Answer on Question #44573 – Physics – Other

The position coordinates of a projectile projected from ground on a certain planet (with no atmosphere) are given by y = (4t-2t^2)m and x = (3t) meter, where t is in second and point of projection is taken as origin. The angle of projection of projectile with vertical is

(1) 30 degree
(2) 37 degree
(3) 45 degree
(4) 60 degree

Solution:

In physics, we use the following equations to determine the vertical and horizontal position of an object at a specific time t.

For vertical, $h = v_y t - \frac{a t^2}{2}$; $h = 4t - 2t^2$
For horizontal $x = v_x t$; $x = 3t$

v is the initial vertical velocity. In terms of the initial velocity, the following equations are used to determine the initial vertical and horizontal velocities.

Initial vertical velocity $v_y = v \sin\theta$, initial horizontal vlocity $v_x = v \cos\theta$

In these equations the angle is with respect to horizontal. Since the angles that given in this problem are with respect to vertical, we need to reverse these equations.

Initial vertical velocity $v_y = v \cos\theta$, initial horizontal velocity $v_x = v \sin\theta$

In this problem, the initial vertical velocity is $v_y = 4\frac{m}{s}$ (coefficient near t in equation of motion along y-axis) and initial horizontal velocity is $v_x = 3\frac{m}{s}$ (coefficient near t in equation of motion along x-axis).
We have a system of equations:

$$\begin{cases} v\cos\theta = 4 \quad (1) \\ v\sin\theta = 3 \quad (2) \end{cases}$$

$$(2) \div (1):$$

$$\frac{v\sin\theta}{v\cos\theta} = \tan\theta = \frac{3}{4}$$

$$\theta = \arctan\left(\frac{3}{4}\right) = 37°$$

Answer: (2) 37 degree