A boat is travelling due west at a speed of 30 km/hr and a boy runs across the deck in a southwest direction at 10 km/hr. Find the velocity of boy relative to sea.

Input Data:

Velocity of boat:

$$V_{boat} = 30 \frac{km}{h}$$

Velocity of boy:

$$V_{boy} = 10 \frac{km}{h}$$

Let the boat move along the x axis. Then the boy's course in relation to the boat: $\alpha = 135°$

Solution:

The speed of the boy relative to the sea is equal to the vector sum of the speeds of the boat and the boy:

$$\overrightarrow{V_{sea}} = \overrightarrow{V_{boat}} + \overrightarrow{V_{boy}}$$

$$V_{sea} = \sqrt{V_{seaX}^2 + V_{seaY}^2}$$

$$V_{sea} = \sqrt{\left(V_{boatX} + V_{boyX}\right)^2 + \left(V_{boatY} + V_{boyY}\right)^2}$$

The sum of the velocities along the x axis:

$$V_{seaX} = V_{boatX} + V_{boyX}$$

The sum of the velocities along the x axis:

$$V_{seaY} = V_{boatY} + V_{boyY}$$

$$V_{boatX} = 30 \ km/h$$

$$V_{boatY} = 0 \ km/h$$

$$V_{boyX} = V_{boy} cos \ \alpha = 10cos135° = -7.07 \ \text{km/h}$$

$$V_{boyY} = V_{boy} sin \ \alpha = 10sin135° = -7.07 \ \text{km/h}$$

$$V_{sea} = \sqrt{(30 - 7.07)^2 + (0 + 7.07)^2} = \sqrt{(22.93)^2 + (7.07)^2} = 24 \ km/h$$

Answer:

The boy's velocity relative to the sea: $24 \ km/h$