8. [12 points] Top Norwegian skier, Wallace, is participating in the ski jumping world championship. During his practice jump, his height (in meters) above his landing spot on the ground t seconds after going airborne is given by $h = A(t) = -4.9t^2 + 15t + 60$.

Throughout this problem include **units**, and express your answers in **exact form** or round your answers to **three decimal places**. Be sure show all the steps needed to get your answers, and **circle** your final answer. Answers with no work shown will not receive credit.

a. [2 points]
How high above his landing spot was Wallace when he first went airborne?

Solution: 60 meters

b. [4 points]
At what time t does Wallace land on the ground?

Solution: Using the quadratic formula, the roots are given by

$$t = \frac{-15 \pm \sqrt{(15)^2 + 4(4.9)(60)}}{-9.8}$$

One of the solutions is negative, hence doesn't make sense in the context of the problem. We throw that one out, so that the only correct solution is

$$t = \frac{-15 - \sqrt{(15)^2 + 4(4.9)(60)}}{-9.8} \approx 5.350$$

c. [6 points]
A daredevil skier, V, did a stunt jump with a jetpack on their back. Suppose that the quadratic function $B(t)$ gives V's height (in meters) above their landing spot t seconds after going airborne. From the reports, it was gathered that V's jump lasted 8 seconds, that they jumped from a height of 48 meters above ground, and that they reached maximum height 3 seconds after they went airborne. Find a formula for $B(t)$.

Solution:
If using vertex form: $B(t) = a(t-3)^2 + k$. Using the two intercepts, we have

$$48 = a(9) + k$$

$$0 = a(25) + k$$

Solving the system of equations gives $a = -3$ and $k = 75$, so that $B(t) = -3(t-3)^2 + 75$.

Alternatively, one can use factored form. Knowing we have a root at $t = 8$, and using the symmetry of the parabola, the other root is at $t = -2$, so that $B(t) = c(t-8)(t+2)$. Using $B(0) = 48$, we get $c = -3$, so $B(t) = -3(t-8)(t+2)$.