

Forces in Equilibrium – Extra Practice

- 1) A box weighing 200 N sits on a cement floor. The coefficient of static friction between the box and floor is 0.25. A man is pushing the box with a horizontal force of 35 N. What is the magnitude of the force of static friction between the box and floor?

- 2) A 100-N block is suspended by two ropes. Each rope makes an angle of 45° above the horizontal. What is the magnitude of the tension force in each rope?

- 3) A child pulls on the rope handle of a toy crate by holding the rope at an angle of 20° above the level floor. The crate weighs 85 N and the coefficient of static friction between the crate and the floor is 0.385.
 - a) If the child pulls with a force of 25 N, does the crate move? Why or why not?

 - b) Keeping the rope at the same angle, the child pulls harder on the crate. This time, he is able to move the box and is now exerting an amount of force that keeps the crate moving at a constant speed. If the coefficient of kinetic friction between the crate and the floor is 0.295, how much tension is now in the rope?

 - c) The child's little brother decides to help him and pushes the crate, such that both of them are going in the same direction. If the little brother holds his arms horizontally and pushes with a force of 7 N, with how much force does the child now need to pull in order to keep the crate moving at a constant speed?

- 4) A man applies a 60-N force to move a box across a level surface with his arms held at an angle of 35° below the horizontal. If the box is moving at a constant speed,
 - a) How much friction is acting on the box?

 - b) If the box weighs 120 N, what is the coefficient of kinetic friction between the box and the floor?

 - c) More contents are placed in the box, such that it now weighs 20 N more. If the man pushes at the same angle, what force does he need to apply to keep the box moving at a constant speed?

 - d) Now what is the coefficient of friction between the box and the floor?

 - e) What is the frictional force now acting on the box?

Solutions:

1) 35 N

2) The tension in each rope is 71 N.

3) a) No; the child would need to pull with at least 31 N of force to overcome the force of static friction acting on the box.

b) 24.1 N

c) 17.4 N

4) a) 49 N

b) 0.32

c) 70 N

d) 0.32 (It is a constant property based on the material of the box and the floor.)

e) 57 N