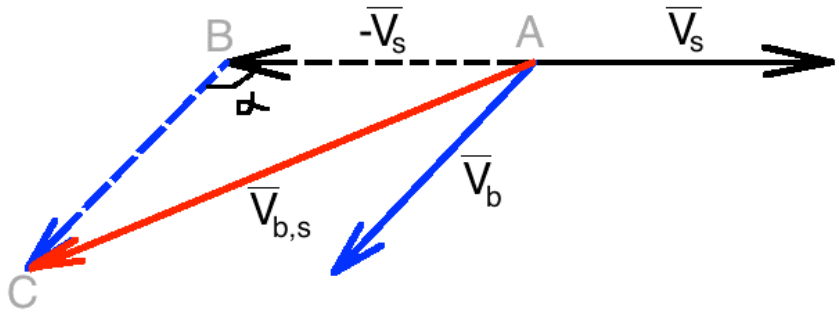
Answer on Question #42198 – Physics - Mechanics | Kinematics | Dynamics

A ship is travelling due east at 30 km/hr and a boy runs across a deck in a south west direction at 10 km/hr. find the velocity of the boy relative to sea

Solution:



$\mathrm{V_s} = 30\frac{\mathrm{km}}{\mathrm{hr}} - \mathrm{velocityof\ the\ ship};$

$\mathrm{V_b} = 10\frac{\mathrm{km}}{\mathrm{hr}} - \mathrm{velocity\ of\ the\ boy};$

Relative velocity of the boy with respect to the sea is the difference between vectors of the boy's and the ship's velocities:

$$\overline{\mathrm{V}}_{\mathrm{b,s}} = \overline{\mathrm{V}}_{\mathrm{b}} - \overline{\mathrm{V}}_{\mathrm{s}} = \overline{\mathrm{V}}_{\mathrm{s}} + (-\overline{\mathrm{V}}_{\mathrm{s}})$$

Triangle ABC:

$$\alpha = 180° - 45° = 135°$$

We can use law of cosines to find the unknown velocity $\mathrm{V_{b,c}}$:

$$\mathrm{V_{b,c}^2} = \mathrm{V_b^2} + \mathrm{V_s^2} - 2\mathrm{V_b}\mathrm{V_c}\cos\alpha$$

$$\mathrm{V_{b,c}} = \sqrt{\mathrm{V_b^2} + \mathrm{V_s^2} - 2\mathrm{V_b}\mathrm{V_c}\cos\alpha} =$$

$$= \sqrt{\left(30\frac{\mathrm{km}}{\mathrm{hr}}\right)^2 + \left(10\frac{\mathrm{km}}{\mathrm{hr}}\right)^2 - 2\cdot 30\frac{\mathrm{km}}{\mathrm{hr}}\cdot 10\frac{\mathrm{km}}{\mathrm{hr}}\cos 135°} = 37.7\ \frac{\mathrm{km}}{\mathrm{hr}}$$

Answer: relative velocity of the boy with respect to the sea is $37.7\ \frac{\mathrm{km}}{\mathrm{hr}}$