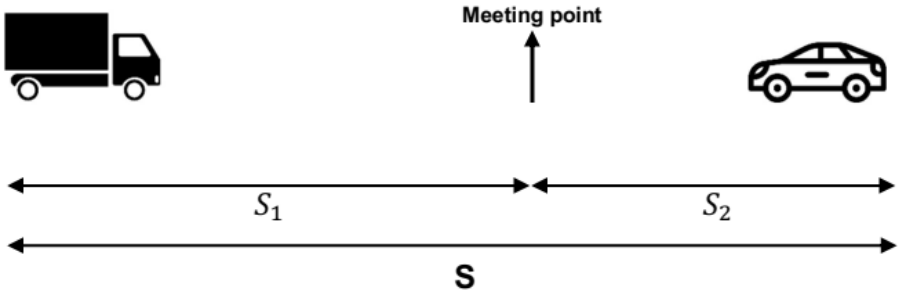
DISTANCE PATTERNS (PART 3 – MEETING WITH SCENERIO)

* Two subjects move in the opposite direction on the same road. They meet at a point after t units of time.



$$\begin{cases} S = S_1 + S_2 \\ t_1 = t_2 = t \\ S = (v_1 + v_2) \times t \end{cases}$$

Relative Speed

Takeaways:

1) When two trains are moving in the opposite direction, then **their relative speed is the sum of the two speeds.**

2)

. When a train crosses a stationary man/ pole/ lamp post/ sign post- in all these cases, the object which the train crosses is stationary and **the distance travelled is the length of the train.**

. When it crosses a platform/ bridge- in these cases, the object which the train crosses is stationary and **the distance travelled is the length of the train and the length of the object.**

3) When two trains are moving in opposite directions, then their speed will be added. **The total distance is the sum of the length of both the trains.**

4) When a train crosses a car/ bicycle/ a mobile man**, the relative speed** between the train and the object is taken depending upon the direction of the movement of the other object relative to the train and **the distance travelled is the length of the train.**

3. MEETING WITH SCENERIO

Ex 1: Two heavily loaded sixteen-wheeler transport trucks are 770 kilometers apart, sitting at two rest stops on opposite sides of the same highway. Driver A begins heading down the highway driving at an average speed of 90 kilometers per hour. Exactly one hour later, Driver B starts down the highway toward Driver A, maintaining an average speed of 80 kilometers per hour. How many kilometers farther than Driver B, will Driver A have driven when they meet and pass each other on the highway?

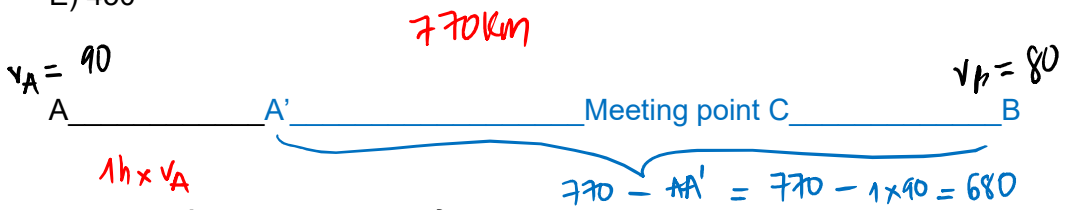
A) 90

B) 130

C) 150

D) 320

E) 450



A' và B xuất phát cùng thời điểm (tức 1h sau khi A đi một mình)

Gọi t là thời gian cần thiết để A và B gặp nhau , tức là thời gian A đi đoạn A'C và B đi đoạn BC

AC – BC = $AA' + A'C - BC = 1 \times 90 + t(v_A - v_B) = 90 + 10t$ =?

. Bước 1: Tìm t

A'B = $680 = A'C + BC = t \times v_A + t \times v_B = t(90 + 80) \rightarrow 680 = 170t \rightarrow t = 4$

. Bước 2: Trả lời câu hỏi AC – BC = ?

$AC - BC = 90 + 10 \times 4 = 130$ → B

Ex 2: Train A traveling at 60 m/hr leaves New York for Dallas at 6 P.M. Train B traveling at 90 m/hr also leaves New York for Dallas at 9 P.M. Train C leaves Dallas for New York at 9 P.M. If all three trains meet at the same time between New York and Dallas, what is the speed of Train C if the distance between Dallas and New York is 1260 miles?

