.

17. If you are at rest, the net force on you is zero. Hence the ground exerts a force on you exactly equal to your weight. The two forces acting on you sum to zero, and so you don't accelerate. If you squat down and then push with a larger force against the ground, the ground then pushes back on you with a larger force by Newton's third law, and you can then rise into the air.

18. In a whiplash situation, the car is violently pushed forward. Since the victim's back is against the seat of the car, the back moves forward with the car. But the head has no direct horizontal force to push it, and so it "lags behind". The victim's body is literally pushed forward, out from under their head – the head is not thrown backwards. The neck muscles must eventually pull the head forward, and that causes the whiplash. To avoid this, use the car's headrests.

19. The truck bed exerts a force of static friction on the crate, causing the crate to accelerate.

20. On the way up, there are two forces on the block that are parallel to each other causing the deceleration – the component of weight parallel to the plane, and the force of friction on the block. Since the forces are parallel to each other, both pointing down the plane, they add, causing a larger magnitude force and a larger acceleration. On the way down, those same two forces are opposite of each other, because the force of friction is now directed up the plane. With these two forces being opposite of each other, their net force is smaller, and so the acceleration is smaller.

21. Assume your weight is W. If you weighed yourself on an inclined plane that is inclined at angle θ, the bathroom scale would read the magnitude of the normal force between you and the plane, which would be $W\cos\theta$.