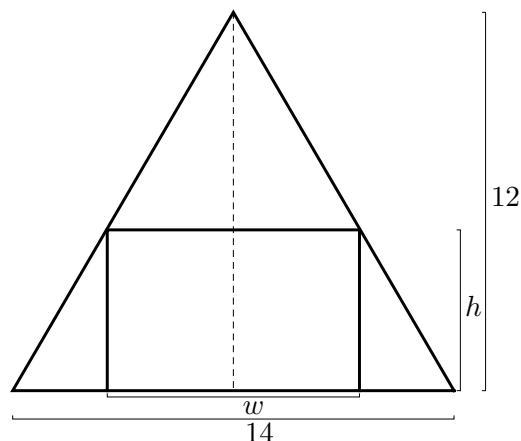


2. [5 points] Caleb has an attic apartment, and his bedroom has a triangular wall that is 14 feet wide and 12 feet tall at its tallest point. He wants to build a rectangular bookcase to put against the wall, as shown to the right. He is trying to maximize the area of the front of the bookcase.



- 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  $w \cdot h = \frac{7(12-h)h}{6}$ .

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.

*Solution:*

$$g'(5) = \lim_{h \rightarrow 0} \frac{g(5+h) - g(5)}{h} = \lim_{h \rightarrow 0} \frac{(5+h)^{2(5+h)} - 5^{10}}{h}.$$