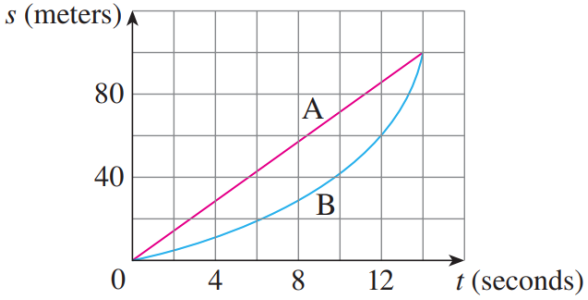
Exercise 12

Shown are graphs of the position functions of two runners, A and B, who run a 100-meter race and finish in a tie.



(a) Describe and compare how the runners run the race.

(b) At what time is the distance between the runners the greatest?

(c) At what time do they have the same velocity?

Solution

Part (a)

Runner A travels at a constant speed for the whole race, whereas runner B starts off slow and gradually increases speed throughout the race. They both arrive at the finish line at the same time (14 seconds).

Part (b)

For as long as runner B is running slower than runner A, the distance between them increases. Only after $t = 10$ does runner B have equal or greater speed than runner A, and the distance between them begins to decrease. The distance between them at $t = 10$ is about
70 meters $-$ 40 meters $=$ 30 meters.

Part (c)

They have the same velocity when the slope of the tangent line to runner B's position graph is the same of the line for runner A. This occurs at $t = 10$ seconds.