

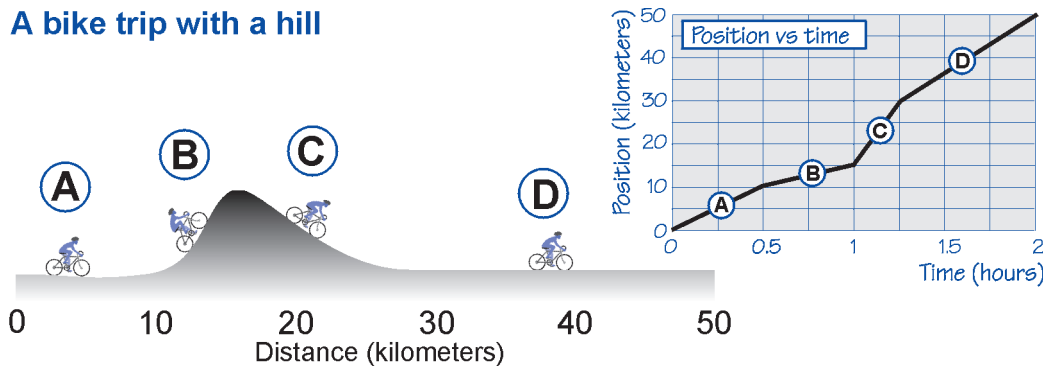
Instantaneous and average speed

Speed does not usually stay constant Does your speed stay exactly the same during a real trip? The answer is, of course not. Your speed is almost always changing. You slow down for stop lights, and speed up to pass people. For the next example, consider taking a bicycle trip. You may remain on flat ground for moment, but eventually you come to a hill. As you climb the hill, you slow down. As you go down the hill, you speed up.

Average speed There are two ways you should think about speed. If it takes you 2 hours to ride 50 kilometers, your **average speed** is 25 kilometers per hour (25 km/h). To calculate average speed, you simply take the total distance traveled divided by the total time taken.

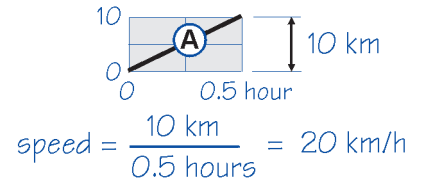
Instantaneous speed At some points along the way, you may go slower, or faster than average. The **instantaneous speed** is the speed you have at a specific point in your journey. You might go uphill at 10 km/h and downhill at 60 km/h, with an average speed of 25 km/h even though your speed was never exactly 25 km/h at any time in the trip!

A bike trip with a hill

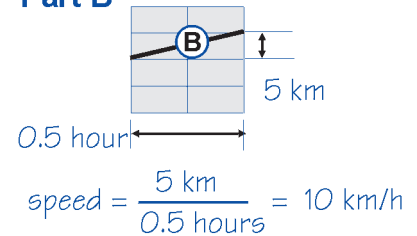


The position vs. time graph The real story is told by the position vs. time graph. The graph captures both the instantaneous speed and the average speed. If the slope of the graph is steep (**C**), you have lots of position changing in little time (figure 2.12) indicating a high speed. If the slope is shallow (**B**), relatively little position changes over a long time, giving a slow speed. If the graph is level the slope is zero, so the speed is also zero, indicating you have stopped and are not moving.

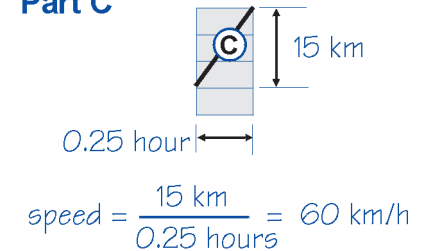
Part A



Part B



Part C



Part D

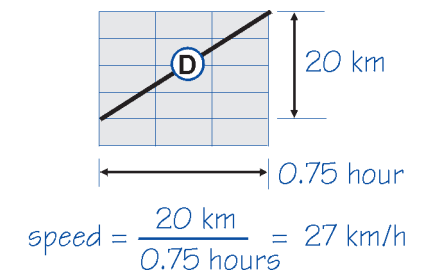


Figure 2.12: Calculating the speed of each part of the trip.