Four Cars Problem

Solution: Let $V(A), V(B), V(C)$ and $V(D)$ be the velocities of cars A, B, C and D respectively. Let the distance and time are measured when car A crosses B. At this moment let the distance of car C is x units and that of car D is y units. Then according to the given conditions

$$\left(V(A)-V(C)\right).1 = x, \qquad \dots(1)$$

$$(V(A)+V(D).2) = y, \qquad \dots(2)$$

$$(V(B)+V(D).4) = y, \qquad \dots(3)$$

$$(V(C)+V(D).6) = y-x. \qquad \dots(4)$$

Let the time taken by car B to cross C be t. Then

$$\left(V(B)-V(C)\right).t = x$$

$$\Rightarrow \qquad t = \frac{x}{\left(V(B)-V(C)\right)}. \qquad \dots(5)$$

From (2) and (3), we have

$$V(A) = 2V(B)+V(D). \qquad \dots(6)$$

From (1), (3) and (6), we have

$$V(B)-V(C) = \frac{4x-y}{4}. \qquad \dots(7)$$

From (5) and (7), we get

$$t = \frac{4x}{4x-y}. \qquad \dots(8)$$

Subtracting ((4) from (3), we get

$$6\left(V(B)-V(C)\right) = x+\frac{y}{2}. \qquad \dots(9)$$

From (7) and (9) it can be shown that

$$y = \frac{5x}{2}.$$

Putting thtis value of y in (8), we get

$$t = \frac{8}{3} \text{ hours} = 2 \text{ hour } 40 \text{ minutes.}$$

This shows that car B will cross car C at $11:40$ h. Ans.