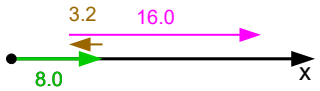
Chapter 3 Problem 28 [†]



Given
$\vec{d_1} = 8.0\ km$ east
$t_1 = 20\ min$
$\vec{d_2} = 3.2\ km$ west or $d_2 = -3.2\ km$
$t_2 = 8.0\ min$
$\vec{d_3} = 16.0\ km$ east
$t_3 = 40\ min$

Solution
a) Find the displacement of the cyclist.

Displacement is the sum of all the distances traveled, taking into account the directions east (+) and west (-).

$$\vec{d} = \vec{d_1} + \vec{d_2} + \vec{d_3} = 8.0 - 3.2 + 16.0 = 20.8\ km$$

In meters, this is

$$\vec{d} = 20,800\ m$$

b) Find the average velocity.

The total time is

$$t = t_1 + t_2 + t_3 = 20 + 8 + 40 = 68\ min$$

In seconds, this is

$$t = 68\ min\left(\frac{60\ s}{1\ min}\right) = 4080\ s$$

Since velocity is the time rate of change of displacement, the average velocity is then the change in position divided by the total time.

$$\vec{v}_{avg} = \frac{\vec{d}}{t} = \frac{20,800\ m}{4080\ s} = 5.1\ m/s$$

[†]Problem from University Physics by Ling, Sanny and Moebs (OpenStax)