

Name:

Key

ID #

1- A particle leaves the origin with an initial velocity $\mathbf{v}_0 = (3 \hat{i})$ m/s and constant acceleration $\mathbf{a} = (-\hat{i} - 5 \hat{j})$ m/s².

What is the particle's velocity when it reaches its maximum x-coordinate?

max. x-coordinate $\Rightarrow v_x = 0$

$$v_{0x} = 3 \text{ m/s}$$

$$a_x = -1 \text{ m/s}^2$$

$$t = ?$$

$$v_x = v_{0x} + a_x t$$

$$0 = 3 - t$$

$$t = 3 \text{ s}$$

$$v_y = v_{0y} + a_y t$$

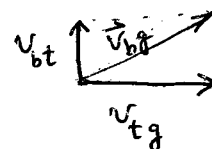
$$v_y = -5(3) = -15 \text{ m/s}$$

\Rightarrow at max. x-coordinate

$$\vec{v} = v_x \hat{i} + v_y \hat{j} = (-15 \hat{j}) \text{ m/s}$$

2- A train moves due east at 6 m/s, along a straight level track. A boy on the train rolls a ball along the floor with a speed of 3 m/s relative to the train. The ball is rolled directly across the width of the train from South to North. Find the speed of the ball relative to the ground. (Show all steps)

$$\begin{aligned} \vec{v}_{bg} &= \vec{v}_{bt} + \vec{v}_{tg} \\ &= (3 \hat{j} + 6 \hat{i}) \text{ m/s} \end{aligned}$$



$$\text{speed} = |\vec{v}_{bg}| = \sqrt{3^2 + 6^2} = 6.7 \text{ m/s}$$