

Answer on Question# 54630– Physics / Mechanics– Kinematics

Question:

A speedboat is towing a paraglider at a constant speed and height on the end of a light rope of length 30m, which makes an angle q with the horizontal. The forces acting on the paraglider are the vertical lift, L , the horizontal drag, D , his weight, W and the tension in the rope, T . How to draw a vector diagram to show the object is in equilibrium?

Answer:

By the Newton's second law of motion

$$m\vec{a} = \vec{F}, \quad (1)$$

where \vec{F} is the net force (i.e. is the vector sum of all the forces). According to the statement of the problem we have $\vec{v} = \overline{const}$ and $h = const$ (fig. 1). It means that a paraglider is in equilibrium. Hence, $\vec{a} = 0$ and the net force is also equals to zero. Namely,

$$\vec{F} = \vec{L} + \vec{W} + \vec{T} + \vec{D} = 0. \quad (2)$$

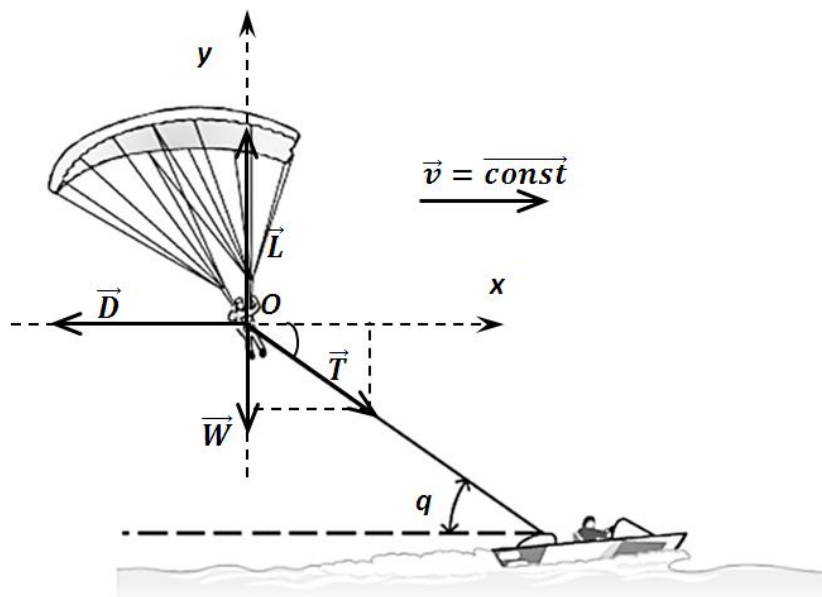


Fig. 1

The projections on the coordinate axes give

$$\begin{cases} Oy: 0 = L - W - T\sin(q); \\ Ox: 0 = T\cos(q) - D. \end{cases} \Rightarrow \begin{cases} L = W + T\sin(q); \\ D = T\cos(q). \end{cases} \quad (3)$$