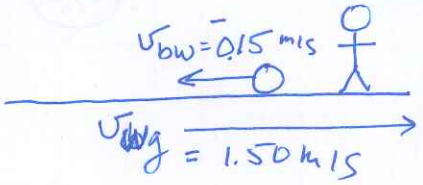
Name: Key Block: ____

PRACTICE QUIZ: MOTION (Partners) - Counts as HW assignment

PART I: Relative Motion: Solve each problem below. Drawing a brief diagram may be helpful. Please show all work (including any formulas used) and BOX your answer after checking the units.

A. (1-Dimensional) A girl at an airport rolls a ball west on a moving walkway that moves east. If the ball's speed with respect to the walkway is 0.15 m/s and the walkway moves at a speed of 1.50 m/s, what is the velocity of the ball relative to the ground? [2]



(+1) for correctly labeled diagram or correct/reasonable formula

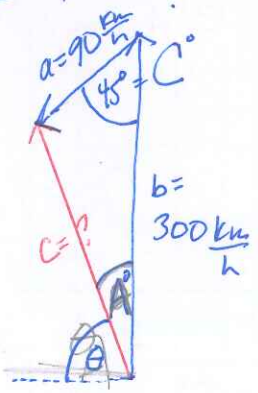
$v_{bg} = v_{wg} + v_{bw} = 1.50 - 0.15 =$ **1.35 m/s (to the right)** (+1) for correct answer with units

B. (2-Dimensional) A pilot must fly his plane due north to reach his destination. The plane can fly at 300 km/h in still air. A wind is blowing from the northeast at 90 km/h.

(i) What is the speed of the plane relative to the ground? [3]

Note: you will need to draw these two velocities as vectors added head to tail. It would make sense to represent them in terms of horizontal (x-component) and vertical (y-component) directions.

But, Law of Cosines is faster!



+1 drawing

(+1) math work

$c^2 = a^2 + b^2 - 2ab \cdot \cos(C°)$

$c^2 = (90)^2 + (300)^2 - 2(90)(300) \cdot \cos(45°)$

$c = 244.8$ km/h (+1) for correct answer

(ii) In what direction must the pilot head her plane to fly due north? [2]

$\cos(A°) = \frac{a^2 - b^2 - c^2}{-2bc} = \frac{(90)^2 - (300)^2 - (244.8)^2}{-2(300)(244.8)} = 0.96559$

Angle $A° = \cos^{-1}(0.96559) = 15.1°$ (+1) for small angle correct

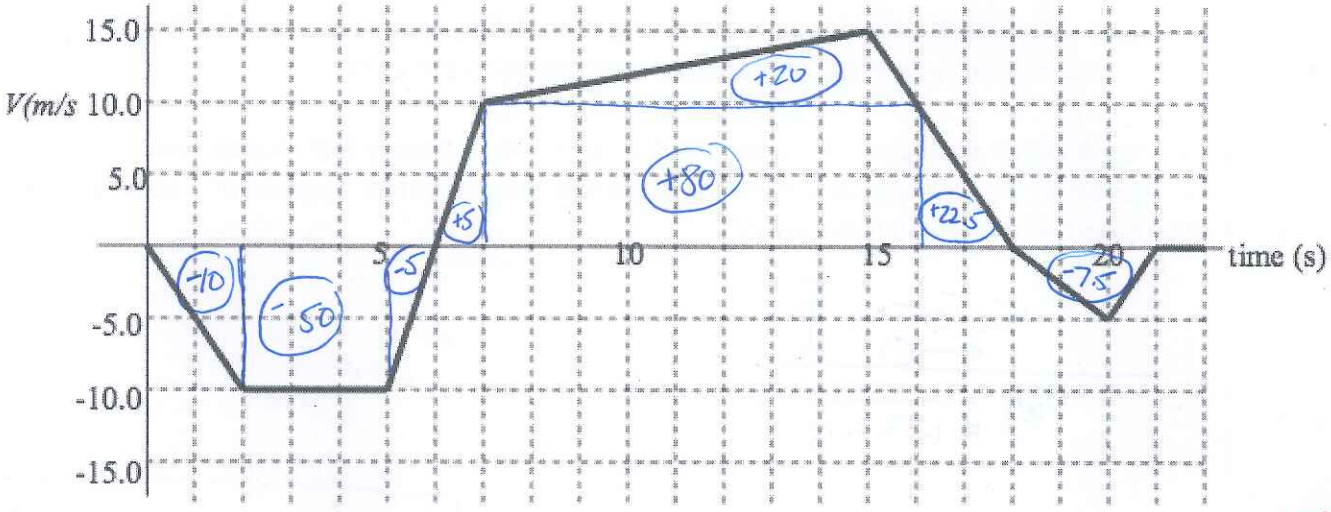
$\theta = 90° - 15.1° = 74.9°$ N of W (Where plane actually goes)

So She must fly at 74.9° N of E to end up going straight NORTH

(+1) for correct larger angle with direction.

