

PHY 2048C Test 1 Chapter 1 - Chapter 4

Directions: Please do all problems and **show all work**. You will be graded on your work in addition to your answers, so if you do not show your work you risk losing points. To simplify your math please use $g = 10 \text{ m/s}^2$.

Note: Please do not write on the test. Write all work and answers on a separate sheet of paper. Please clearly indicate all answers.

1. Write all four kinematics equations.
2. Modify the four kinematics equations for the case that you choose to work in a coordinate system where t_0 is not set to 0. Hint: Your answer will be similar to the regular kinematics equations, but the term t_0 will be added at certain points.
3. Some drops a ball off of the top of a 125-m-tall building. In this problem, you will be solving for the time it takes the ball to hit the ground. **(a)** Define your coordinate system, be thorough. **(b)** Write down the given information, be sure to include hidden information. **(c)** State what physics principle is at play here. How do you know this? **(d)** Select an equation. **(e)** Solve for the time it takes for the ball to hit the ground.
4. Consider the vectors $\vec{A} = 7\hat{i} - 3\hat{j} + 5\hat{k}$ and $\vec{B} = 2\hat{i} + 3\hat{j}$. **(a)** What is $\vec{A} + \vec{B}$? **(b)** What is $-5\vec{A}$?
5. Someone kicks a ball off of a 15-m-high cliff. The kick is at an angle of 30 degrees above the horizontal with a speed of 20 m/s. In this problem you will be ultimately solving for the distance from the cliff that the ball lands. **(a)** Write down all the given information. Be sure to organize it effectively. **(b)** Solve for the time it will take the ball to hit the ground. **(c)** Solve for the horizontal distance from the cliff that the ball will land.
6. What are the direction and magnitude of a centripetal acceleration?
7. A particle has an acceleration described by the equation $\vec{a} = bt^2\hat{i} + ct^3\hat{j}$. **(a)** What is the magnitude and direction of the velocity? **(b)** Write the equation of motion for this particle (an equation of motion is a formula for the position as a function of time).
8. A projectile is launched from ground level at angle θ and speed v_0 into a headwind that causes a constant horizontal acceleration of magnitude a opposite the direction of motion. **(a)** Find an expression in terms of a and g for the launch angle that gives maximum range. **(b)** What is the angle for maximum range if a is 10 percent of g ?

9. A rubber ball is shot straight up from the ground with speed v_0 . Simultaneously, a second rubber ball at height h directly above the first ball is dropped from rest. (a) At what height above the ground do the balls collide? Your answer will be an algebraic expression in terms of h , v_0 and g . (b) What is the maximum value of h for which a collision occurs before the first ball falls back to the ground? (c) For what value of h does the collision occur at the instant when the first ball is at its highest point?