Answer on Question #47260-Physics-Other

Runner A is initially 4.0 mi west of a flagpole and is running of 6.0 mi/h due east. Runner B is initially 3.0 mi east of the flagpole and is running with constant velocity of 5.0 mi/h due west. How far are the runners from the flag pole when they meet?

Solution

This is a more challenging problem. We start out by identifying our coordinate axis and origin. We take the flagpole to be the origin and the East direction as positive and West direction as negative. Each runner has an equation of motion written relative to the location of the flagpole:

RUNNER A: he is 4.0 mi west of the pole and running east. His initial location is negative, and his velocity is positive:

$$X(A) = -4.0\,mi + \left(6.0\frac{mi}{h}\right)t$$

RUNNER B: he is 3.0 mi east of the flagpole and running west. His initial location is positive and his velocity is negative:

$$X(B) = 3.0\,mi - \left(5.0\frac{mi}{h}\right)t$$

We first find the time it takes for them to meet by setting each equation equal to each other, then solve for t:

$$X(A) = X(B)$$

$$-4.0\,mi + \left(6.0\frac{mi}{h}\right)t = 3.0\,mi - \left(5.0\frac{mi}{h}\right)t$$

$$\left(11.0\frac{mi}{h}\right)t = 7.0\,mi$$

$$t = \frac{7.0\,mi}{11.0\frac{mi}{h}} = 0.636\,h.$$

Now that we know when they meet, we can find their distance to the flagpole by plugging this time into either equation. To check your answer, plug it into both equations and you should get the same answer:

$$X(A) = -4.0\,mi + \left(6.0\frac{mi}{h}\right)(0.636\,h) = -0.18\,m$$

$$X(B) = 3.0\,mi - \left(5.0\frac{mi}{h}\right)(0.636\,h) = -0.18\,m.$$

The answers match which means we must have done this right.

Answer: $-0.18\,m$.