PART II: Graphs Motion: Answer ALL of the questions (i - vi) below regarding the graph presented.

The graph below show the motion of a fly that starts his trip flying to the LEFT.



1 pt each

C. (i) What is the displacement of the fly between 6 and 18 seconds? 127.5 m [1]

+127.5 - 65 - 7.5

(ii) What is the total displacement of the fly for the entire trip? 55 m [1]

(iii) What is the total distance traveled by the fly? 200 m [1]

(iv) What is the average velocity of the fly? $\frac{\text{total disp}}{\text{total time}} = \frac{55\text{ m}}{22\text{ sec}} = 2.5\text{ m/s}$ [1]

(v) What is the average speed of the fly? $\frac{\text{total distance}}{\text{total time}} = \frac{200\text{ m}}{22\text{ s}} = 9.1\text{ m/s}$ [1]

(vi) Create the corresponding acceleration graph for the fly's motion on the axes below. [2]
(the slope of the V-t graph is = acceleration)

(+1) for horizontal lines (+1) Accuracy.

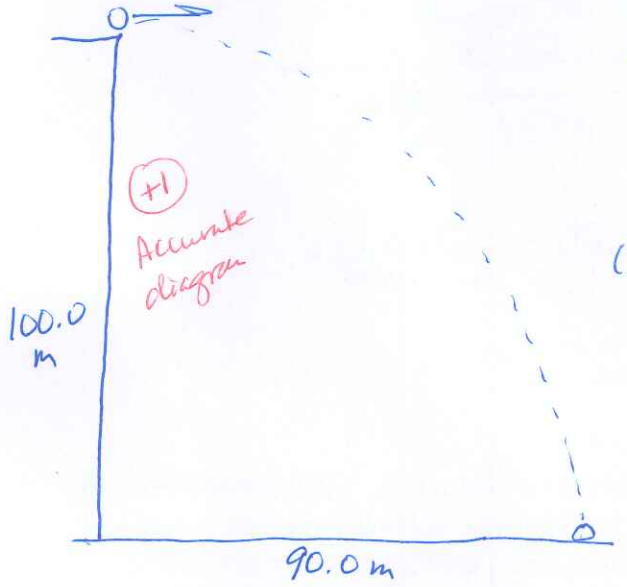
PART III: Projectile Motion: Solve both problems below. Draw a picture to help and remember to separate the horizontal (x) and vertical (y) directions. Show all work including the SUVAT formulas used. Be consistent with decimals places in your answer (same as those given in question). Check your units at the end and box your answer(s).

D. A rock is thrown horizontally from a 100.0 m high cliff. It strikes the ground 90.0 m from the base of the cliff.

(i) How long does it take to hit the ground?

(ii) At what speed was the rock initially thrown?

Math Shown units correct



+1 Accurate diagram

(i) vertically $s = ut + \frac{1}{2}at^2$ ($u = 0$)

$$t = \sqrt{\frac{2d}{a}} = \sqrt{\frac{2(-100)}{-9.8}} = \boxed{4.5\,s} \quad (+1)$$

(ii) horizontally $u = \frac{s}{t} = \frac{90.0\,m}{4.5\,s} = \boxed{20\,m/s} \quad (+1)$

E. A football is kicked at an angle θ = 37° with a velocity of 22 0 m/s.

(i) What is the maximum height of the football?

(ii) How far does the ball travel before it hits the ground?

(+1) Accurate diagram.

$u_x = 22\,m/s \cdot \cos(37°) = +17.6\,m/s$ (SOHCAHTOA)

$u_y = 22\,m/s \cdot \sin(37°) = +13.2\,m/s$ (" ")

(i) Vertically $v_y^2 = u_y^2 + 2a_y s_y$ $\quad s_y = \frac{v_y^2 - u_y^2}{2a_y} = \frac{0 - (13.2)^2}{2(-9.8)} = \boxed{8.9\,m}$ (+1)

(ii) Find t (vertically) $v_y = u_y + a_y t$ $\quad t = \frac{v_y - u_y}{a_y} = \frac{0 - 13.2}{-9.8} = 1.35_5 \times 2 = 2.7\,s$ for whole trip

Then horizontally $s_x = u_x \cdot t = 17.6\,\frac{m}{s} \cdot 2.7\,s = \boxed{47.5\,m}$ (+1)