

Physics I

Set no. 3

Please assume that $g = 10 \text{ m/s}^2$ (magnitude the acceleration due to gravity) unless otherwise stated

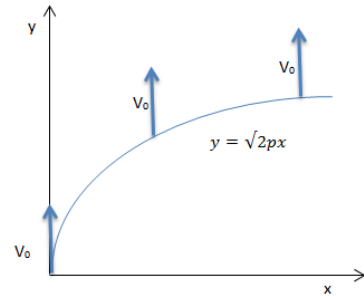
1. The body moves along the parabola described by an equation

$$y^2 = 2px$$

The velocity vector throw on the tangent to the apex of the parabola has a constant value v_0

Please find :

- the velocity vector and its magnitude
- the acceleration vector and its magnitude



2. From the river bank we let out a boat with a drive with a v_B - constant and perpendicular to the water speed . The speed of the water (direction parallel to the shore) depends on the distance from the shore and is described by the formula:

$$V_w = V_0 \sin(\pi y/L).$$

V_0 and L are fixed (L is the width of the river).

Please find the value of the vector of the boat's speed in relation to the shore, the equation of movement and track (path equation) and the distance d , to which the current carries the boat from the starting point to the point of arrival on opposite bank.

(E) 3. Throw the body a) vertically b) horizontally, c) diagonally in the coordinate system

Specify vectors \vec{r} , \vec{v} and \vec{a} . Find equation of motion and equation of trajectory and

- max height
- range
- range, max height

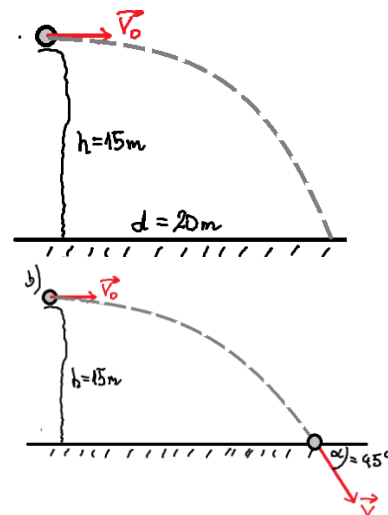
(E) 4. A stone is thrown outward from the top of a 59.4-m high cliff with an upward velocity component of 19.5 m/s. How long is stone in the air?

(E) 5. A large cannon is fired from ground level over level ground at an angle of 30° above the horizontal. The muzzle speed is 980 m/s. Neglecting air resistance, what horizontal distance will the projectile travel before striking the ground?

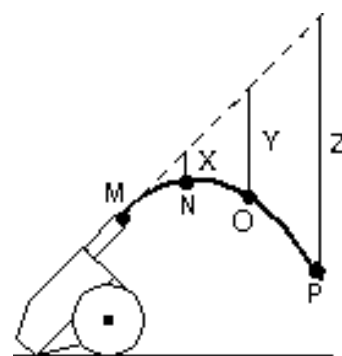
(E) 6. A boy on the edge of a vertical cliff 20 m high throws a stone horizontally outwards with a speed of 20 m/s. Please find:

- the horizontal distance from the foot of the cliff at what the stone strikes the ground,
- the angle between velocity vector and the horizontal when the stone falls to the ground.

7. A body was thrown horizontally on the edge of a vertical cliff ($h = 15 \text{ m}$). Please determine the initial velocity of the body, v_0 , if:
- the horizontal distance from the foot of the cliff to where the body strikes the ground is $d = 20 \text{ m}$,
 - the angle between velocity vector and the horizontal when the stone falls to the ground equals $\alpha = 45^\circ$.



8. A cannon fires a projectile as shown. The dashed line shows the trajectory in the absence of gravity; points MNOP correspond to the position of the projectile at one second intervals. If $g = 10 \text{ m/s}^2$, please calculate the lengths X,Y,Z.



8. An object is moving on a circular path of radius $r = 2 \text{ m}$ at a constant speed $v = 4.0 \text{ m/s}$. Please find the time required for one revolution.
9. A particle moves at constant speed in a circular path. The instantaneous velocity and instantaneous acceleration vectors are (please choose):
- both tangent to the circular path
 - both perpendicular to the circular path
 - perpendicular to each other
 - opposite to each other
 - none of the above
10. A car rounds a $r = 20 \text{ m}$ radius curve at $v = 10 \text{ m/s}$. Please find the magnitude of its acceleration.
11. A girl jogs around a horizontally circle with a constant speed. She travels one fourth of a revolution, a distance of $d = 25 \text{ m}$ along the circumference of the circle, in $t = 5 \text{ s}$. Please calculate the magnitude of her acceleration.