If you are sailing a 131-foot two-masted schooner on a steady eastward heading at 15 knots (i.e., 15 nautical miles per hour), what does your ship have?
a. A net force that is nonzero
b. A nonzero acceleration
c. A severe tilt to leeward likely to roll crewmembers on the windward side right out of their bunks
d. None of the above

Now explain the reasoning underlying your choice in the first question.

Key is recognizing that acceleration is zero

I put none of the above because if the ship is moving at a constant velocity, then the rate of change of the velocity, or the acceleration, would be zero. Therefore, if the acceleration is zero, the net force on the object would also be zero. Thereby eliminating the first two choices.

A more expansive response that addresses C.

I chose option d. (None of the above) for question one.

I chose this because it said it was sailing at a steady eastward heading at 15 knots. This means that the schooner would have constant velocity. Acceleration refers to the rate of change of velocity. **If the velocity is constant, then the acceleration would be zero. This eliminates b.**

Newton's second law states that the net force exerted on a body is proportional to its acceleration. **Therefore, the net force would have to be zero since the acceleration is zero.** This eliminates a.

Option c. just sort of did not make sense to me. If the schooner was tilting and moving enough to roll crewmembers out of their bed, I would think it would be difficult to say the boat was truly maintaining a constant eastward direction, but it is. So I don't think option c. would be correct.

So why does it intuitively seem that there needs to be a force?

I chose "a net force that is nonzero".I eliminated C because it had nothing to do with newtons law. I also eliminated B because horizontal acceleration will remain zero. **I chose A because a net force is when acceleration depends on the sum of all the factors acting on it (in this case, wind and the current).** I would assume moving eastward indicates it is moving in a positive direction. net force would be >0.

For example, a runners parachute. **A runner runs with a parachute on their back so there is resistance while they are running. The parachute is pulling back on the runner while the runner is pulling forward on the parachute. In this case, the net force would be positive because the runner should exert more force going forward than the parachute exerts pulling back.**

The engine on a fighter airplane can exert a force of about 100,000 Newtons (which is equivalent to 24,000 pounds). The take-off mass of the fighter plane is about 17,000 kg. (Which means its weight is 37,500 pounds.) If you mounted the airplane engine on your car, what acceleration would you get? (Use a reasonable estimate for the mass of your car.)

Straightforward, good approximation

I would assume that a car weighs about two tons, so 2,000 kg. Assuming this, and knowing that Acceleration equals the net force divided by the mass, I can assume that the **acceleration is equal to 100,000 N divided by 2,000 kg. The acceleration will equal around 50 N/kg (m/s2).** This seems like an accurate acceleration for a car with a jet rocket attached to it.

Another good example, still needing the calculator crutch!

I drive a SUV which should weigh around 2000 kg. Using the scalar formula F=ma, the acceleration can be found.

Estimations: F=ma, 100,000N=20,000kg x a(m/s^2), 5m/s^2= acceleration

Cal: 100,000N= 19,000kg x a(m/s^2), 5.26 m/s^2 = acceleration

Problem with using Imperial units and answer doesn't seem reasonable

I estimate my car is around 1.5 tons which is about 3,000lbs. Since F_{net}= ma we can rearrange this to a=\frac{F_{net}}m to find acceleration. Using this equation the acceleration of my car with a fighter plane engine would be **a =\frac{24,000lb\frac{m}s^2}{3000lb}** which is about \frac{24}3 =8 . From this I can assume that if I strapped a plane engine onto my car I would have an acceleration of 8\frac{m}{s^2}