8. (15 points) The functions $r = f(t)$ and $V = g(r)$ give the radius and the volume of a commercial hot air balloon that is being inflated for testing. The variables $t$ and $r$ are measured in minutes and feet respectively, while the volume $V$ is measured in cubic feet. The inflation begins at $t = 0$. 

In each case, translate the words or phrases given below into the precise mathematical expression that represents them. This mathematical expression will consist only of numbers, variables and symbols defined in this problem, and other mathematical symbols related to function notation and operations. For example, in problem 1(b) the notation “$p'(6)$” is a mathematical expression. There we gave an expression and you were asked to interpret. Here we are giving the interpretation and you are to supply the mathematical expression.

You may assume $V$ and $r$ are strictly increasing, differentiable functions.

(a) The average rate of change in the volume of the balloon when the radius expands from 10 to 12 feet:

Mathematical Expression \( \frac{g(12) - g(10)}{2} \)

(b) The volume of the balloon $t$ minutes after inflation began:

Mathematical Expression \( g(f(t)) \)

(c) The volume of the balloon if the radius was twice as big:

Mathematical Expression \( g(2r) \)

(d) The time elapsed when the radius of the balloon is 30 feet:

Mathematical Expression \( f^{-1}(30) \)

(e) The time elapsed when the volume of the balloon is 10,000 cubic feet:

Mathematical Expression \( f^{-1}(g^{-1}(10,000)) \)