Name Answer Key   Date ________________________
Honors Physics   Vectors/Projectiles WS #7H
Period _______   Mrs. Nadworny

Projectile Simulations

1. Set the initial velocity to 0 m/s. Set the launch angle to 0 degrees. Set the y_o to 50 m. Click Fire and watch the projectile fall. The blue arrow represents the components of the velocity. It will not stop once it reaches the orgin. You will need to pause it when it approaches the origin. You can use the bottom slider bar to move forward and backward through the simulation.

2. Reset the simulation and fire the projectile again. Pause the simulation when the projectile is at the origin. Record the time it took to land. [You may need to use the time slider to find the correct moment.]

   3.18 s

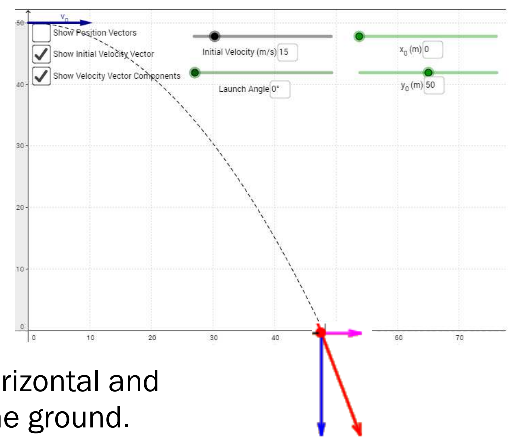
3. Reset the simulation. Change the initial velocity to 15 m/s. Fire the projectile. Pause the simulation when the projectile "lands". Record the time it took to land. [You may need to use the time slider to find the correct moment.]

   3.19 s

4. Which projectile, if either, hit the ground first?

   They landed at (approximately) the same time.

5. On the diagram at right, sketch and label the horizontal and vertical components of the projectile's velocity as it hits the ground as well as the resultant velocity.



6. Repeat the simulation again and pay careful attention to the horizontal and vertical components of the projectile's velocity as it travels to the ground.
   a. What happens to the horizontal component?

      It remains the same

   b. What happens to the vertical component?

      It increases

7. Play the simulation again several times, each time increasing the projectile's velocity from 0.0 m/s to 5.0 m/s to 10. m/s to 15. m/s to 20. m/s.
   a. What happens to the amount of time it takes the projectile to hit the ground?

      It remains the same

   b. What happens to the horizontal distance the projectile travels?

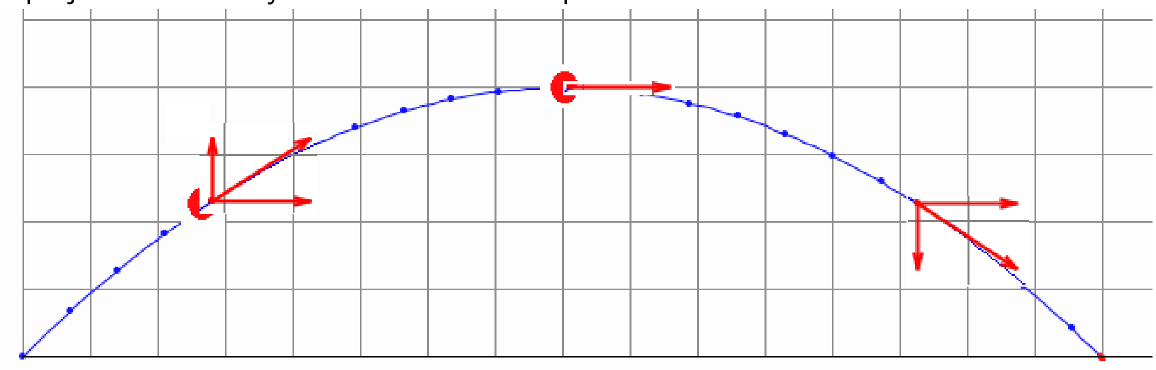
      It increases

   c. What happens to the vertical distance the projectiles travels?

      It remains the same

Part Two: Angle Projectiles

8. Set the initial velocity to 25 m/s, the launch angle to 45°, and the y_o to 0 m. Fire the projectile. Pay careful attention to the horizontal and vertical components of the projectile's velocity as it travels through the air. On the diagram below, sketch horizontal and vertical component vectors for the projectile's velocity at each of the three positions shown as well as the resultant velocity.



   a. What happens to the horizontal component?

      It remains the same

   b. What happens to the vertical component?

      It decreases then increases

   c. What happens to the resultant velocity?

      It decreases then increases

9. Click Reset to clear the screen. With the velocity set to 25 m/s don't play the simulation but instead increase the angle from the lowest to the highest possible angles. Watch what happens to the horizontal and vertical components as well as the resultant velocity.

   a. What happens to the horizontal component?

      It decreases

   b. What happens to the vertical component?

      It increases

   c. What happens to the resultant velocity?

      It remains the same

   d. What angle has equal horizontal and vertical components?

      45°

10. With the velocity still set to 25 m/s, launch the stone from each of the angles listed below. Note the time of flight (move slider bar until the moment the projectile lands), the horizontal range (x value when the projectile lands), and the maximum height of the ball (move slider bar to when the projectile was at its peak). Complete the chart below.

Angle	15^0	20^0	30^0	40^0	45^0	50^0	60^0	70^0	75^0
Time (s)	1.32	1.74	2.55	3.28	3.61	3.91	4.42	4.79	4.93
Range (m)	31.88	40.88	55.21	62.82	63.82	62.83	55.25	40.96	31.9
Height (m)	2.14	3.72	7.97	13.17	15.94	18.71	23.92	28.16	29.75

Questions

Answer the following questions based on the results of your simulations.

1. As the angle increased, what happened to the time the projectile was in the air?

   It increased

2. Based on the pattern of the data, what angle would give the greatest time of flight?

   90^o

3. As the angle increased, what happened to the maximum height the projectile reached?

   It increased

4. Based on the pattern of the data, what angle would give the greatest maximum height?

   90^o

5. Which angle gave the greatest horizontal range?

   45^o

6. As the angle increased, what happened to the horizontal range of the projectile?

   It increased then decreased

7. a) Do any two angles have (approximately) the same range? If so, which?

   15^o,75^o 20^o,70^o 30^o,60^o 40^o,50^o

   b) What is the relationship between the two angles in any pair of angles listed above?

   They are complimentary (add up to 90^o)