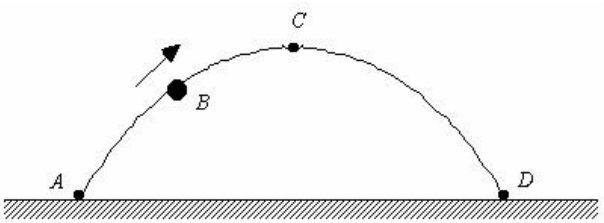
Name _____

1. A small cart is rolling at a constant velocity on a flat track. It fires a ball straight up into the air as it moves. Make a prediction about what will happen to the ball: **A**: Will it land behind the cart **B**: Ahead of the cart, or **C**: Land inside the cart? Sketch its trajectory, measured from the ground. Sketch its trajectory, measured from the cart.

2. In the parabolic trajectory of an object represented in the figure below,
   (a) At which point(s) is the speed (magnitude of velocity) the greatest?
   (b) At which point(s) is the speed the lowest? What is the speed at that point?
   (c) At which point(s) is the speed the same? Is the velocity the same at those points?
   (d) At which point(s) is the acceleration zero? (**E**: Nowhere)
   (e) Draw the velocity vector and the acceleration vector at each point.



Projectile Motion: (1): $y = v_{0y}t + \frac{1}{2}a_y t^2$, (2): $v_y = v_{0y} + a_y t$, (3): $v_y^2 = v_{0y}^2 + 2a_y y$
x-direction ($a_x = 0$), so $x = v_{0x}t$

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3. You are flying in a helicopter trying to drop emergency supplies to a target. Should you **A**: drop the supplies before you pass the target, **B**: when the target is directly below you, or **C**: wait until you pass the target?

   Suppose you are flying at a height of $500m$ above the ground and moving with a speed of $65m/s$.
   (a) Make a sketch of the trajectory of the supplies package.
   (b) How long does it take to reach the ground?
   (c) What is the x-component of its velocity just before it hits the ground?
   (d) At what horizontal distance from the target do you need to launch it?
   (e) When the supplies hit the target, will you be **A**: behind the target, **B**: directly above the target, or **C**: ahead of the target?

4. A toy rocket is launched with an initial speed of $35m/s$ at an angle of $80°$ above the horizontal. How high will it go in the air, and how far will it land from the launch point?

5. Projectile Motion Challenge: With your team members: Pick your favorite object to launch (Cannonball, Tank shell, Golf ball, Baseball, Football, Pumpkin, Human, Piano, Car). Next, pick an angle between $25° - 80°$, an initial speed between $5m/s - 15m/s$. Calculate where the landing pad should be placed to catch your object.
   Object:
   Launch angle:
   Launch speed:
   Predicted horizontal target distance: