

Assignment 3

September 30, 2022

- Q1 A ball is dropped from the roof of the building. It took 2.6s to reach the ground. How tall is the building?
- Q2 A tennis ball is thrown straight up, leaving the hand with a speed of 3 m/s.
- (a) How high would the ball go?
 - (b) How long would the ball reach the maximum height?
 - (c) How long does it take for the ball to fall back from the apex?
- Q3 A ball is thrown straight up with velocity of 8.3 m/s.
- (a) What is the time for the ball to reach the maximum height?
 - (b) What is the maximum height of the ball?
 - (c) How long does it take for the ball to fall back from the apex?
- Q4 From the previous two questions, you can see that the time to fall back from the apex of trajectory is the same as the time it takes to reach the apex.
- (a) Why is that the case? Try to reason using mathematical formulations like we derived the 5 important equations.
 - (b) If the ball is tossed straight up with an initial velocity \vec{v}_i , what do you think the velocity of the ball is when it falls back down to you? Why is that the case? Provide a mathematical justification.
- Q5 In the 5 kinematic equations under uniform acceleration, the last one is $v_f^2 = v_i^2 + 2a\Delta d$. While keeping the acceleration uniform, list one occasion that this equation is NOT valid. Why is it the case? Hint: What part of a vector is not preserved after taking its square?
- Q6 Provide a situation where
- (a) $\vec{g} > 9.81 \text{ m/s}^2$
 - (b) $\vec{g} < 9.81 \text{ m/s}^2$

Hint: Try to google the term "gravitational acceleration formula", and see what affects the value of \vec{g} .

Bonus If the air resistance is no longer negligible, when a ball is thrown straight up:

- (a) Will the ball reach the apex sooner or later?
- (b) Will the apex of the trajectory be higher or lower?
- (c) Will the speed of the ball when it falls back be faster or slower?

You don't need a mathematical justification, but please provide some reasoning on why you think this is the case.