

Projectile Motion Problem Set

1. A friend throws a baseball horizontally. He releases it at a height of 2.0 m and it lands 21 m from his front foot, which is directly below the point at which he released the baseball. (a) How long was it in the air? (b) How fast did he throw it?
2. A cannon mounted on a pirate ship fires a cannonball at 125 m/s horizontally, at a height of 17.5 m above the ocean surface. Ignore air resistance. (a) How much time elapses until it splashes into the water? (b) How far from the ship does it land?
3. A juggler throws a ball with an initial horizontal velocity of +1.1 m/s and an initial vertical velocity of +5.7 m/s. What is its acceleration at the top of its flight path? Make sure to consider the sign when responding. Consider the upward direction as positive.
4. The muzzle velocity of an armor-piercing round fired from an M1A1 tank is 1770 m/s (nearly 4000 mph or mach 5.2). A tank is at the top of a cliff and fires a shell horizontally. If the shell lands 6520 m from the base of the cliff, how high is the cliff?
5. A cannon is fired horizontally from atop a 40.0 m tower. The cannonball travels 145 m horizontally before it strikes the ground. With what velocity did the ball leave the muzzle?
6. You are returning a tennis ball that your five-year-old neighbor has accidentally thrown into your yard, but you need to throw it over a 3.0 m fence. You want to throw it so that it barely clears the fence. You are standing 0.50 m away from the fence and throw underhanded, releasing the ball at a height of 1.0 m. State the initial velocity vector you would use to accomplish this.
7. Your friend has climbed a tree to a height of 6.00 m. You throw a ball vertically up to her and it is traveling at 5.00 m/s when it reaches her. What was the speed of the ball when it left your hand if you released it at a height of 1.10 m?
8. Your projectile launching system (which is at ground level) is partially jammed. It can only launch objects with an initial vertical velocity of 42.0 m/s, though the horizontal component of the velocity can vary. You need your projectile to land 211 m from its launch point. What horizontal velocity do you need to program into the system?
9. A professional punter can punt a ball so that its "hang time" is 4.20 seconds and it travels 39.0 m horizontally. State its initial velocity in rectangular coordinates. Ignore air resistance, and assume the punt receiver catches the ball at the same height at which the punter kicks it.
10. A canon ball is launched from a 251.0m tall tower with a velocity of 23 m/s at an angle of 38° . (a) How far away from the cannon will the cannon ball hit the ground? (b) What is the maximum height of the cannon ball?