

Answer #2

The answer is (b); the ball on the dipped track gets to the end first and wins the race. The two balls go along together for the first part of the race. As the ball on the dipped track goes down, its horizontal velocity increases, so *it gets ahead*. When it returns to its original level, it *slows down to its original horizontal speed*, but in so doing it never goes slower than the ball on the flat track, so it never gets behind the other ball or even allows the flat track ball to catch up. The two balls then move along at the same speed with the dipped track ball remaining ahead of the straight track ball by a constant amount.

Click on the photograph of the apparatus below for a video showing this demonstration in action.



The same thing happens when two people are walking along a straight flat road. If one of the two runs for a short time (the dip) then slows down to the original walking speed, the runner will get ahead during the time he or she is running. After slowing back down to the same walking speed, the two will then move along at the same speed but the one who ran will remain a constant distance ahead of the person who walked the whole time.

A more mathematical way of "discovering" this result is to draw graphs of horizontal velocity versus time for each of the two balls. Then draw curves of the integral of the velocity curves for each, which are the horizontal position versus time for each of the balls. After the ball on the dipped track returns to its original level its horizontal position can be observed from the graph to be greater than that of the ball on the flat track for any time.

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