Name _____

Newton's 1st Law: An object moving at a constant velocity will continue at that constant velocity until a net external force acts to change it. (Note that at rest ($v = 0$) is a special case of a constant velocity)

- If $a = 0$, $\iff F_{net} = 0$
- If $a \neq 0$, $\iff F_{net} \neq 0$

1. How can each of these situations be explained from Newton's 1st law?
   When you slam your foot on the brake of your car, you lunge forward (when not wearing a seatbelt).

   When you hit the gas and your car rapidly accelerates, you are pressed backwards against the seat.

   When you round a curve, you feel yourself pushed against the side of the car.

   If you are trying to get ketchup (or shampoo, soap, etc) out of a bottle, the best way to do it is to turn it upside down and give it a sharp *upward* smack, forcing the bottle to quickly move upward.

   Concussions and bodily injuries, like in a car crash

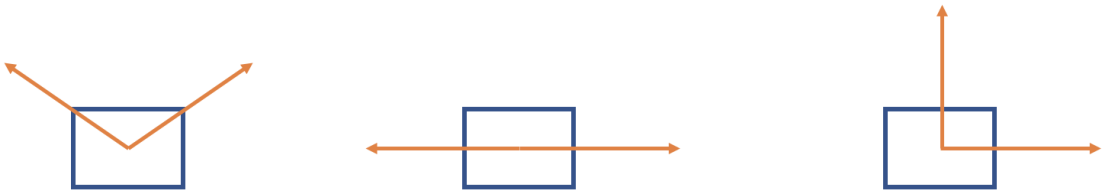
   Why are child safety seats installed such that the child faces the rear of the car?

2. Is the following statement correct? An object at rest or moving at a constant velocity has no forces acting on it. **A**: Yes, **B**: No

3. How much force does it take to keep a $1kg$ object moving at a constant $+5m/s$, in the absence of friction, air resistance or other forces? **A**: 5N, **B**: 0N **C**: -5N

4. Suppose the net force acting on an object is zero. **A**:True, **B**:False
   (a) The object must be at rest.
   (b) The object could be accelerating.
   (c) The object's velocity could be changing.
5. Suppose a box is accelerating because exactly two forces are acting on it. **A**:True, **B**:False
   (a) The velocity of the box can never be zero.
   (b) The sum of the two forces cannot be zero.
   (c) The forces must be pushing in the same direction.

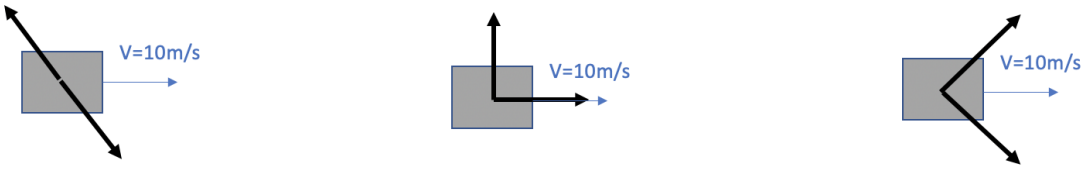
A box starts at rest and has two forces of equal magnitude acting on it. Sketch the direction the box will move, if at all.



6. A rocket is moving sideways in deep space with its engine off from A to B. It is not near any stars or planets or other outside forces. Its engine is fired at point B and left on for $2s$ while the rocket travels from point B to some point C. Draw in the shape of the path from B to C. Then show the path from point C, after the engine is turned off.

C

7. Suppose an object is moving with a constant velocity of $10m/s$ to the right. It has two forces of equal magnitude acting on it as shown in the different cases. For each case, indicate whether the object will accelerate and if so, indicate the direction. Make a sketch of the path of the object.



8. What is inertia? Why is Newton's 1st law often called the Law of Inertia?