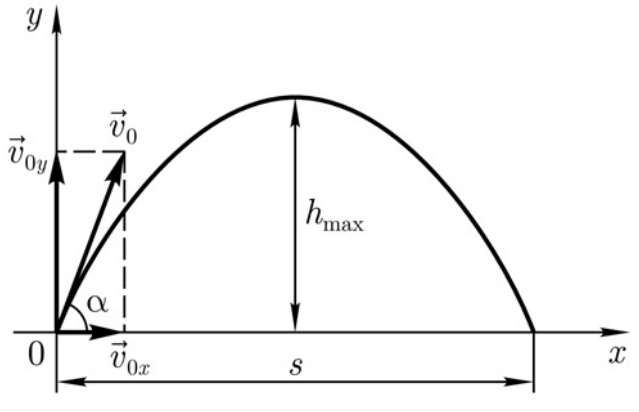
**Answer on Question #71521, Physics / Mechanics | Relativity**

**Question.** A bullet is fired at a $10°$ angle from a rifle having a muzzle velocity of $150\ m/sec$. How many seconds is the bullet in the air? How far does the bullet travel horizontally before striking the ground? How far does the bullet rose before beginning to fall?

**Given.** $\alpha = 10°; v_0 = 150\ m/s.$

**Find.** $t, S, h_{max} - ?.$

**Solution.**




The initial horizontal velocity is $v_{0x} = v_0 \cos\alpha$ and the initial vertical velocity is $v_{0y} = v_0 \sin\alpha$. So

$$y = v_{0y}t - \frac{gt^2}{2} \quad and \quad v_y = v_{0y} - gt = v_0 \sin\alpha - gt$$

If $y = h_{max}$ then $v_y = 0$. Hence

$$t_1 = \frac{v_{0y}}{g} = \frac{v_0 \sin\alpha}{g}, \quad t_1 = t_2 \ \rightarrow \ t = t_1 + t_2 = \frac{2v_0 \sin\alpha}{g} = \frac{2 \cdot 150 \cdot \sin 10}{9.8} = \mathbf{5.3\ s}.$$

$t_1$ is the time during which the bullet was moving upwards; $t_2$ is the time during which the bullet was moving down.

$$S = v_{0x}t = v_0 \cos\alpha \frac{2v_0 \sin\alpha}{g} = \frac{v_0^2 \sin 2\alpha}{g} = \frac{150^2 \cdot \sin 20°}{9.8} = \mathbf{785\ m}.$$

$$y = h_{max} = v_{0y}t_1 - \frac{gt_1^2}{2} = v_0 \sin\alpha \cdot \frac{v_0 \sin\alpha}{g} - \frac{g}{2}\left(\frac{v_0 \sin\alpha}{g}\right)^2 = \frac{v_0^2 \sin^2\alpha}{2g} = \frac{150^2 \cdot \sin^2 10°}{2 \cdot 9.8} = \mathbf{34.6\ m}.$$

**Answer.** $t = 5.3\ s; S = 785\ m; h_{max} = 34.6\ m.$