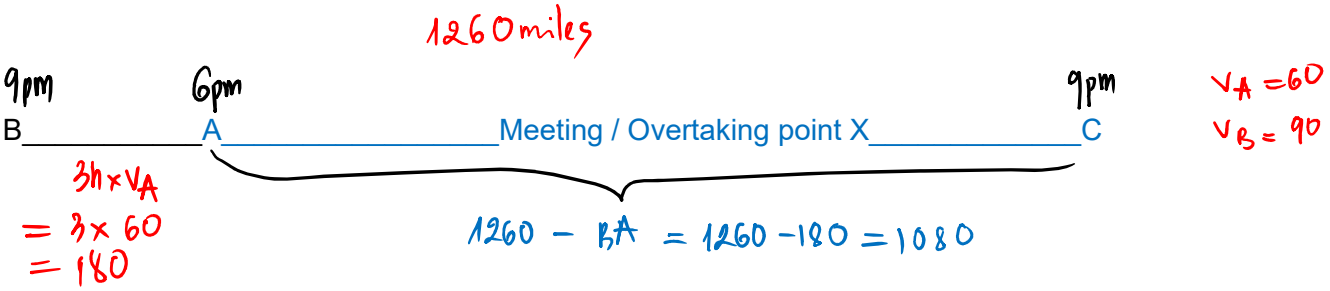
A. 60 m/hr

B. 90 m/hr

C. 120 m/hr

D. 135 m/hr

E. 180 m/hr



$v_C = ?$

Bài toán kết hợp cả Overtaking và Meeting with Scenarios.

Gọi t là thời gian để B đuổi kịp A (B đi đoạn BX và A đi đoạn AX) thì đó cũng chính là thời gian C đi đoạn XC.

. Bước 1: Tìm t

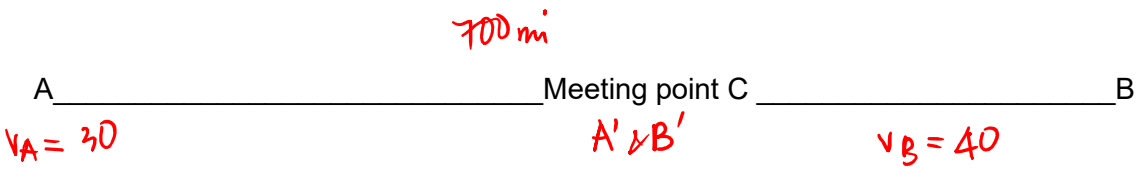
BA = $180 = t(v_B - v_A) = 30t \rightarrow t = 6$

. Bước 2: Tìm v_C

AC = 1080 = $t(v_A + v_C) = 6 \times (60 + v_C) \rightarrow v_C = 120$

→ C

Ex 3: Train A starts from station A traveling at 30 miles per hour toward station B. At the same time, on a parallel track, train B leaves station B at 40 miles per hour toward station A. When the two trains meet, how far is train A from station B if the distance between stations A and B is 700 miles?
(A) 140
(B) 240
(C) 300
(D) 340
(E) 400



CB = ?

Ta có: AB = 700 = t(30+40) = 70t → t = 10 → CB = 10 x 40 = 400 → E

Ex 4: Two trains of length 100 m and 250 m run on parallel tracks. When they run in the same direction, they take 70 sec to cross each other and when they run in opposite directions, they take 10 sec to cross each other. The speed of the faster train is

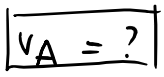
(A) 5 m/s

(B) 15 m/s

(C) 20 m/s

(D) 25 m/s

(E) 35 m/s



Bài toán kết hợp cả Overtaking và Meeting with Scenarios.

Lưu ý, để train A vượt train B (dù đang di chuyển cùng chiều hay ngược chiều) thì train A cũng phải đi hết 1 đoạn đường có chiều dài = Length of train A + Length of train B = 100 + 250 = 350. Bạn có thể tưởng tượng, bạn đang đứng ở đuôi train A và bạn cần nhìn thấy được đuôi/đầu train B trong trường hợp ngược chiều / cùng chiều.

. Same direction: $70s \times (v_A - v_B) = 350 \rightarrow v_A - v_B = 5$

. Opposite direction: $10s \times (v_A + v_B) = 350 \rightarrow v_A + v_B = 35$

→ $v_A = 20 \rightarrow$ C

Takeaway:

When two trains are moving in same direction, then their speed will be subtracted.

When two trains are moving in opposite directions, then their speed will be added.

