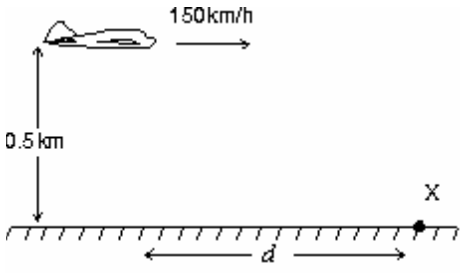
Chapter 4 – (Motion in two and three dimension) Extra problems

1- The airplane shown is in level flight at an altitude of 0.50 km and a speed of 150 km/h. At what distance d should it release a heavy bomb to hit the target X? Take g = 10 m/s^2. (A: 417 m)

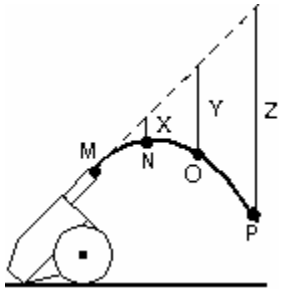


2- A stone is thrown horizontally from the top of a 20-m high hill. It strikes the ground at an angle of 45°. With what speed was it thrown? (A: 20 m/s)

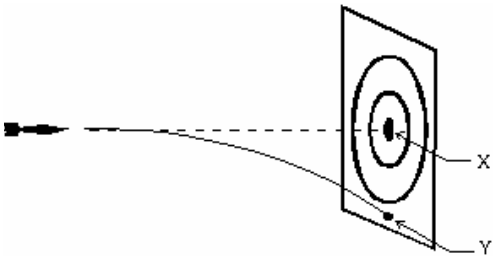
3- A large cannon is fired over level ground at an angle of 30° above the horizontal. The muzzle velocity is 980 m/s. Neglecting air resistance, the projectile will travel what horizontal distance before striking the ground? (A: 85,000 m)

4- A boy on the edge of a vertical cliff 20 m high throws a stone horizontally outwards with a speed of 20 m/s. It strikes the ground at what horizontal distance from the foot of the cliff? Use g = 10 m/s^2. (A: 40 m)

5- A cannon fires a projectile as shown. The dashed line shows the trajectory in the absence of gravity; points MNOP correspond to one second intervals. Using g = 10 m/s^2, the lengths X,Y,Z are: (A: 5 m, 20 m, 45 m)



6- A dart is thrown horizontally toward X at 20 m/s as shown. It hits Y 0.1 s later. The distance XY is: (A: 0.05 m)



7- A projectile is fired over level ground with an initial velocity that has a vertical component of 20 m/s and a horizontal component of 30 m/s. Using $g = 10\ m/s^2$, the distance from launching to landing points is: (A: 120 m)

8- An object is moving on a circular path of radius π meters at a constant speed of 4.0 m/s. The time required for one revolution is: (A: $\pi^2/2$ s)

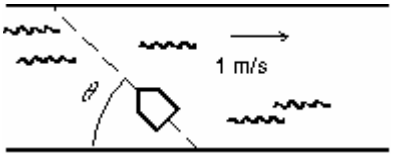
9- A Ferris wheel with a radius of 8.0m makes 1 revolution every 10 s. When he is at the top, essentially a diameter above the ground, he releases a ball. How far from the point on the ground directly under the release point does the ball land? (A: 9.1 m)

10- A boat is able to move through still water at 20 m/s. It makes a round trip to a town 3.0 km downstream. If the river flows at 5 m/s, the time required for this round trip is: (A: 320 s)

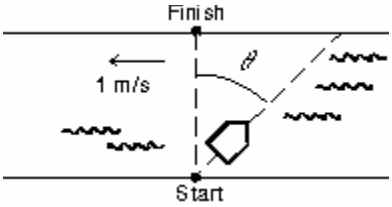
11- A boat is traveling upstream at 14 mph with respect to a river that is flowing at 6 mph (with respect to the ground). A man runs directly across the boat, from one side to the other, at 6 mph (with respect to the boat). The speed of the man with respect to the ground is: (A: 10 mph)

12- A ferry boat is sailing at 12 km 30° W of N with respect to a river that is flowing at 6.0 km/h E. As observed from the shore, the ferry boat is sailing: (A: due N)

13- A boy wishes to row across a river in the shortest possible time. He can row at 2 m/s in still water and the river is flowing at 1 m/s. At what angle θ should he point the bow (front) of his boat? (A: 90°)



14- A girl wishes to row across a river to a point directly opposite as shown. She can row at 2 m/s in still water and the river is flowing at 1 m/s. At what angle with respect to the line joining the starting and finishing points should she point the bow (front) of her boat? (A: 30°)



15- Car A is moving with a speed of 30 km/h along the positive x-axis and car B is moving with a speed of 40 km/h along the positive y-axis. What is the velocity of car B with respect to car A? (A: (-30i + 40j) km/h)

16- A ball leaves the ground with a speed of 50 m/s at an angle of 60 degrees with the horizontal. Find its speed at its highest point. (A: 25 m/s)

17- A stone is thrown from the ground into the air with an initial velocity V = (5.0i + 9.0j) m/s. To what maximum height will the stone rise? (A: 4.1 m)

18- A particle starts from the origin at t = 0 with a velocity of 8.0j m/s and moves in the XY plane with a constant acceleration of (4.0i +2.0j)m/s**2. At the instant the X coordinate of the particle is 32 m, find its y coordinate. (A: 48 m)

19- A stone is thrown horizontally from the top of a 40m high hill. It strikes the ground at an angle of 30 degrees as shown in Fig.2. With what speed was it thrown? (A: 49 m/s)

20- A river has a steady flow of 0.30 m/s. A student swims downstream a distance of 1.2 km and returns to the starting point. If the student can swim at a constant speed of v in still water and the downstream portion of the swim takes him 20 minutes, the time required for the entire swim is: (A: 70 minutes)

21- Find the magnitude of the centripetal acceleration of a particle on the tip of a fan blade, 0.150 m in radius, rotating at 1200 revolutions every minute. (A: 2370 m/s**2)

22- A boat can travel with a velocity of 1.70 m/s in still water (that is Vbw = 1.70 m/s). The boat heads (points) across a river where the current is 0.75 m/s (that is Vwg = 0.75 m/s). What is the speed of the boat relative to the ground? (A: 1.86 m/s)