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 $R = 2\ m$ 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:
      i. Does the ball move at constant *speed* (yes/no) ?
      ii. 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?
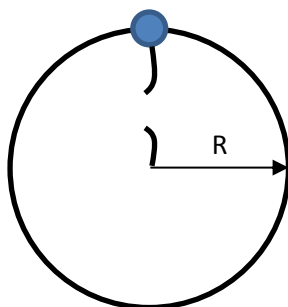
Yes/no:
Explanation (2 pts):

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

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):

R

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 20 km/h *from* the North. It takes you 4 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 $\vec{v}_{WG}$)

       i. $\Delta x = vt$

Selection:
Solution (2 pts):

      ii. $\vec{v}_{PW} + \vec{v}_{WG} = \vec{v}_{PG}$

     iii. $v^2 = v_0^2 + 2\,a\ \Delta x$