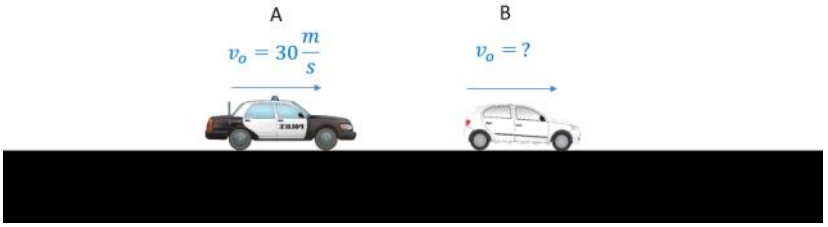
Problem 1

Relative Motion Worked Example

- A police officer notices a car speeding by. If the police car is traveling 30 m/s and the radar gun measures the relative velocity to be 15 m/s, how fast is the speeding car actually going? If the police car immediately begins accelerating at a constant rate and catches up to the speeding car after 15 seconds, what is the rate of acceleration of the police car?



$$V_{B/0} = V_{A/0} + V_{B/A} = \boxed{45\ m/s}$$

$V_{A/0}$: $30\ m/s$ ↑ $\quad$ $V_{B/A}$: $15\ m/s$ ↑

$$X_{B/0} = X_{A/0} + \cancel{X_{B/A}}^{\,0}$$ ← when cars meet

$$45t = \frac{1}{2}at^2 + 30t$$

$45t$: T $\quad$ $\frac{1}{2}at^2$: ↑ $\quad$ $30t$: ↑

$$t = 15\ s$$

$$\frac{1}{2}a(15)^2 = 15(15) \rightarrow \boxed{a = 2\ m/s^2}$$