Projectile Motion Review Sheet

1. Calculate the speeds of the two velocities given below.
   $v_x = 25$ m/s $v_y = -15$ m/s $v_x = 8$ m/s $v_y = 3$ m/s

   v =_____ v = _____

2. What are the components of the following velocities?
   A ball is kicked with a velocity of 14 m/s at an angle of 25° above the horizontal.

   v_x = _____ m/s v_y = _____ m/s

   A pen is thrown straight up with a velocity of 15 m/s.

   v_x = _____ m/s v_y = _____ m/s

3. A bullet is shot horizontally with a speed of 800 m/s from an initial height of 2 m.
   a. How long is the bullet in the air?

   b. How far away does the bullet land?

   c. If the bullet was just dropped from that height, how long would it take to hit the ground?

4. A student throws a ball horizontally out of a window. It hits the ground in 0.9 seconds and lands 15 meters away (horizontally) from the window.
   a. What was the initial velocity of the ball? Give both components.

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b. From what height was the ball thrown?

c. What is the final vertical velocity?

d. What is the final speed of the ball?

5. A baseball was hit with an initial velocity of 45 m/s at an angle of 40° above the horizontal. It was eventually caught at the same height from which it was hit.
   a. What were the horizontal and vertical components of the intital velocity?

   b. How long was it in the air?

   c. How far did it travel horizontally?

   d. What was the baseball's maximum height?

   e. What was the velocity of the baseball at its maximum height? Give both components.

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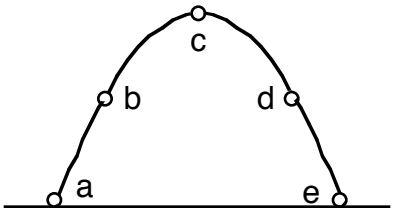
6. A soccer ball is kicked up in the air with some initial velocity. Imagine the path of the ball is shown in the diagram to the right. The letters are just some random positions of the ball. C is the maximum height of the ball, and points b and d are at the same height, and points a and e are the initial and final positions of the ball.



   a. While the ball is going up (from a to c), what happens to the <u>horizontal</u> component of its velocity?

   b. While the ball is going up (from a to c), what happens to the <u>vertical</u> component of its velocity?

   c. While the ball is going up (from a to c), what happens to the acceleration of the ball?

   d. At point c (its maximum height) what is the <u>horizontal</u> component of its velocity?

   e. At point c (its maximum height) what is the <u>vertical</u> component of its velocity?

   f. At point c (its maximum height) what is the acceleration of the ball?

   g. While the ball is going down (from c to e), what happens to the <u>horizontal</u> component of its velocity?

   h. While the ball is going down (from c to e), what happens to the <u>vertical</u> component of its velocity?

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i. While the ball is going down (from c to e), what happens to the acceleration of the ball?

j. How does the time from a to c compare to the time from c to e?

7. Imagine that the horizontal velocity of a ball that is kicked across a level field is 15 m/s and the ball was in the air for a total of 4 seconds.
   a. How far away does the ball land?

   b. How many seconds would it take for the ball to reach its maximum height?

   c. What are the components of the velocity of the ball at its maximum height?

   d. What was the initial vertical velocity of the ball?

   e. If you wanted the ball to stay in the air longer, what would you change?

   f. Would the change (in e.) affect the height? If so, how (higher/lower)?

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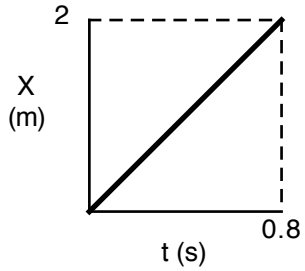
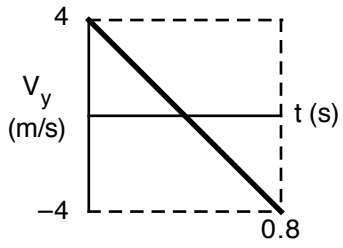
g. Would the change (in e.) affect how far away the ball lands? If so, how (farther/shorter)?

8. Some students did a lab in which they recorded a ball that was tossed between two students. They made the following graphs from their data:





a. What was the horizontal velocity of the ball?

b. What was the initial vertical velocity of the ball?

c. So what was the intial speed of the ball?

d. What is the slope of the vertical velocity vs time graph? Does your answer make sense?

e. What was the maximum height of the ball?

f. Make the graphs of horizontal velocity (v_x) vs time and height (y) vs time.