Physics 3A: Basic Physics I
Quiz #3c: Solutions

Name:XXXXXXXXXXXXXXXXXXXXXXXX
Student ID #:_________________________
Discussion Section:____________________
Date:________________________________
Signature:____________________________

\[ v_{xf} = v_i \cos(\theta) = \text{constant} \quad v_{yf} = v_i \sin(\theta) - gt \quad x_f = x_i + v_i \cos(\theta) t \quad y_f = y_i + v_i \cos(\theta) t - \frac{1}{2} gt^2 \]

\[ a_e = \frac{v_i^2}{r} \quad a_r = \frac{d[v]}{dt} \quad y_f = (\tan(\theta_i)) x_f - \left( \frac{g}{2 v_i^2 \cos^2(\theta_i)} \right) x_f^2 \]

\[ T = \frac{2 \pi r}{v} \quad h = \frac{v_i^2 \sin^2(\theta_i)}{2g} \quad R = \frac{v_i^2 \sin(2\theta_i)}{g} \quad a_e = -a_r = -\frac{v_i^2}{r} \quad \vec{v}_{PO} = \vec{v}_{PO'} - \vec{v}_{O'O} \]

\[ g = 9.80 \text{ m/s}^2 \]

(circle the letter of your answer)

1. (2 pts) A blue BMW car is driven off a horizontal cliff. One second later a red VW car is driven off the same cliff with the same velocity as the BMW. At what point in the motion after the VW leaves the cliff will the two cars be the closest to each other? Only consider times prior to the BMW hitting the ground. (ignore air resistance)

a.) Just before the BMW hits the ground
b.) Just as the VW leaves the cliff
c.) When the VW is halfway to the ground
d.) Depends on the relative masses of the two cars
e.) Not enough information to tell

2. (2 pts) A ball is thrown at an angle of 45 degrees relative to horizontal. Which of the following quantities of the resulting motion are constant during the motion:

a.) magnitude of its velocity and magnitude of its acceleration
b.) direction of its velocity and direction of its acceleration
c.) vertical component of velocity and magnitude of velocity
d.) horizontal component of its velocity and its acceleration
e.) None of the above

3. (6 pts) You swing your TA on the end of a string around in a circle of radius 1.50 m, at a height above the ground of 2.25 m, parallel to the ground. The string breaks and your TA hits the ground d meters (horizontally) away from the point on the ground directly below the break point. If the centripetal acceleration is 4.20 m/s^2, what is d? (use back of sheet as well, circle your final answer and show all work)
Look at $x$: $x_f = d = x_i + v_i t = 0 + v_i \cos(\theta) t = v_i t$ need $t$ and $v_i$ get $v_i$ from centripetal acceleration: $a_c = \frac{v^2}{r}$ so $v = \sqrt{a_c r} = \sqrt{(4.20)(1.50)} = 2.51 \text{ m/s}$

for $t$, use $y$-direction: $y_f = y_i + v_{iy} t - \frac{1}{2} g t^2 = y_i + v_i \sin(\theta) t - \frac{1}{2} g t^2 = y_i - \frac{1}{2} g t^2$

solve for $t$: $t = \sqrt{\frac{(y_i - y_f)^2}{g}} = \sqrt{\frac{(2.25 - 0.00)^2}{9.80}} = 0.677 \text{ s}$

put into $x$: $d = v_i t = 2.51(0.677) = 1.70 \text{ m}$