

Homework #2. 2D Kinematics

Attempt ALL problems by Wednesday night (11:59pm, Oct. 7, 2020).

The hard deadline is Sunday night (11:59pm, Oct. 11, 2020)

1. A projectile launched at an angle to the horizon with an initial velocity of 10 m/s spent 2 s in the air. The projectile hit the ground with a speed of 14 m/s. Find the projectile's launch height and the maximum height during the flight. Neglect air resistance and assume acceleration of gravity to be 10 m/s^2 .
2. A projectile is launched at an angle θ and speed v_0 . What is the maximum value attained by the angular velocity of the rotation of the projectile's velocity vector?
3. A stone is thrown from the ground two times with the same speed by at different angles. The ranges come out the same, but the total flight times differ by a factor of $\sqrt{3}$. What are the launch angles?
4. A stone is thrown from the ground two times with the same speed by at different angles. The ranges come out to be 30m in both cases, and the air time for the first shot was 3s. What was the second air time?
5. A cannon ball is launched at 75° to the horizon and follows a parabolic trajectory. At first, the cannon ball is going away from the launch site. Then is approaching it for 10s and finally moving away again. What is the launch speed of the cannon ball? Assume $g = 10 \text{ m/s}^2$.
6. A particle, acted upon by a constant force, moves along the trajectory governed by $y = 0.04x^2$ (x and y are measured in meters). It passes point $x = 0$ with a velocity of 10 m/s. Find the particle's velocity 2 seconds later.
6. A cannon can launch a cannon ball with a fixed launch speed v . Which launch angle will yield the maximum range if the final altitude is h ? Consider positive and negative h .