ESCALATORS

- An escalator is a moving stairway where people can walk up/ down the stairs themselves along with the moving stairs.
- Here, the speed of the escalator is perceived as the rate at which the escalator moves the steps i.e. the number of steps moved by the escalator in unit time because the entire escalator setup does not move at a certain speed.
- The number of steps in an escalator is considered as the distance say 50 steps, 60 steps, etc.

- The basic thing to understand is that
- If you're moving 'with' the escalator, you'd have to climb less steps on your own because the escalator also will 'push you forward' some number of steps on its own. For example, if you climb 70 stairs on your own, and escalator pushes out 30 stairs in your favor in the same time, you'd have climbed 100 stairs in total.
- If you're moving 'against' the escalator, you'd have to climb more steps on your own because the escalator will try to 'pull you back' some number of steps on its own. For example, if you climb 70 stairs on your own, and escalator pushes out 30 stairs against you in the same time, you'd have climbed 40 stairs in total.
- Remember!
- With the escalator = Less steps to climb than the total
- Against the escalator = More steps to climb than the total

So, we can say that the total number of steps in an escalator is covered by

- The moving stairs alone when a person remains stationary on a step
- A person walking along with the moving stairs either in the same or in the opposite direction of the movement of the stairs

Thus we can infer that the movement of stairways influences the rate at which a person covers steps in an escalator.

Hence, by applying the concept of effective speed we learn that

(i) When a person walks up/down opposite to the movement of stairs

The actual rate at which a person covers the steps = Difference of the rates at which the person and the escalator cover the steps.

(Here, it is assumed that the rate at which a person covers the steps is always greater than the rate at which an escalator moves the steps)

(ii) When a person walks up/down in the direction of the movement of stairs

The actual rate at which a person covers the steps = Sum of the rates at which the person and the escalator moves the steps

(Here, the rate at which a person covers the steps is either lesser or greater than the rate at which an escalator covers the steps)

Generally,

No. of steps in an escalator = sum of the steps covered by the person and the moving stairs

(when the person moves in the direction of the moving stairs)

or

No. of steps in an escalator = difference of the steps covered by the person and the moving stairs

(when the person moves opposite to the moving stairs)

Practice Questions:

1. Jagjeet can walk up an escalator in 9 seconds when he takes 25 steps. If he takes only 7 steps then he will reach in 15 seconds. What is the total number of steps in the escalator?

Hint : 25+ 27 = 52=25+3*9=7+15*3

a) 62
b) 50
c) 52
d) 54

Ans: C

2. Anil and his son step into 2 different escalators which are moving down at the same speed. The father reaches down in 30 seconds taking 26 steps whereas the son reaches in 18 seconds taking 34 steps. Find the total number of steps in the each escalator assuming both have equal number of steps.

Hint: (46-26 =20 /30=2/3

34+2/3*18=46)

a) 60

b) 20

c) 46

d) 12

Ans: C

3. Abhrajit gets down a moving escalator in 4 seconds during which the escalator moves 44 steps. If the total number of steps in the escalator is 72, then how many steps does the man move down the escalator per second?

a) 4

b) 11

c) 7

d) 9

Ans: C (4*7 +44 = 72)

4. Lovedeep keeps on walking at constant speed in the moving escalator. It takes him 30 seconds to reach the top and 90 seconds to come back. If his walking speed is constant in both the direction, find out the time taken by the man to walk up when the escalator is stationary. 45-30=15 seconds saved by escalator in 30 seconds

So in 90 seconds 45 seconds extra work so 45+45=90

a) 40

b) 45

c) 54

d) 60

Ans: B

. A person is walking up an ascending escalator. He covers 50 steps and reaches the top in 25 seconds. If the total number of steps on the escalator is 200. Find the ratio of the speed of the person of the speed of the escalator. 50/25 : 150:25 =1:3

a) 2 : 3

b) 1 : 3

c) 3 : 1

d) 3 : 2

Ans: B