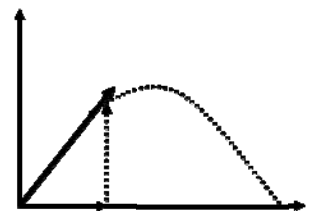


### Symmetrical Projectile Motion

1. A cannon is elevated at an angle of 45 degrees. It fires a ball with an initial speed of 300 m/s. It lands at the same height it was fired from. A) What height does the ball reach? B) How long is the ball in the air? C) What is the horizontal range?
  
2. A trail bike comes to a ditch. A ramp with an incline of 10 degrees has been built so that the bike can jump the ditch. If the bike needs to jump a horizontal distance of 7 m to clear the ditch, how fast must it be going when it leaves the ramp and land at the same height it launched from?
  
3. A place kicker kicks a football at an angle of  $40^\circ$  above the horizontal. The initial velocity  $v_0$  of the ball is 22 m/s. Determine the **maximum height** that the ball attains. Determine the **time** of flight between kickoff and landing. Determine the range of the ball.
  
4. A Projectile is fired from the ground and lands back at the same elevation. Its initial velocity is :  $V_0 = 20 \text{ m/s @ } 60^\circ$  What are the x and y components? What is the total time the projectile in the air? At what time does it reach it's max. height? What is the horizontal distance traveled? What is the maximum altitude of the object?



Complete the following Table:

Initial Velocity	Time of Flight	Maximum Height	Range
40m/s @ 0°			
40m/s @ 10°			
40m/s @ 20°			
40m/s @ 25°			
40m/s @ 30°			
40m/s @ 35°			
40m/s @ 40°			
40m/s @ 45°			
40m/s @ 50°			
40m/s @ 55°			
40m/s @ 60°			
40m/s @ 65°			
40m/s @ 70°			
40m/s @ 80°			
40m/s @ 90°			

Enrichment: A baseball is thrown toward a player with an initial speed of 20 m/s at an angle of 45 degrees with the horizontal. At the moment the ball is thrown, the player is 50 m from the thrower. At what speed and direction must the player run to catch the ball at the same height at which it was released?