

Notes - Projectiles

- Projectiles are objects falling through the air due to gravity. However what makes projectiles different from falling bodies is they also have horizontal movement not just vertical.
- The path that a projectile follows is called a trajectory.
- Suppose a person drops their gum out the window of their car as they drive by you. What would the trajectory of the gum look like to you? **Start of drop**



- What would the trajectory of the gum look like to the person who dropped it? **Start of drop**



- The gum trajectory never changed but the **VIEWPOINT** did!
- Because the vertical movement is independent of the horizontal movement we can figure out each for projectiles.
- Horizontal components have x as part of the letter and vertical components have y.

- Ex. 1 - $\vec{v}_{avg} = \frac{\vec{d}_f - \vec{d}_i}{\Delta t}$ becomes $\vec{v}_x = \frac{\vec{d}_{xf} - \vec{d}_{xi}}{\Delta t}$

- To solve for vertical components of a projectile we can use either

$$\vec{d}_y = \vec{v}_y t + \frac{1}{2} \vec{a} t^2 \quad \text{or} \quad \vec{v}_{yf} = \vec{v}_{yo} + \vec{a} t$$

Where \vec{d}_y represents the displacement in the vertical direction, \vec{v}_y is the vertical velocity at the start and \vec{v}_{yf} is the vertical final velocity.

TYPE 1 PROJECTILES

Objects launched Horizontally

- These objects have no initial vertical velocity. That is they are launched horizontal only.
- Ex. - A rock is thrown +15 m/s horizontally at your sister as she keeps bugging you to play "tea" with her. She ducks and the rock goes off a 44 m high cliff. How long does it take to reach the bottom of the cliff?

Answer -

Given

Need

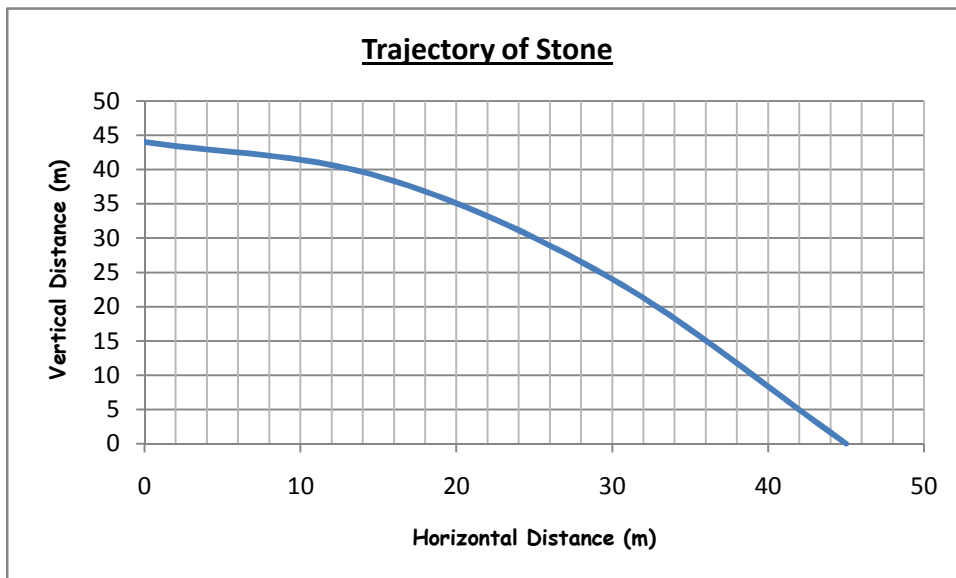
- How far from the base of the cliff does the rock hit?

Answer -

Given

Need

- Draw a sketch of the rocks trajectory.



TYPE 2 - PROJECTILES

Objects launched at an Angle

- Objects launched with both vertical and horizontal components are solved by doing the horizontal and vertical trajectories separately.
- The range (R) is the horizontal distance the object moves from the start till the object returns to the start surface height.
- Ex. 1 - The flight of a bullet follows a parabola. If the initial velocity of the bullet is 250 m/s at an angle of 66° above the horizontal how long does it take to land?

Answer -

Given

Need

- Ex. 2 - How high did the bullet fly?

Answer -

- Ex. 3 - What was the range of the bullet?

Answer -