2. [5 points] Caleb has an attic apartment, and his bedroom has a triangular wall that is 14 feet wide and 12 feet tall at its tallest point. He wants to build a rectangular bookcase to put against the wall, as shown to the right. He is trying to maximize the area of the front of the bookcase.

a. [3 points] If the bookcase has width \( w \) and height \( h \), write a formula relating \( w \) and \( h \).

\[
\text{Solution: Exploiting properties of similar triangles, we get} \\
\frac{w}{12-h} = \frac{14}{12}, \\
\text{so} \\
w = \frac{7(12-h)}{6}.
\]

b. [2 points] Using your answer from (a), find an expression for the area of the front of the bookcase in terms of the variable \( h \).

\[
\text{Solution: Area } w \cdot h = \frac{7(12-h)h}{6}.
\]

3. [4 points] Suppose \( g(x) = x^{2x} \). Write an explicit expression for \( g'(5) \) using the limit definition of the derivative. Your expression should not contain the letter “\( g \)”. Do not evaluate your expression.

\[
\text{Solution:} \\
g'(5) = \lim_{h \to 0} \frac{g(5+h) - g(5)}{h} = \lim_{h \to 0} \frac{(5+h)^{(5+h)} - 5^{10}}{h}.
\]