

Answer on Question#60255 –Physics– Mechanics –Relativity

A car moves towards north at a speed of 54 km/h for 1 h. Then it moves eastward with same speed for same duration. The average speed and velocity of car for complete journey is ?

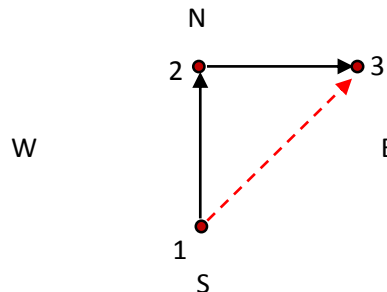
Solution.

$$t_1 = t_2 = 1h$$

$$v_1 = v_2 = 54km/h$$

$$v_{as} - ?$$

$$v_{av} - ?$$



The car was moving as shown in Figure. Red arrow shows the displacement of the car. The formula for average speed is calculated by finding the ratio of the total distance covered by the object to the time taken to cover that distance. Hence

$$v_{as} = \frac{\text{Total distance traveled}}{\text{Total time taken}}$$

The car was driving with constant speed for 2 hours. Hence

$$\text{Total distance traveled} = 2h \cdot \frac{54km}{h} = 108km$$

$$\text{Total time taken} = 2h$$

$$\text{Therefore } v_{as} = \frac{108km}{2h} = \frac{54km}{h}$$

Average velocity can be calculated by determining the total displacement divided by the total time of travel.

$$v_{av} = \frac{\text{Total displacement}}{\text{Total time taken}}$$

As can be seen from the figure, the displacement of the car is equal to the hypotenuse of a right triangle $\Delta 123$. $12 = 23 = 54km$.

Using the Pythagorean theorem for triangle $\Delta 123$ get

$$13 = \sqrt{(12)^2 + (23)^2} \rightarrow 13 = \sqrt{54^2 + 54^2} = 54\sqrt{2}km$$

$$\text{Therefore } v_{av} = \frac{54\sqrt{2}km}{2h} = \frac{27\sqrt{2}km}{h} \approx \frac{38,2km}{h}$$

$$\text{Answer: } v_{as} = \frac{54km}{h}; v_{av} = \frac{27\sqrt{2}km}{h} \approx \frac{38,2km}{h}.$$