Answer on Question #43497 – Physics - Mechanics | Kinematics | Dynamics | for completion

A boy throws a ball vertically up wards with a velocity of 25 m/s while he was standing on a cliff on the way down it just misses the thrower and falls down on the ground if the height of the building was 49 m. Determine
a) the total time of flight?
b) the velocity which with it reaches the ground?

Solution:
$V = 25\dfrac{m}{s}$ – initial velocity of the ball;
$h = 49m$ – height of the building;
Equation of motion for the ball along the Y-axis:

$$y: h = -Vt + \frac{gt^2}{2}$$
$$gt^2 - Vt - 2h = 0$$

We have a quadratic equation (t-total time of floght), and we take only positive root of the equation (time t can not be negative):

$$t = \frac{V + \sqrt{V^2 + 8gh}}{2g} = \frac{25\frac{m}{s} + \sqrt{\left(25\frac{m}{s}\right)^2 + 8 \cdot 9.8\frac{m}{s^2} \cdot 49m}}{2 \cdot 9.8\frac{m}{s^2}} = 28.4\ s$$

Rate equation for the ball along Y-axis (V_{final}-final velocity of the ball):

$$V_{final} = -V + gt = -25\frac{m}{s} + 9.8\frac{m}{s^2} \cdot 28.4\ s = 253\frac{m}{s}$$

Answer: a) $28.4\ s$
b) $253\frac{m}{s}$