1. D According to Newton’s First Law, an object maintains a constant velocity if the net force acting on it is zero. Since the two forces in D cancel each other out, the net force on the particle is zero.

2. B Newton’s First Law tells us that a net force of zero is acting on an object if that object maintains a constant velocity. The car going around the racetrack in statement I has a constant speed, but since its direction is constantly changing (as it’s going in a circle), its velocity is also changing, and so the net force acting on it isn’t zero.The person in statement II exerts a force on the door, but neither she nor the door actually moves: the force is exerted so as to hold the door in place. If the door isn’t moving, its velocity is constant at zero, and so the net force acting on the door must also be zero.Though no one is pushing on the soccer ball in statement III, some force must be acting on it if it slows down and comes to a stop. This is a result of the force of friction between the ball and the grass: if there were no friction, the ball would keep rolling.Since the net force is zero only in statement II, B is the correct answer.

3. E Newton’s Second Law tells us that F = ma. From this we can infer that a = F/m. Since F is directly proportional to a, quadrupling F will also quadruple a. And since m is inversely proportional to a, halving m will double a. We’re quadrupling a and then doubling a, which means that, ultimately, we’re multiplying a by eight.

4. C Newton’s Second Law tells us that . The net force acting on the object is: 15 N left – 5 N right = 10 N left. With that in mind, we can simply solve for A:

5. E 70Since the block is motionless, the net force acting on it must be zero. That means that the component of that pulls the block to the left must be equal and opposite to the component of that pulls the block to the right. The component pulling the block to the right is sin 60 = (0.866)(10.0 N). The component pulling the block to the left is sin 30 = 0.500 . With these components, we can solve for :

6. A In both cases, the spring scale isn’t moving, which means that the net force acting on it is zero. If the person in scenario 1 is pulling the spring scale to the right with force F, then there must be a tension force of F in the string attaching the spring scale to the post in order for the spring scale to remain motionless. That means that the same forces are acting on the spring scale in both scenarios, so if the spring scale reads 50 N in scenario 1, then it must also read 50 N in scenario 2. Don’t be fooled by the lengths of the pieces of string. Length has no effect on the tension force in a string.

7. B Solving this problem demands an understanding of Newton’s Third Law. Since the person exerts a force to pull the string to the right, the string must exert an equal and opposite force to pull the person to the left. Further, we know that the person moves at a constant velocity, so the net force acting on the person is zero. That means there must be a force pushing the person to the right to balance the string’s reaction force pulling to the left. That other force is the reaction force of the Earth: the person moves forward by pushing the Earth to the left, and the Earth in turn pushes the person to the right. This may sound strange, but it’s just a fancy way of saying “the person is walking to the right.”

8. E The weight of any object is the magnitude of the force of gravity acting upon it. In the case of the man, this force has a magnitude of:

9. D 71The force needed to move the crate is equal and opposite to the maximum force of static friction, where is the coefficient of static friction. Therefore, the magnitude of the force parallel to the floor is

10. C When the person is pushing on the moving box, the box accelerates, meaning that F is greater than the force of kinetic friction, . When the box is at rest, the person is unable to make the box move, which means that the maximum force of static friction, , is greater than or equal to F.You may be tempted by D: the box isn’t moving, so the force of static friction perfectly balances out the pushing force exerted by the person. However, is the maximum coefficient of static friction. The force of static friction is always only enough to resist the pushing force, so it’s possible that the person could apply a greater force and still not make the object budge. Also, note that B states a physical impossibility. The coefficient of static friction is always greater than the coefficient of kinetic friction.