

Relative Motion


Motion is relative

All motion is relative to the observer or to some fixed object.

When you see a car drive by, it is moving with respect to you.

If you are in a car that is going at the same speed, the other car will not be moving respect to you.

But both cars are moving with respect to the ground.

 <http://video.google.com/videoplay?docid=5045171464168585988>

Point of reference

In talking about motion, it is important to indicate your point of reference.

In the case of moving automobiles, it is usually assumed the speed is with respect to ground. But there are situations where the speed or velocity may be with respect to another object or an observer.

For example, suppose a car was traveling at 60 km/h and hit another car, but there was hardly a dent. The reason is that the second car was traveling in the same direction at 59 km/h, so the car was going only 1 km/h with respect to the second car when it hit.

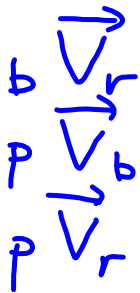
Sun looks like it is moving in the sky

Another example of relative motion is how the sun appears to move across the sky, when the earth is actually spinning and causing that apparent motion.

Relative Motion

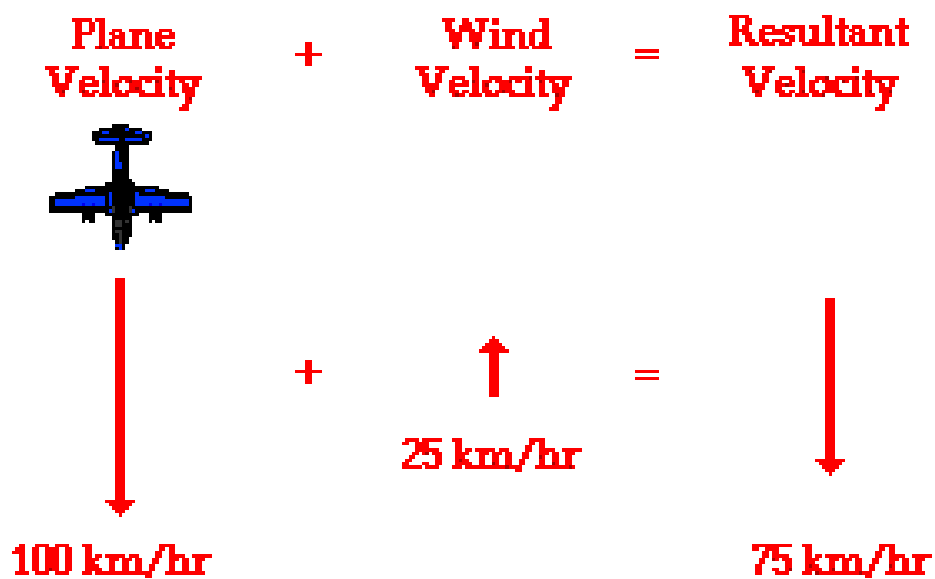
A bus is travelling at 18 m/s. If a passenger walks to the front of a bus at 3.0 m/s, what is her velocity relative to the bus?

...relative to the road?

