While still on the top of the school (15 m high) a second egg is thrown straight upwards with an initial speed of 8.0 m/s.

a) What is the maximum height reached by the egg?

$\vec{v}_i = 8.0\ m/s\ [up]$

$\vec{v}_f = 0$ (stops at max height)

$\vec{a}_g = 9.8\ m/s^2\ [down]$ always for free fall

$\vec{\Delta d} = ?$

$$\vec{v}_f^{\,2} = \vec{v}_i^{\,2} + 2\vec{a}\vec{\Delta d}$$

$$\frac{\vec{v}_f^{\,2} - \vec{v}_i^{\,2}}{2\vec{a}} = \vec{\Delta d}$$

$$\frac{0^2 - (+8)^2}{2(-9.8)} = \vec{\Delta d}$$

$\vec{\Delta d} = 3.27\ m\ [up]$

max height = 15 m + 3.27 m = 18.27 m

b) How fast is the egg traveling when it strikes the ground?

$\vec{v}_i = 8.0\ m/s\ [up]$

$\vec{a}_g = 9.8\ m/s^2\ (down)$

$\vec{v}_f = ?$ Not zero!!

$\vec{\Delta d} = 15\ m\ [down]$

$$\vec{v}_f^{\,2} = \vec{v}_i^{\,2} + 2\vec{a}\vec{\Delta d}$$

$$\vec{v}_f^{\,2} = (8\ m/s)^2 + 2(-9.8\ m/s^2)(-15\ m)$$

$$\vec{v}_f^{\,2} = 358\ m^2/s^2$$

$$\vec{v}_f = \pm\sqrt{358}\ m/s$$

$$\vec{v}_f = \pm 18.9\ m/s$$

$$= -18.9\ m/s$$

$\vec{v}_f = 18.9\ m/s\ [down]$

c) How fast is the egg traveling as it passes the top of the school on the way down?

$\vec{\Delta d} = 0$

$\vec{a}_g = 9.8\ m/s^2\ [down]$

$\vec{v}_i = 8\ m/s\ [up]$

$\vec{v}_f = ?$

$\vec{v}_f^{\,2} = \vec{v}_i^{\,2} + 2\vec{a}\Delta\vec{d}$

$= (8\ m/s)^2 + 2(-9.8\ m/s^2)(0)$

$\vec{v}_f^{\,2} = (8\ m/s)^2$

$\vec{v}_f = \pm 8\ m/s$

$\vec{v}_f = 8\ m/s\ [down]$

There is symmetry along the path.

d) How long is the egg in the air?

$\vec{v}_i = 8\ m/s\ [up]$

$\vec{a}_g = 9.8\ m/s^2\ [down]$

$\vec{\Delta d} = 15\ m\ [down]$

$\Delta t = ?$

$\vec{\Delta d} = \vec{v}_i \Delta t + \frac{1}{2}\vec{a}(\Delta t)^2$

$-15 = 8\Delta t + \frac{1}{2}(-9.8)\Delta t^2$

$-15 = 8\Delta t - 4.9\Delta t^2$

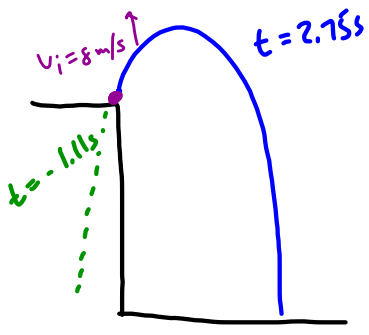
$4.9\Delta t^2 - 8\Delta t - 15 = 0$

$$\Delta t = \frac{8 \pm \sqrt{(-8)^2 - 4(4.9)(-15)}}{2(4.9)}$$

$$= \frac{8 \pm \sqrt{358}}{9.8}$$

$$\Delta t_1 = \frac{8 + \sqrt{358}}{9.8} = 2.75\ s \checkmark$$

$$\Delta t_2 = \frac{8 - \sqrt{358}}{9.8} = -1.11\ s \times$$



Some helpful guidelines:

When an object is dropped...

$v_i = 0$

$v_f \neq 0$ $V_f = \max V$

When an object is launched upwards and lands at the same height...

$\Delta d = 0$

When an object reaches it's maximum height...

$v = 0$