Name_____

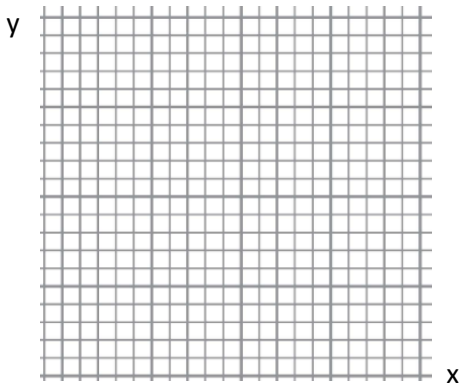
Date_____Pd____

UNIT I: Worksheet 4

1. A web page designer creates an animation in which a dot on a computer screen has a position of $\vec{r} = [4.0\ cm + (2.5\ cm/s^2)t^2]\hat{\imath} + (5.0\ cm/s)t\hat{\jmath}$.
   a. Find the magnitude and direction of the dot's average velocity between t = 0 and t = 2.0 s.

   b. Find the magnitude and direction of the instantaneous velocity at t = 0, t = 1.0 s, and t = 2.0 s.

   c. Sketch the dot's trajectory from t = 0 to t = 2.0 s, and show the velocities calculated in part (b).



2. The coordinates of a bird flying in the xy-plane are given by $x(t) = \alpha t$ and $y(t) = 3.0\ m - \beta t^2$, where $\alpha = 2.4\ m/s$ and $\beta = 1.2\ m/s^2$.
   a. Calculate the velocity and acceleration vectors of the bird as functions of time.

   b. Calculate the magnitude and direction of the bird's velocity and acceleration at t = 2.0 s.

   c. At this instant, is the bird speeding up, is it slowing down, or is its speed instantaneously not changing? Explain.

   d. Is the bird turning? Justify your answer.

3. A 10,000 N car comes to a bridge during a storm and finds the bridge washed out. The driver must get to the other side, so he decides to try leaping it with his car. The side the car is on is 21.3 m above the river, while the opposite side is a mere 1.8 m above the river. The river itself is a raging torrent 61.0 m wide.
   a. How fast should the car be travelling just as it leaves the cliff in order just to clear the river and land safely on the opposite side?

   b. What is the speed of the car just before it lands safely on the other side?

4. A pistol that fires a signal flare gives the flare an initial speed (muzzle speed) of 120 m/s.
   a. If the flare is fired at an angle of 55^0 above the horizontal on the level salt fields of Utah, what is the horizontal range? You can ignore air resistance.

   b. If the flare is fired at the same angle over the flat Sea of Tranquility on the moon, where $g = 1.6\ m/s^2$, what is its horizontal range?