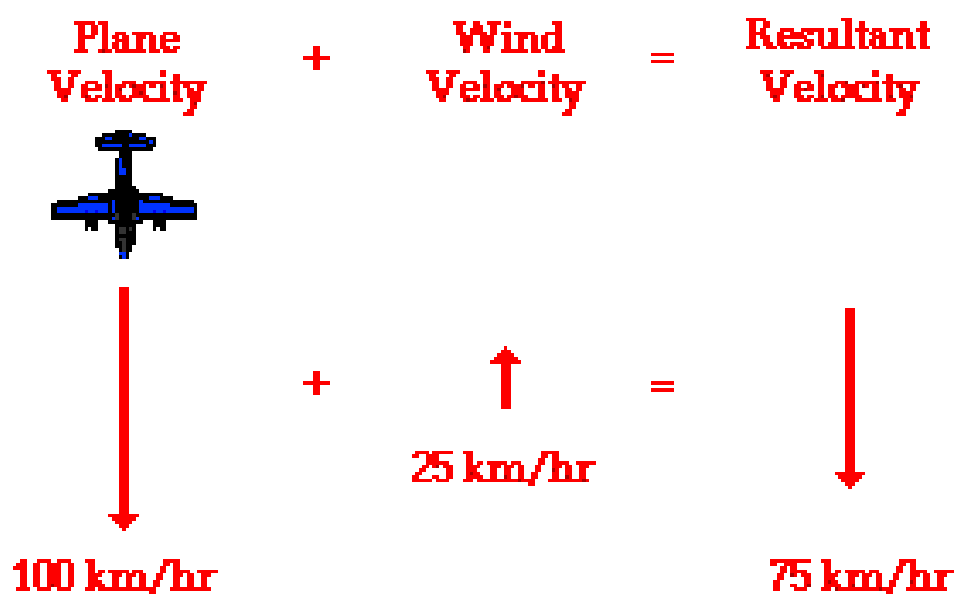


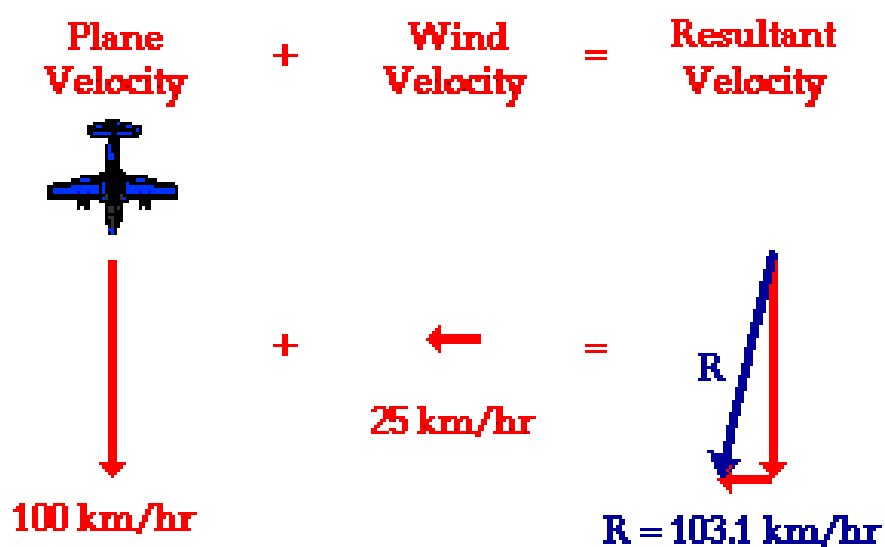
$$\begin{array}{c}
 \rightarrow \\
 \downarrow \\
 p \quad V_b \\
 \circledast \\
 3
 \end{array}
 +
 \begin{array}{c}
 \rightarrow \\
 \downarrow \\
 \circledast \quad V_r \\
 18
 \end{array}
 =
 \begin{array}{c}
 \rightarrow \\
 \downarrow \\
 p \quad V_r \\
 21 \text{ m/s}
 \end{array}$$

A bus is travelling at 18 m/s. If a passenger walks to the back of a bus at 3.0 m/s, what is her velocity relative to the bus?
...relative to the road?



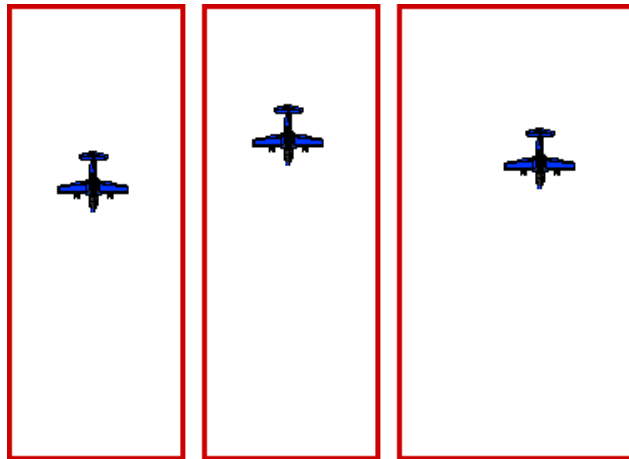
Car A is moving North at 65 km/h and car B is moving North at 55 km/h along the same road. What is the velocity of car A with respect to car B?





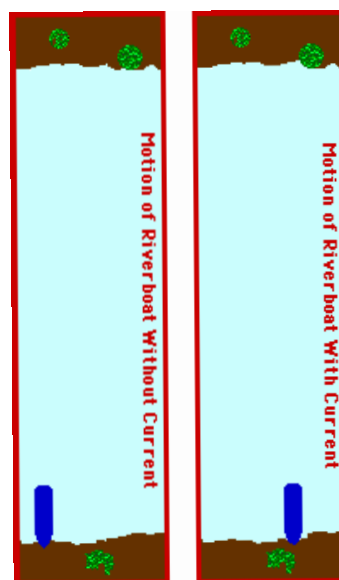
Which is which???

Crosswind, tailwind, or headwind?



A boat can travel at 4.0 m/s in still water. If a river current moves at 3.0 m/s, find the velocity of the boat if it goes

- (a) downstream
- (b) upstream
- (c) across stream




A boat can travel at 4.0 m/s relative to the water. The current is 3.0 m/s. If the boat is to travel directly across the river, at what angle must the boat head?

A Piper Colt can travel at $125\text{km/h}[\text{N}]$ but there is a crosswind of $55\text{km/h}[\text{E}]$.

(a) What is the plane's velocity?

(b) What direction does the plane need to head in order to travel due North?



 <http://www.youtube.com/watch?v=pv5zWaTEVkl>

An aircraft can fly at 100 km/hr [S] in still air. The wind is blowing at 25 km/hr. Find the velocity of the plane relative to the ground if the wind is blowing to the:

- [South]
- [North]
- [West]
- What must be the plane's **heading** in order to fly due south when the wind is blowing West?

* 'in still air' \rightarrow same as 'relative to the ground'
 \rightarrow plane's \vec{v} not affected by wind

Read p. 95-98

p. 116 #35, 36a&c, 39a&b, 41

Worksheet #6 - Relative Velocity in 2 Dimensions

