6.1) Horizontal projection

Worked example

A particle is project horizontally at $50\ ms^{-1}$ from a point 44.1 metres above a horizontal surface. Find:

(a) the time taken by the particle to reach the surface
(b) the horizontal distance travelled in that time.
(c) the distance of the impact point from the original point.

Your turn

A particle is project horizontally at $25\ ms^{-1}$ from a point 78.4 metres above a horizontal surface. Find:

(a) the time taken by the particle to reach the surface
(b) the horizontal distance travelled in that time.
(c) the distance of the impact point from the original point.

a) 4 s
b) $100\ m$
c) $130\ m$ (2 sf)

Worked example

A particle is projected horizontally with a velocity of $30\ ms^{-1}$. Find:

a) The horizontal component of the displacement of the particle from the point of projection after 1.5 seconds

b) The vertical component of the displacement of the particle from the point of projection after 1.5 seconds

c) The distance of the particle from the point of projection after 1.5 seconds

Your turn

A particle is projected horizontally with a velocity of $15\ ms^{-1}$. Find:

a) The horizontal component of the displacement of the particle from the point of projection after 3 seconds

b) The vertical component of the displacement of the particle from the point of projection after 3 seconds

c) The distance of the particle from the point of projection after 3 seconds

a) $45\ m$

b) $44\ m$ (2 sf)

c) $63\ m$ (2 sf)

Worked example

A particle is projected horizontally with a speed of $U\ ms^{-1}$ from a point 176.4m above a horizontal plane.
The particle hits the plane at a point which is at a horizontal distance of 180m away from the starting point.
Find the initial speed of the particle.

Your turn

A particle is projected horizontally with a speed of $U\ ms^{-1}$ from a point 122.5m above a horizontal plane.
The particle hits the plane at a point which is at a horizontal distance of 90m away from the starting point.
Find the initial speed of the particle.

$18\ ms^{-1}$

Worked example

A particle is projected horizontally with a speed of 15 ms^{-1} from a point h m above a horizontal plane.
The particle hits the plane at a point which is at a horizontal distance of 120m away from the starting point.
Determine the value of h.

Your turn

A particle is projected horizontally with a speed of 30 ms^{-1} from a point h m above a horizontal plane.
The particle hits the plane at a point which is at a horizontal distance of 210m away from the starting point.
Determine the value of h.

$$h = 240.1$$

Worked example

A particle of mass $10\ kg$ is projected along a horizontal rough surface with a velocity of $20\ ms^{-1}$.
After travelling a distance of $40\ m$ the ball leaves the rough surface as a projectile and lands on the ground which is $3\ m$ vertically below. Given that the total time taken for the ball to travel from the initial point of projection to the point when it lands is 4.0 seconds, find:

a) The time for which the particle is in contact with the surface
b) The coefficient of friction between the particle and the surface
c) The horizontal distance travelled from the point of projection to the point where the particle hits the ground

Your turn

A particle of mass $5\ kg$ is projected along a horizontal rough surface with a velocity of $10\ ms^{-1}$.
After travelling a distance of $4\ m$ the ball leaves the rough surface as a projectile and lands on the ground which is $1.5\ m$ vertically below. Given that the total time taken for the ball to travel from the initial point of projection to the point when it lands is 1.0 seconds, find:

a) The time for which the particle is in contact with the surface
b) The coefficient of friction between the particle and the surface
c) The horizontal distance travelled from the point of projection to the point where the particle hits the ground

a) 0.45 s (2 sf)
b) 0.48 (2 sf)
c) $7.5\ m$ (2 sf)