

Name: \_\_\_\_\_ DISC: \_\_\_\_\_ Score: \_\_\_\_\_ / 20

## Instructions:

- Do your own work.
- Answer the questions below in the space provided.
- Make sure you show all your work and any equations that you use.
- Please place a box around your answers.
- Remember to give the correct units with all numerical answers

Q1	Q2	Q3	Q4
10	10	5	5

1. You are spinning a ball attached to a massless string of length  $R = 3\text{ m}$  in a circle.
- a. Draw a diagram of the motion of the ball including the vectors for the velocity and acceleration.

Diagram (2pts):

- b. Let's consider the circular motion of the ball:

- Does the ball move at constant *speed* (yes/no) ?
- For *uniform circular motion* the acceleration of a rotating object is  $a = \frac{v^2}{r}$ . If the ball moves at a constant *speed*, why is there an acceleration?

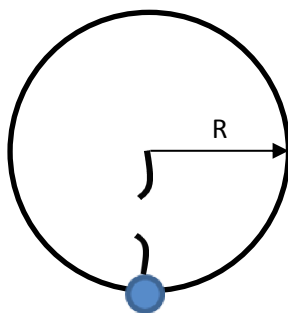
Yes/no:  
Explanation (2 pts):

- c. The ball experiences a radial acceleration  $a = 1.5g$ . What is the speed of the ball? (Use  $g = 9.81\text{ m/s}^2$ .)

Speed (2 pts):

- d. The string is spontaneously cut at the point shown in the diagram below. Draw the path on the diagram representing the motion of the ball *after* the string has been cut. Include labels.

Diagram (2 pts):



2. You are an airplane pilot. You are traveling from San Francisco to Chicago, a 3000 km trip due East. There is a wind blowing 45 km/h *from* the North. It takes you 4.5 hours to make the trip. You want to know the air speed of your airplane (remember:  $\Delta x = vt$ ).

- a. To keep your airplane heading East you must:

Selection:

- i. Stear the airplane into the wind (North).
- ii. Stear the airplane with the wind (South).
- iii. Stear the airplane due East

- b. Draw a vector diagram showing the velocities important in this problem. Include a coordinate system and labels for the vectors.

Diagram (coord.  
System = 0.5 pts):  
Vector Lables:

- c. Describe in your own words the steps you need to take to calculate the airspeed of the airplane.

Problem solving  
steps (2 pts):

- d. Select the equation, or equations, you need from the list below. Then find the air speed,  $\vec{v}_{PW}$  (remember: vectors!!!). (Hint: Write out the components of the airplane's ground velocity,  $\vec{v}_{PG}$  and the wind velocity  $\vec{v}_{WG}$ )

Selection:  
Solution (2 pts):

- i.  $\Delta x = vt$
- ii.  $\vec{v}_{PW} + \vec{v}_{WG} = \vec{v}_{PG}$
- iii.  $v^2 = v_0^2 + 2 a \Delta x$