

## Advanced Symmetrical Projectile Motion

1. A football is kicked at an angle of  $45^\circ$  and travels 82 m before hitting the ground.
  - a) Find its **initial velocity**
  - b) **How long** was it in the air?
  - c) What is its **maximum height**?
  
2. A shot put is released with a velocity of 12 m/s and stays in the air for 2.0 sec.
  - a) At what **angle** was it released? [HINT: Think of **ALL** the kinematic equations with  $\theta$  in it!]
  - b) What was the shot put's **range**?
  
3. Find the **angle of elevation  $\theta$**  of a tank's cannon which fires a shell with a muzzle velocity of 120 m/s and hits a target on the same level (What is  $\Delta y$ ?) but 1300 m distant.
  
  
  
  
  
  
  
  
  
  
4. A baseball is thrown straight downward with initial velocity of 8 m/s from a height of 25 m. Compute the following:
  - a) Compute the **time** it takes the baseball to reach the ground.
  - b) Calculate the **velocity** the baseball strikes the ground with.
  
  
  
  
  
  
  
  
  
  
5. A marble dropped from a bridge strikes the water in 5 sec.
  - a) Calculate the **impact velocity** ( $v_y$ ).
  - b) What is the **height** of the bridge?

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Chapter 3: Two Dimensional Motion

6. Morten Anderson, a place kicker, tries for a field goal. He kicks the ball  $40^\circ$  above the horizontal. The initial velocity ( $v_i$ ) of the ball is 23 m/s.
- Determine the maximum height that the ball attains.
  - Determine the time of flight between kickoff and landing.
  - Determine the range of the football.
  - If the uprights were 27 yards away, and the uprights are 10 feet off the ground, does he make the field goal? [hint: find  $y$  at the time  $t$  where  $x = 22$  yards.] [convert!]
7. A hunter aims *directly* at a target 120 m away.
- If the bullet leaves the gun at a velocity of 250 m/s, by how much will it miss the target?
  - At what angle** *should* the gun be aimed so the target will be hit?
8. A projectile is launched from ground level to the top of a cliff which is 195 m away and 155 m high. If the projectile lands on top of the cliff 7.6 sec after it is fired, find the **initial velocity** of the projectile (**BOTH magnitude AND direction**). Neglect drag.