

Answer on Question #45450, Physics, Other

Jim is driving his car at 32 m/s (72 mi/h) along a highway where the speed limit is 25 m/s (55 mi/h). A highway patrol car observes him pass and quickly reaches a speed of 35 m/s. At that point, Jim is 250 m ahead of the patrol car.

How far does the patrol car travel before catching Jim?

Solution:

Given:

$$v_1 = 32 \text{ m/s,}$$

$$v_2 = 35 \text{ m/s,}$$

$$d_1 = 250 \text{ m,}$$

$$d_2 = ?$$

If both cars are travelling in the same direction, one at 32 ms^{-1} and the other at 35 ms^{-1} then their relative velocity is $v_r = 3 \text{ ms}^{-1}$ (by vector addition).

The time to catching Jim is

$$t = \frac{d_1}{v_r} = \frac{250}{3} = 83.3 \text{ s}$$

The distance traveled by the patrol car travel before catching Jim is

$$d_2 = v_2 t = v_2 \frac{d_1}{v_r} = \frac{35 \cdot 250}{3} = 2916.7 \text{ m}$$

Answer: $d_2 = 2916.7 \text{ m}$