Score _____

Instructions:
1. Do all of your work on this sheet.
2. **Show all of your steps** in problems for full credit.
3. **Be clear and neat** in your work. Any illegible work, or scribbling in the margins, will not be graded.
4. Place your **answers in a box**. Do not forget **units**!
5. If you need more space, you may use the back of the page and write **On back** in the problem space.

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1. **Multiple Guess (2 pts)** Find the answer which best fits the question and write it in the space provided.

a. Two objects are fired into the air shown in the figure below. Projectile 1 reaches the greater height, but projectile 2 has the greater range. Which one is in the air the longest?
   a) Projectile 1, because it travels higher than projectile 2
   b) Projectile 2, because it has the greater range.
   c) Both projectiles spend the same amount of time in the air.
   d) Projectile 2, because it has the smaller initial speed and, therefore, travels more slowly than projectile 1.

   _____

b. A plane traveling horizontally 10,000 m above the earth at 200 mph drops a package. Assuming no air resistance, the package lands _____ the plane.
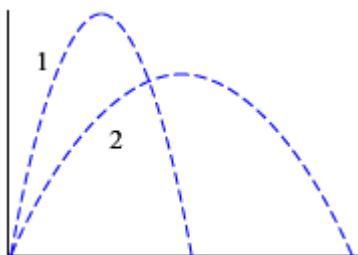   a) in front of b) directly under c) behind d) none of the above

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2. **Definition/Principle (5 pts)**

a. A particle travels along a circle of radius r at speed v.

   i. What are the magnitude and direction of the acceleration?

   ii. What is the period of this motion?

b. Carefully indicate on path 2 in the figure the initial velocity and the velocity at the top of the path.
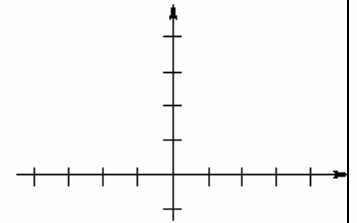

3. **Problems (13 pts)**.
a. Consider the vectors
   A: Magnitude 2.0 m in a direction 120° from the positive x-axis,
   B $= 3.0\,\mathbf{i} + 4.0\,\mathbf{j}$ m.

   i. Find the y-component of **A**.

   ii. Sketch **A**, **B** and **B** – **A**.

iii. Find the magnitude and direction of **C** $=$ **A** $+$ **B**.

b. Consider $\mathbf{r} = (5.1t^2 + 3.0t + 2.5)\mathbf{i} + (-6.2t + 1.7)\mathbf{j}$ in meters.
   i. Find $\mathbf{r}_0$ and $\mathbf{v}_0$.

   ii. What is the acceleration?

c. A diver runs horizontally with a speed of 1.20 m/s off a board that is 3.00 meters above the water. How far forward has the diver gone before hitting the water?

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Bonus
A large boulder rolls off a cliff with a speed of 50.0 m/s at an angle of 30° below the horizontal and at a point 400.0 m above the base of the. How long will the boulder be in the air?
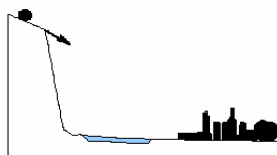
There is a 200 m diameter pond with its edge 50 m from a point directly below the boulder. Will the boulder land in the pond?