Problem:

A boat travels upstream a distance of 24 miles. It then takes the downstream return trip of 24 miles. The total time for the round trip is 6 hours. If the water in the stream travels at 3 mph, what would be the speed of the boat in still water?

Solution :

Let (V) be the speed of the boat in still water.

Then, when It travels upstream (against the current) the boat's speed is (V – 3) mph… and when it travels downstream (with the current), the boat's speed is (V + 3) mph.

The distance traveled is the same… D = 24 miles, each way.

Use Distance = Speed X Time (i.e.,) D = (V) x (T). → T = D / V.

The time to go upstream is then T(up) = D / (V – 3)

The time to go downstream is, T(down) = D / (V + 3)

The total time for the round trip is 6 hr… i.e., T(tot) = 6 hr.

Since T(tot) = T(up) + T(down) , then,

6 = 24 / (V – 3) + 24 / (V + 3)

Get a common denominator and simplify the numerator a bit. You should get this…

6 / 24 = (2V) / (V^2 - 9) ; where the symbol V^2 means "V – squared"

Multiply both sides by each denominator…

8V = V^2 - 9 → V^2 - 8V - 9 = 0 → factors into (V – 9)(V + 1) = 0

So, V = 9 mph or V = -1. Disregard the negative speed because it will give negative times if substituted into the above expression for the time, T(up).

Result: The speed of the boat in still water is… 9 mph.