Quiz 2 – PH241 **Name**_____ ☐ **Pledged**

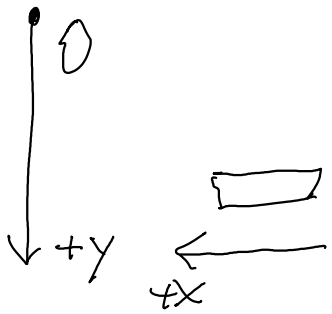
A rock falls from a cliff that is 56 meters above the water. It falls directly into a boat, moving with constant velocity, that was 15 meters from the point of impact when the object was released.

Please draw a picture and coordinate system

(A) What was the speed of the boat?

(B) What was the velocity of the rock right before it hits the boat as seen by the passenger in the boat (Hint:$v_{RB} = v_{RW} + v_{WB}$)?

For constant acceleration motion is given as:
$v_y = v_{0y} + at$
$\Delta y = v_{0y}t + \frac{1}{2}at^2$
$v_y{}^2 = v_{0y}{}^2 + 2a\Delta y$
$\Delta x = v_{0x}t$
if in freefall $a = g = 9.81 m/s^2$ towards the earth
if $c + bt + at^2 = 0$ then t = $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$



$15m = V_{0\,Boat}\, t$

$56m = 0t + \frac{1}{2}(9.8 m/s^2)\, t^2$

$t = 3.38 s$

so $V_{0\,Boat} = \frac{15m}{3.38 s}$

$V_{Boat} = 4.44 m/s$

B)

$V_{RB} = V_{RW} + V_{WB}$

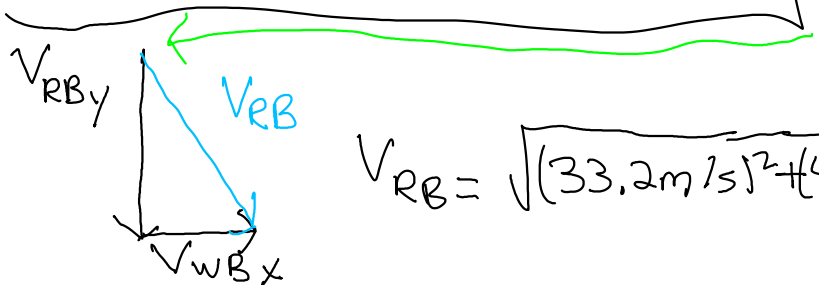
2 equations

$V_{RBx} = V_{RWx} + V_{WBx}$ → $-4.4 m/s$

$V_{RBy} = V_{RBy} + V_{WBy}$

$V_{RBy} = V_{0y} + g(3.38 s)$

$V_{RBy} = 33.2 m/s$



$V_{RB} = \sqrt{(33.2 m/s)^2 + (4.4 m/s)^2} = 33.5 m/s$