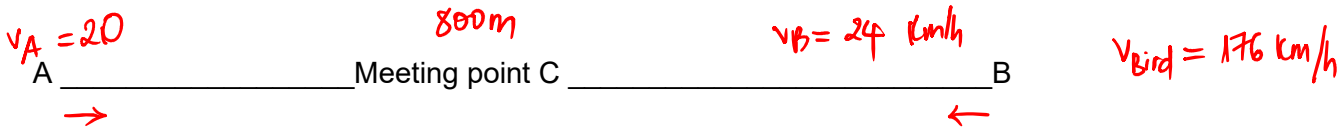
→ In both the above cases, the total distance is the sum of the length of both the trains.

Similar questions:

. A train travelling at 60 kmph crosses another train travelling in the same direction at 50 kmph in 30 seconds. What is the combined length of both the trains?

Keys: 250/3 m (lưu ý đổi đơn vị)

Ex 5: Amit & Bimal are at a distance of 800 m. They start towards each other at 20 & 24 kmph. As they start, a bird sitting on the cap of Amit, starts flying towards Bimal, touches Bimal & then returns towards Amit & so on, till they meet. What is the distance traveled by the bird, if its speed is 176 kmph?

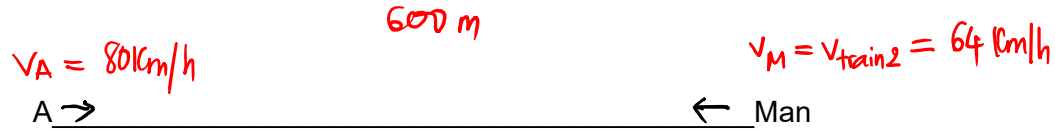


$S_{bird} = t_{bird} \times v_{bird} = t_{meeting} \times 176 = ?$ (Bài này nói dài dòng nhưng thực chất chỉ cần ta tìm thời gian để 2 người gặp nhau, vì chim cũng sẽ bay miệt mài trong đúng khoảng thời gian t này)

Ta có: AB = 800 = $t_{meeting} \times (v_A + v_B) = t_{meeting} \times (20+24) \rightarrow t_{meeting} = \frac{800}{44}$

Như vậy, $S_{bird} = \frac{800}{44} \times 176 = 800 \times 4 = 3200$ meters (nhớ đơn vị của 800 vẫn là m và ta chưa đổi đơn vị gì hết)

Ex 6: Train A, 600 meter long is running at 80 kmph will take how many seconds to cross a man sitting in another train which is 400 meter long, running at 64 kmph in the opposite direction?



Ở đây, để train A cross được người đàn ông, ta cần train A đi hết đoạn đường chính là chiều dài của train A.

Vì man đang ngồi trên tàu nên vận tốc của man bằng vận tốc của tàu.

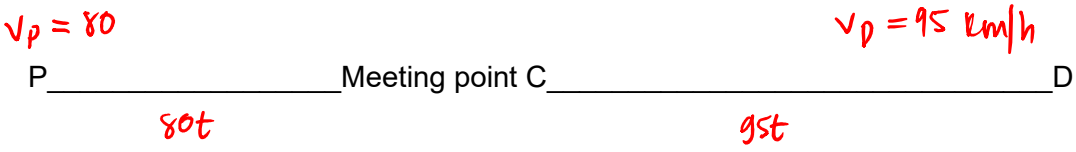
Ta có: 600 = t x $\frac{(80+64)\times 1000}{3600}$ (đổi đơn vị km/h → m/s)

$\rightarrow t = \frac{600}{144} \times \frac{18}{5} = 15$ seconds

Takeaway:

When a train crosses a car/ bicycle/ a mobile man, the distance travelled is the length of the train.

Ex 7: Two trains start at the same time from Pune and Delhi and proceed towards each other at 80 kmph and 95 kmph respectively. When they meet, it is found that one train has travelled 180 km more than the other. Find the distance in kms between Delhi and Pune.

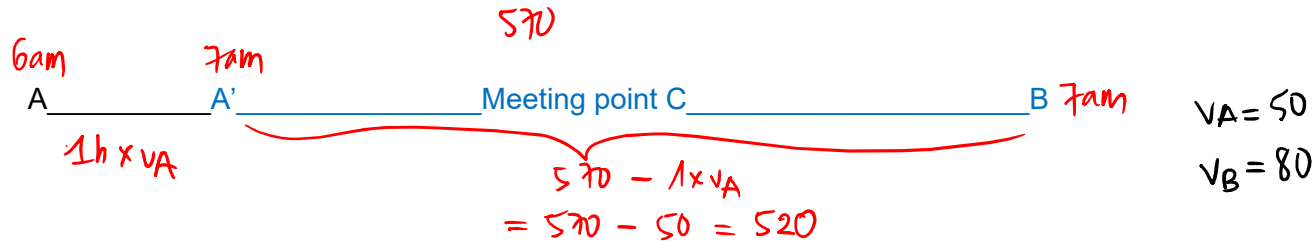


PD = t(80+95) = ?

