

DAY 22 - Homework

1. Discuss whether the following are inertial reference frames:
 - (a) a table in a lab room that is bolted to the floor.
 - (b) an airplane cruising at 35,000 ft moving a steady 500 mph with no turbulence.
 - (c) a car traveling at 30 mph on a smooth, straight road.
 - (d) a car traveling at 30 mph moving around a gentle turn.
 - (e) a car traveling at 30 mph moving around a sharp turn.
 - (f) an airplane accelerating down a runway.
 - (g) a bus braking from 50 mph to 20 mph.
2. Discuss whether the following statement is true.

"The table in front of you is smooth and horizontal. You take a large, smooth marble, place it on the table in front of you, and let it go so it is stationary with respect to the table. The marble does not move. You are in an inertial reference frame."
3. Discuss whether the following statement is true.

"The table in front of you is smooth and horizontal. You take a large, smooth marble, place it on the table in front of you, and let it go so it is stationary with respect to the table. The marble does not move. You are at rest."
4. An airplane moving at 250 mph with respect to air (250 mph air speed) has a gun in a turret that can fire both forward and rearward. The bullets leave the gun at 1200 mph with respect to the gun:
 - (a) Calculate the speed of the bullets with respect to air if the turret is firing forward.
 - (b) Calculate the speed of the bullets with respect to air if the turret is firing rearward.
 - (c) What is the percent difference in Kinetic Energy (with respect to air) between bullets shot forward and bullets shot rearward?



<http://www.howto-onlinebooks.com/LancasterPS.jpg>

If the plane has an air speed of 250 mph but is flying into a 20 mph headwind:

- (a) find the speed of the bullets with respect to the Earth if the turret is firing forward.
- (b) Calculate the speed of the bullets with respect to Earth if the turret is firing rearward.

5. A toy tank moves to the right at 0.5 m/s. Its gun is 10 cm above the ground and shoots marbles directly forward with a speed of 2.5 m/s relative to the tank.



- At the moment when the front of the tank is at the blue arrow, its gun shoots a marble which hits the ground at the yellow arrow. The arrows are painted on the ground. Calculate the distance between the blue and yellow arrows from the ground's reference frame (ground is at rest, tank is moving).
6. Calculate the distance between the blue and yellow arrows from the tank's reference frame (tank at rest, ground is moving). Did you get the same answer as in the above question? You should, if the laws of physics are the same in all inertial reference frames.