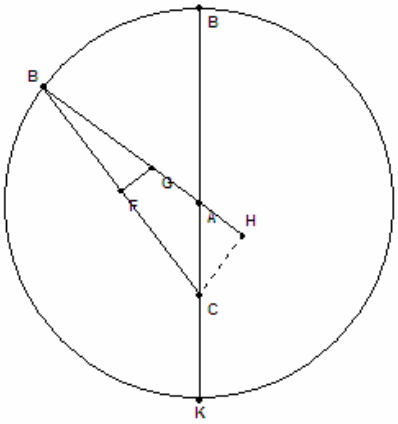
The Key Radial and Tangential Components

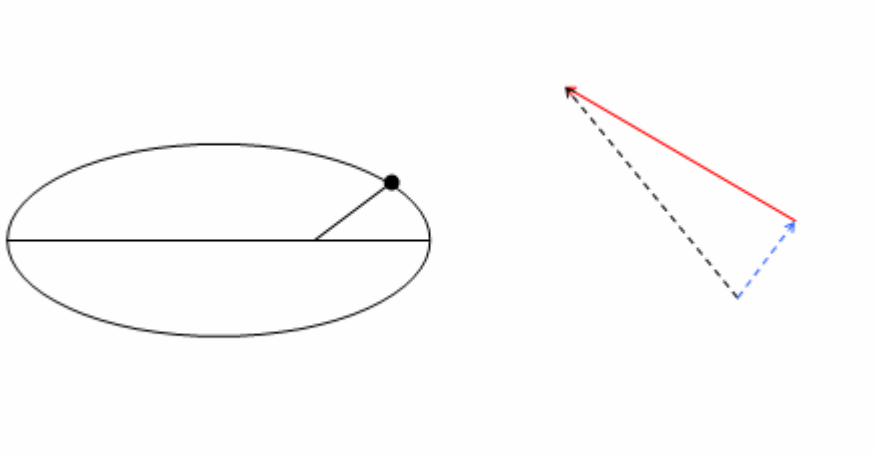
Like Chapter 13, this chapter is another pause for visualization of velocity components that are represented in the hodograph. If I have been presenting things nicely so far, you will be able to visualize that the actual total velocity of the planet can be broken down into two components that are at right angles to each other. One is the component of velocity along the radius to the Sun and the other is at a right angle to this radius. It is worthwhile to examine total velocity broken into these basic radial and tangential components, all being represented in the hodograph.



Total velocity is represented by $\overline{CB}$

Radial and tangential velocity in the hodograph

In Chapter 4 we saw that there is a correct way to break velocity arrows into component velocity arrows. Using that knowledge we see that if we have the correct magnitude and direction for both tangential and total velocity we can get the third component which is the radial velocity. It is the missing dashed blue arrow in the arrangement below:



Let the black dashed arrow represent total velocity of the planet and the red arrow represent tangential velocity of the planet. We learned earlier in Chapter 3 that a vector is identical to the sum of its perpendicular components. To clarify, we may choose to break a vector into components that are perpendicular to each other. Here we choose tangential velocity to be one of the components of total velocity. The other component must be perpendicular to tangential velocity as stated. Since the red arrow represents tangential velocity which is perpendicular to the radius from the Sun to the planet, its perpendicular is parallel to the radius to the Sun. Thus the blue arrow which is perpendicular to tangential velocity represents radial velocity. And so, radial velocity is represented by the segment $\overline{CH}$ in the hodograph above wherein $\overline{CB}$ represents total velocity and $\overline{HB}$ represents tangential velocity.

At this point the reader should have a solid familiarity with the definitions and orientations of total velocity, tangential velocity, and radial velocity.