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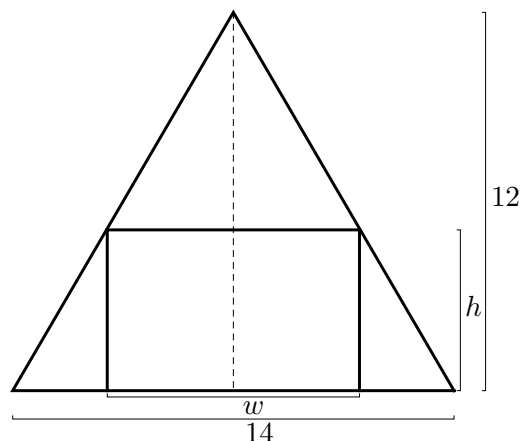. [5 points]  Caleb has an attic apartment, and his bedroom has a triangular wall that is 14 feet wide and 12 feet tall at its tallest point. He wants to build a rectangular bookcase to put against the wall, as shown to the right. He is trying to maximize the area of the front of the bookcase.

    **a**. [3 points]  If the bookcase has width $w$ and height $h$, write a formula relating $w$ and $h$.

> *Solution:*  Exploiting properties of similar triangles, we get
> $$\frac{w}{12 - h} = \frac{14}{12},$$
> 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 $h$.

> *Solution:*  Area $w \cdot h = \dfrac{7(12 - h)h}{6}$.

**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.

> *Solution:*
> $$g'(5) = \lim_{h \to 0} \frac{g(5 + h) - g(5)}{h} = \lim_{h \to 0} \frac{(5 + h)^{2(5+h)} - 5^{10}}{h}.$$