Physics 203 - Section: 06/01/2015 Quiz 1 Name : .....

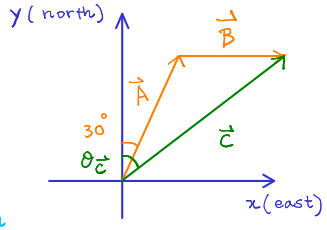
For full credit, be sure to show all your work.

1) (1 point) A woman walks 250 meters in the direction 30 degrees EAST of NORTH, then 175 meters directly EAST. Find the magnitude and the angle of her final displacement from the starting point.

$\vec{A}$: 250 m, 30° east of north $\rightarrow \begin{cases} A_x = 250 \sin 30^\circ \text{ m} \\ A_y = 250 \cos 30^\circ \text{ m} \end{cases}$

$\vec{B}$: 175 m, east $\rightarrow \begin{cases} B_x = 175 \text{ m} \\ B_y = 0 \end{cases}$

$\vec{C} = \vec{A} + \vec{B}$



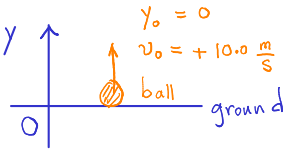
$\rightarrow \begin{cases} C_x = A_x + B_x = 300 \text{ m} \\ C_y = A_y + B_y = 125\sqrt{3} \text{ m} \end{cases}$ or $\begin{cases} |\vec{C}| = \sqrt{C_x^2 + C_y^2} = 370 \text{ m} \\ \theta_{\vec{C}} = \tan^{-1}\frac{C_x}{C_y} = 54^\circ \text{ east of north} \end{cases}$

2) (1 point) A ball is hit straight up into the air with a speed of 10.0 m/s. a) Calculate the time required for the ball to rise to its maximum height. b) Calculate the maximum height reached by the ball.

a) Let's choose the origin to be the ground and upward direction positive.

$y(t) = y_0 + v_0 t + \frac{1}{2}at^2 = 0 + 10.0t - \frac{1}{2}(9.8)t^2$

$v(t) = v_0 + at = 10.0 - 9.8t$



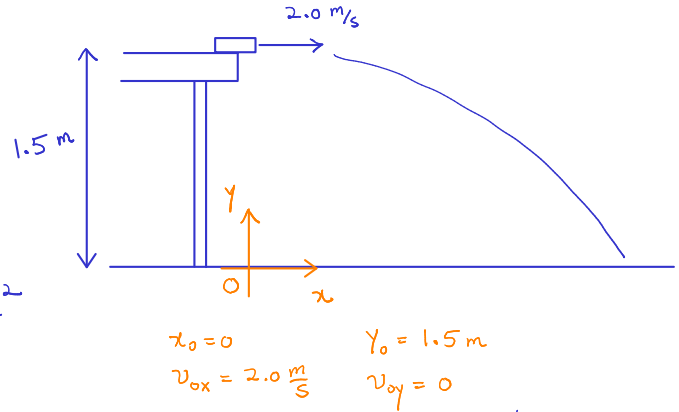
What do we know about the maximum height point?

Velocity is zero. So $v(t^*) = 10.0 - 9.8t^* = 0 \rightarrow t^* = 1.02$ s.

b) $y(t^*) = 10.0t^* - \frac{1}{2}9.8t^{*2} = 5.1$ m.

3) (1 point) A hockey puck slides off the edge of a table with an initial velocity of 2.0 m/s. and experiences no air resistance. The height of the tabletop above the ground is 1.50 m. a) How long does it take for the puck to reach the ground? b) Find the maximum horizontal distance that hockey puck travels before it hits the ground .

$\theta = 0 \rightarrow \begin{cases} v_{ox} = 2.0 \frac{m}{s} \\ v_{oy} = 0 \end{cases}$



We choose the origin on the ground right below the edge of the table.

$x(t) = x_0 + v_{ox}t + \frac{1}{2}a_x t^2 = 2.0t$

$y(t) = y_0 + v_{oy}t + \frac{1}{2}a_y t^2 = 1.5 \text{ m} - \frac{1}{2}9.8t^2$

a) What do we know about the moment t^* where the puck reaches the ground?

$y(t^*) = 0 \rightarrow 1.5 \text{ m} - \frac{1}{2}9.8t^{*2} = 0 \rightarrow t^* = \begin{cases} +0.55 \text{ s} \checkmark \\ -0.55 \text{ s} \times \end{cases}$ The eq'ns are correct for $t \geq 0$.

b) $x(t^*) = 2.0t^* = 1.1$ m.