

Name:

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Section

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The Masters School

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DOBBS

Physics



Position and Velocity II

1. The British woman who won the NYC marathon this year, Paula Radcliffe, also holds the world marathon record, 2 h 15 m 25 s. The marathon distance is 42.195 km, or 26.2 miles. Determine her average speed in m/s AND minutes/mile of a runner achieving this record.

$$2 \text{ hrs } 15 \text{ min } 25 \text{ sec} = 8125 \text{ sec}$$

$$V_{\text{avg}} = \frac{\Delta x}{\Delta t} = \frac{42,195 \text{ m}}{8125 \text{ sec}} = 5.19 \text{ m/sec}$$

$$V_{\text{avg}} = \frac{\Delta x (\text{miles})}{\Delta t (\text{min})} = \frac{26.2}{135.4} = .1934 \text{ miles/min}$$

$$\frac{1}{\text{ANS}} = 5.17 \text{ min/mile}$$



2. Runner A is initially 5.0 km west of a flagpole, and is running with a constant velocity of 3.5 km/h due east. Runner B is initially 4.0 km east of the flagpole and is running with a constant velocity of 2.5 km due west. Where are the runners in relation to the flagpole when their paths cross? Give a displacement in kilometers.

Diagram labels: $\Delta x_A = 5.25$, $\Delta x_B = 3.75$, 5 km , 4 km , 0.25 km , $V_A = 3.5 \text{ km/h}$, $V_B = 2.5 \text{ km/h}$, $\Delta t_A = ?$, $\Delta t_B = ?$, $\Delta t_A = \Delta t_B$.

Equations:

$$V = \frac{\Delta x}{\Delta t} \quad \therefore \quad \Delta t = \frac{\Delta x}{V} = \frac{\Delta x_{\text{tot}}}{V_{\text{tot}}} = \frac{\Delta x_A + \Delta x_B}{V_A + V_B} = \frac{9 \text{ km}}{6 \text{ km/h}} = 1.5 \text{ hrs}$$

$$\Delta x_A = V_A \Delta t_A = (3.5 \text{ km/h})(1.5 \text{ hrs}) = 5.25 \text{ km}$$

$$\Delta x_B = V_B \Delta t_B = (2.5 \text{ km/h})(1.5 \text{ hrs}) = 3.75 \text{ km}$$

Final Answer = 0.25 km East of flagpole

by Collin + Blair
Bennett

3. A tortoise can run with a speed of $.16 \text{ m/s}$, and a hare can run exactly 15 times as fast. In a race, they both start at the same time, but the hare stops to rest for 2.00 min . If the tortoise wins by 20 cm ,
- How long does the race take? Give your answer in seconds, you should get an answer between $100 - 150$ seconds.

- What is the length of the race?