EdExcel Mechanics 2

Kinematics of a particle

Section 1: Projectiles

Exercise

1. A particle is projected from point O on horizontal ground at a speed of 25 ms^{-1} and at an angle of 30° to the horizontal.
    (i) Draw a diagram showing the path of the projectile.
    (ii) Write down the initial components of the velocity in the horizontal and vertical directions.
    (iii)Write down equations for the velocity of the projectile at time t.
    (iv)Write down equations for the position at time t.

2. For the particle in question 1 find
    (i) The maximum height reached,
    (ii) The time that it takes to return to the same level as the point of projection,
    (iii)The horizontal range.

3. A particle is projected from point O on horizontal ground with a velocity of 50 ms^{-1} at an angle of 30° to the horizontal. Find
    (i) The velocity of the particle after 2 seconds,
    (ii) The time taken for the particle to reach its greatest height,
    (iii)The greatest height reached by the particle.

4. A stone is thrown horizontally from a cliff 50 m high. It travels 65 m horizontally before hitting the water. Find
    (i) the time in the air,
    (ii) the initial speed of the stone.

5. A ball is thrown horizontally from a tower 19.6 m high at a speed of 24.5 ms^{-1}.
    Find the horizontal distance that it travels before hitting the ground and its velocity as it hits the ground.

6. A particle is projected from point O on a horizontal plane with a speed 45 ms^{-1} and at an angle θ such that tan $\theta = 2$.
    (i) Write down the initial horizontal and vertical components of the velocity.
    (ii) Write down equations for the velocity at time t.
    (iii)Write down equations for the position at time t.
    (iv)Find the time of flight and the range.
    (v) Find the maximum height reached.

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7. A golf ball is given an initial velocity of 30 ms^{-1} at an angle α to the horizontal such that $\tan\alpha = \frac{4}{3}$. Find

    (i) The horizontal and vertical components of the velocity initially,
    (ii) The time to reach the highest point and the maximum height reached,
    (iii)The time of flight and the range.

8. A tennis player serves the ball horizontally with a speed of 20 ms^{-1} and at a height of 2.8 m. The net is 1 m high and 12 m away. Will the ball clear the net and if so by how much?