

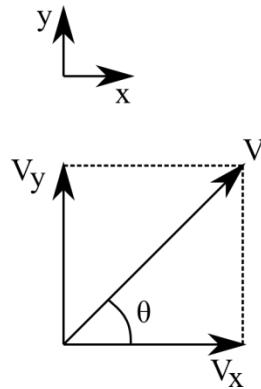
Answer on Question 63145, Physics, Mechanics

Question:

At takeoff, the horizontal and vertical velocities of a high jumper are 2.0 and 3.9 m/s, respectively. What are the resultant velocity and angle of takeoff?

Solution:

Here's the sketch of our task:



Here, v is the resultant velocity of the high jumper; v_x , v_y are the projections of the resultant velocity of the high jumper on axis x and y , respectively; θ is the angle of takeoff.

a) We can find the resultant velocity from the Pythagorean theorem:

$$v = \sqrt{v_x^2 + v_y^2} = \sqrt{\left(2.0 \frac{m}{s}\right)^2 + \left(3.9 \frac{m}{s}\right)^2} = 4.38 \frac{m}{s}.$$

b) We can find the angle of takeoff from the triangle:

$$\tan \theta = \frac{v_y}{v_x},$$

$$\theta = \tan^{-1} \left(\frac{v_y}{v_x} \right) = \tan^{-1} \left(\frac{3.9 \text{ m/s}}{2.0 \text{ m/s}} \right) = 62.8^\circ.$$

Answer:

a) $v = 4.38 \text{ m/s}$

b) $\theta = 62.8^\circ$.