

### Question #16215

Let  $v_0$  denote the velocity at horizontal part of the track, and  $v_0'$  denote the velocity at the end of the upward part of the track. First, let's find  $v_0'$ , using the law of conservation of energy:

$$\frac{mv_0^2}{2} = \frac{mv_0'^2}{2} + mgh \Rightarrow v_0'^2 = v_0^2 - 2gh \quad (1)$$

Then, for the movement from the end of the upward part of the track:

$$S_x = v_0' \cos \varphi t$$

$$S_y = v_0' \sin \varphi t - \frac{gt^2}{2} \quad (2)$$

$$\text{Find the maximum of } S_y: \quad \frac{dS_y}{dt} = v_0' \sin \varphi t - gt = 0 \Rightarrow T = \frac{v_0' \sin \varphi}{g} \quad (3)$$

At this moment of time, the skateboarder will reach the maximum height.

Plugging (3) into (2), obtain:  $H_{max} = \frac{v_0'^2 \sin^2 \varphi}{2g}$ . Plugging (1) into latter formula, finally obtain:

$$H_{max} = \frac{(v_0^2 - 2gh) \sin^2 \varphi}{2g} = 0.35 \text{ m}$$