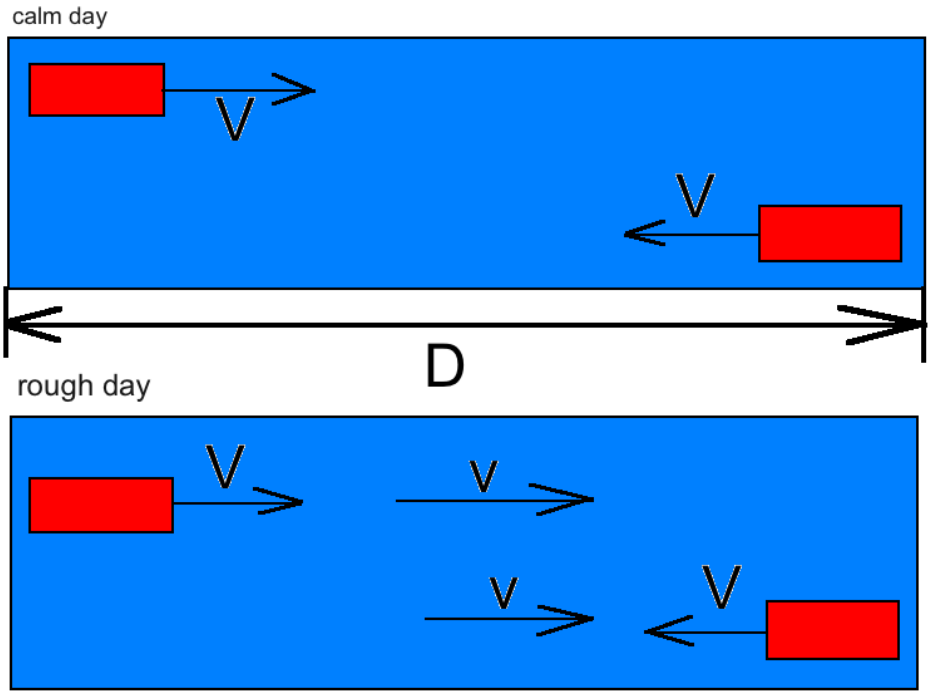
on a calm a boat can go across a lake and return in time T0 (knot) at a speed V. on a rough day there is a uniform current at speed v to help the onward journey and impede the return journey. if the time taken to go across and return on the rough day be T, then T/T0 will be ?

Solution:



Let the distance of the trip (go across and return) is D, then the travel time in calm day is:

$$T_0 = \frac{D}{V} + \frac{D}{V} = \frac{2D}{V} \qquad (1)$$

the travel time in rough day is:

$$T = \frac{D}{V+v} + \frac{D}{V-v} = \frac{D(V-v+V+v)}{(V+v)(V-v)} = \frac{2DV}{(V+v)(V-v)} \qquad (2)$$

$(2) \div (1)$:

$$\frac{T}{T_0} = \frac{2DV}{(V+v)(V-v)} \cdot \frac{V}{2D} = \frac{V^2}{V^2-v^2} = 1 - \frac{V^2}{v^2}$$

Answer: $\frac{T}{T_0} = 1 - \frac{V^2}{v^2}$