Kinematics In 2D

1. A particle is projected horizontally with a speed of 14.7 m/s. Find the horizontal and vertical displacements of the particle from the point of projection after 2 seconds. Find also how far the particle then is from the point of projection.

2. A particle is projected horizontally from a point 44.1 m above a horizontal plane. The particle hits the plane at a point which is, horizontally, 39 m from the point of projection. Find the initial speed of the particle.

3. A stone is thrown horizontally at 21 m/s from the edge of a vertical cliff and falls to the sea, 40 m below. Find the horizontal distance from the foot of the cliff to the point where the stone enters the sea.

4. A fielder retrieves a cricket ball and throws it horizontally with a speed of 28 m/s to the wicket-keeper standing 12 m away. If the fielder releases the ball at a height of 2 m above level ground, find the height of the ball when it reaches the wicket-keeper.

5. A particle is projected from a point on a horizontal plane and has an initial velocity of $28\sqrt{3}$ m/s at an angle of elevation of 60°. Find the greatest height reached by the particle and the time taken to reach this height. Find also the horizontal distance travelled by the particle.

6. A particle is projected from a point on a horizontal plane and has an initial velocity of 45 m/s at an angle of elevation of $\tan^{-1}\frac{3}{4}$. Find the time of flight and the range of the particle on the horizontal plane.

7. A ball is launched at speed 20m/s at ground level at 70 degrees to the horizontal. Find:

   (a) The maximum height reached by the ball. $\boxed{18.0}$

   (b) The distance travelled horizontally by the ball. $\boxed{26.2}$

8. A shot put is thrown from a height of 2.1 metres above ground level. It is projected at an angle of 40 degrees to the horizontal at a speed of 30m/s. Find the distance horizontally travelled by the ball when it hits the ground. $\boxed{92.9}$

9. A stone is thrown from the edge of a vertical cliff and has an initial velocity of 26 m/s at an angle $\tan^{-1}\frac{5}{12}$ below the horizontal. The stone hits the sea at a point level with the base of the cliff and 72 m from it. Find the height of the cliff and the time for which the stone is in the air. (Let $g = 10$ m/s^2 in this question.)

10. A batsman hits a ball at a velocity of 17.5 m/s angled at $\tan^{-1}\frac{3}{4}$ above the horizontal, the ball initially being 60 cm above level ground. The ball is caught by a fielder standing 28 m from the batsman. Find the time taken for the ball to reach the fielder and the height above ground at which he takes the catch.

11. ★ A ball is launched at an angle of 10 degrees to the horizontal from ground level across a flat field. It travels a horizontal distance of 40 metres before it hits the ground. What was the initial speed of the ball.