

3.4 The Instantaneous Average Speed

Zip and Zap are taking a ride in a car and wrestle with how to compute average speed of an object.

Zip: *(driving a car and looking over at Zap)* I've got a riddle for you Zap.

Zap: *(reclined way back in the passenger seat)* Hit me.

Zip: You are travelling to a town nearby, and want to average 60 mph on the way to your destination. When you are half way to your destination, you realize you have averaged 30 mph. How fast do you have to drive on the second half to average 60 mph?

Pause the dialogue for 2 minutes and discuss what you think the answer to Zip's question is.

Zap: Boy, I think the answer is probably ninety miles per hour. That seems logical.

Zip: You'd think that but try it.

Zap: What do you mean try it? You're the one driving.

Zip: I mean in your head. This problem is missing one vital piece of information.

Zap: I noticed that. It doesn't tell you the distance travelled.

Zip: You got it. Make up a distance.

Zap: Sure. Let's say they go 100 mil...

Zip: *(interrupting Zap)* No no no no. Make up an easier distance like 120 miles.

Zap: Why is 120 miles easier? Isn't 100 miles easier?

Zip: Nope. Check this out. If he travels 120 miles and wants to average 60 mph, how long does it have to take him?

Zap: Two hours.

Zip: Correct. So he has to complete his journey in two hours to average 60 mph.

Zap: I think I see where this is going. So when he is half way, which is 60 miles, you told me he averaged 30 mph. Going 60 miles at 30 miles per hour means it took him two hours for the first half of the journey.

Zip: Do you see any problem with that?



Zap: No.

Zip: How long does he have to make the entire journey of 120 miles?

Zap: Two hours.

Zip: How long did it take him to do the first half?

Zap: Two hours...DOH! I see now! He has to do the second half of his trip instantaneously!

Zip: You got it! There is no possible speed that you can go to average 60 mph if you did the first half in 30 mph. You'd have to go to ludicrous speed!

Zap: But what if we went 100 miles. Would it work then?

Zip: Nope. You'd run into the same problem, the calculations would give you decimal answers instead of nice round numbers. It works with different speeds too! Like 50 mph and 25; any two that have a ratio of 2:1.

Zap: Whoa. That problem seemed so easy. It was an average. It seemed like I could just add the two speeds and then divide them by two like when I take an average normally.

Zip: I know. Average speed is both distance and time. You have to take the total distance divided by the total time. Instantaneous speed is how fast you're going at one instance. They're quite different.

Zap: Sure, like if I was driving that first half at an average of 30 mph. I could have been going really fast at one point and then maybe stopped at a light. As long as I travelled that first half of 60 miles in two hours, I would average 30 mph, but my instantaneous speed could be all over the place.

Zip: You've got it! Now check this. If I go 60 miles per hour, how far do I go in a minute?

Zap: Geez. Turn the music back on. I'm done!

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