PHYSICS 117 – HOMEWORK SET 2

Q 1 Before jumping, you are moving at the same speed as the walls, the floor, the air in the room, etc.... Upon jumping, nothing exerts a force that would slow you down (gravity only pulls you down), so the wall comes no closer.

Q 3 Newton's law suggests that some force acts in the opposite direction of the book's motion so that it slows down: friction between the book and table.

Q 7 The acceleration of the car pulls on the end of the tassel where it attaches to the mirror. The free end is pulled by the attached end, but only after a slight delay. The free end would remain motionless until pulled, and would not be able to catch up to the attached end.

Q 9 Without the force of the seat belt, your body would continue at its original speed while the windshield slowed down.

Q 10 The term is 'whiplash'—in a rear-end collision, the seat transfers the force of the colliding car to your body and moves you forwards; without the headrest, your head remains behind until your neck pulls it forwards like the tassel of Q 7.

Q 15 The answer is no. It is simply a fact about vectors that the sum of a set of vectors need not point in the same direction as any vector in the set.

Q 17 Another fact about vectors is that the magnitude of the sum of two vectors with equal magnitudes may be anywhere between zero and twice the magnitude of the vectors. In this case, depending on how the people pulling on the ropes are arranged around the car, the net force could be anywhere between zero and 1400 N.

Q 21 The acceleration is always in the direction of the net force, regardless of the velocity of the object. Thus, the boat accelerates due east in both cases.

Q 39 The velocities of both crates are both constant; thus, regardless of the velocities' magnitudes, the accelerations are both zero.

Q 43 The acceleration of the freezer is zero, so the net force is zero; thus, the frictional force must be equal (and opposite) to your force.

Q 59 The horse moves across the ground, as do people, through the frictional force between the horse's feet and the ground. If this force is greater than the force of the cart, then the horse moves forwards. If the force of the horse on cart is then greater than friction on the cart wheels, the cart also moves forwards.

Q 26 The acceleration is proportional to the force, so if the force doubles, the acceleration does, too.

E 1 a) 8 + 6 = 14, b) 8 – 6 = 2, c)right triangle: $\sqrt{(8)^2 + (6)^2} = 10$.

E 7 $a = \frac{F}{m} = \frac{5000 \text{ N}}{50{,}000 \text{ kg}} = .1 \text{ m/s}^2$.

E 11 $F = ma = (1200 \text{ kg})(3 \text{ m/s}^2) = 3600$ N. The final velocity does not matter.

E 2 a) 5 + 12 = 17, b) 12 - 5 = 7, c) right triangle: $\sqrt{(12)^2 + (5)^2} = 13$.

E 12 $a = \frac{W}{m} = \frac{50 \text{ N}}{30 \text{ kg}} = 1.67 \text{ m/s}^2$.

E 23 Presumably, there is no friction acting on the skaters, and the gravitational force is balanced by the ice pushing upwards. The force of the mother on daughter should equal the net force on the daughter, and this should equal the force of daughter on mother. The force on the daughter is $(25 \text{ kg})(2 \text{ m/s}^2) = 50$ N. The force on the mother is the same. The mother's acceleration is then $a = \frac{F}{m} = \frac{50 \text{ N}}{50 \text{ kg}} = 1 \text{ m/s}^2$.