Answer on Question #45269, Physics, Mechanics | Kinematics | Dynamics

Pulling a body is easier or pushing. Why?

Solution:

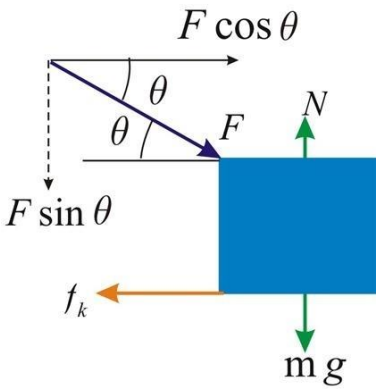
It depends on the direction of the force vector use to push or pull. If the two directions are equal, and the position of the force vectors are consistent with each other, then the amount of force to push would be the same as the amount of force to pull.

A body starts to move when the applied force is more than the frictional force, which acts in a direction opposite to that of the motion of the body.

When we move a body shorter than us, (a lawn mower, for example) the force applied is not horizontal.

When a force (F) is applied to a body at an angle `θ', it is equivalent to applying a horizontal force of F Cosθ and a vertical force of F Sinθ. Where `θ' is the angle of the line of action of the force to the horizontal. This is termed as resolving the forces). F Cosθ is the horizontal component and F Sinθ is called the vertical component.

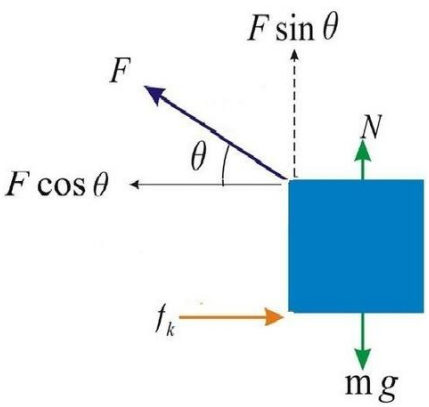
See this Free Body Diagram for Pushing:



Notice that **Fsinθ** acts **downwards** along with the weight **mg** and therefore increases the normal reaction N (Normal reaction is equal to sum of all the vertical forces). And friction is directly dependent on Normal reaction. More is N more is the frictional force.

When we pull a body, the vertical component acts upward. So pulling a body of weight `W' by applying the same forces `F' at an angle θ', is equivalent to moving a body of weight mg - (F Sinθ) with a horizontal force F Cosθ.

See this Free Body Diagram for Pulling:



Notice that **Fsinθ** acts upwards along with the weight **mg** and therefore decreases the normal reaction N. Therefore the frictional force is reduced.

Thus, when you push there is one component of force that adds to the weight of the body and hence there is more friction. When you pull the vertical component of force is against the weight of body and hence there is less overall friction. So it is easy to pull than push an object.

Answer: When the force applied to body is not horizontal, it is easy to pull than push an object.