Calculus I: Modeling the Flight of a Water Balloon

Let's suppose that you are standing on a 154-foot high balcony holding a water balloon. Now you don't want to be accused of *dropping* water balloons, so instead you throw the balloon straight upwards. Let's say you release the balloon 160 feet above the ground with an initial velocity of 48 feet per second (ft/s).

1) Using that the acceleration due to gravity near the surface of the earth is –32 feet per second per second (ft/s/s), use calculus to find a function $v(t)$ giving the velocity of the balloon (in ft/s) t seconds after you throw the balloon.
   [*Hints:* Acceleration is the rate of change of velocity.
   Your acceleration function is $a(t) = -32$ ft/s/s.
   If you were to measure the height of the balloon above the ground in meters rather than feet, your acceleration function would be $a(t) = -9.8$ m/s/s.
   Does your velocity function have the correct initial value?
   That is, does it have the correct value at $t = 0$?]

2) Now use calculus to find a function $h(t)$ giving the height or position of the balloon above the ground (in feet) t seconds after you release it.
   [*Hints:* Velocity is the rate of change of position or height.
   Does your height function have the correct initial height?]

3) After how many seconds will the balloon hit the ground?
   Therefore, what is a reasonable *domain* for the height function $h(t)$?
   After how many seconds would the balloon hit a 6-foot tall object standing on the ground?

4) How fast will the balloon be traveling when it hits the ground?
   How fast would it be traveling upon impact if it were to hit the 6-foot tall object?

5) Graph the function $h(t)$.
   What kind of graph does $h(t)$ have? [The graph is called a …]
   After how many seconds does the balloon begin to fall?
   How high does the balloon travel before it begins to fall?
   What then is the *range* of the height function $h(t)$?