As a tennis ball is struck, it departs from the racket horizontally with a speed of . The ball hits the court at a horizontal distance of 19.6 m from the racket. How far above the court is the tennis ball when it leaves the racket?

As there is no horizontal speed in this question (by mistake maybe), the answer will be presented as a general formula.

V_x – Horizontal component of the speed.

V_y - Vertical component of the speed.

We will assume that there is no air resistance. In these conditions, the ball will move horizontally with constant speed = V_x = speed at the departure from the racket (that one that should be in the task).

Therefore horizontal distance is:
$\boldsymbol{S = V_x * t;}$

and the time of flight:
$\boldsymbol{t = S/V_x;}$

In the vertical plane the ball moves with acceleration of **g=9.81 m/s²**. At the beginning of the flight V_y=0, therefore vertical distance is described with the equation:

$$\boldsymbol{H = \frac{1}{2} * g * t^2 = \frac{1}{2} * g * (\frac{S}{V_x})^2,}$$

where *g = 9.81 m/s²*, *S = 19.6 m*, V_x must be given in the task.

Answer:

$$\mathbf{H = \frac{g * S^2}{2 * V_x{}^2}}$$