Ta có, khi gặp nhau: 95t – 80t = 180 → t = $\frac{180}{15} = 12$

→ PD = $12 \times 175 = 2100$ kms

Ex 8: The distance between two places A and B is 570 kms. A train starts from A at 50 kmph at 6 am and another starts from B at 80 kmph at 7 am towards each other. At what time will they meet?

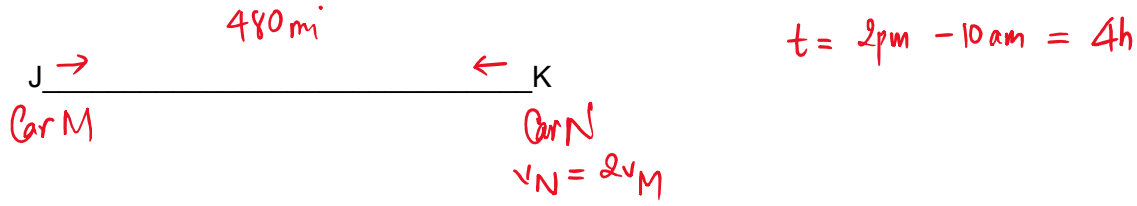


Gặp lúc mấy giờ = 7am + t = ?

Ta có, A'B = 520 = t x (50+80) → t = 4 hours

→ Gặp lúc 7 + 4 = 11am

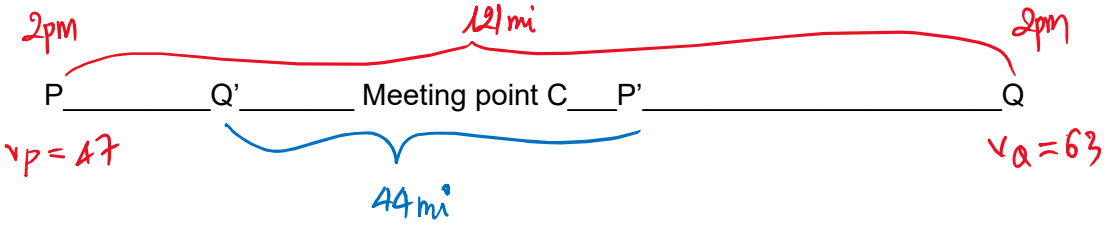
Ex 9: City J is 480 miles north of City K. At 10 AM, Car M starts in J, driving south toward K. Also at 10 AM, Car N starts in K, driving north toward J, at twice the speed of Car M. Both cars maintain constant speeds, and they pass each other at 2 pm going in opposite directions. What is the speed of Car N?



v_N = ?

Ta có: JK = 480 = t x (v_M + v_N) = 4 x 3v_M → v_M = 40 → v_N = 80 mi/h

Ex 10: Cars P and Q are approaching each other on the same highway. Car P is moving at 47 miles an hour, and Car Q is moving at 63 miles an hour. At 2 pm, they are approaching each other and are 121 miles apart. Eventually they pass each other. At what time are they moving away from each other and are 44 miles apart?



Mấy giờ thì cách nhau 44 mi sau khi gặp nhau?

. Bước 1: Tìm t_1 để 2 xe gặp nhau

PQ = 121 = t_1 x (47+63) → $t_1 = \frac{121}{110} = 1.1$ hours

. Bước 2: Tìm t_2 để 2 xe từ C đi xa ra và cách nhau 44mi

Q'P' = 44 = t_2 x (47+63) → t_2 = 44/110 = 0.4 hour

Vậy cần 1.1 + 0.4 hours = 1.5 hours từ 2pm tức 3 : 30 pm là đáp án đúng.

Takeaways: Sau khi giải xong ta hoàn toàn có thể rút kinh nghiệm để làm nhanh vào lần sau:

Distance 2 xe cần đi = 121 + 44 = 165 = t^* x (47+63) → $t^* = \frac{165}{110} = 1.5$ hours