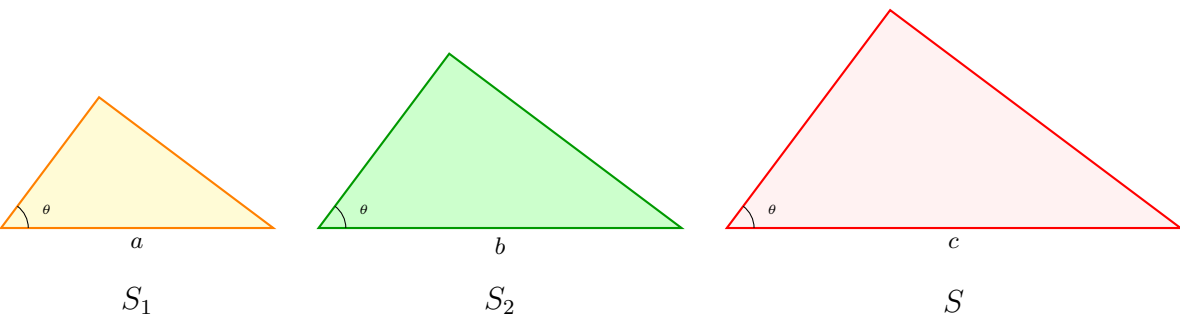$$S = S_1 + S_2$$

Since the triangles are similar, their areas are proportional to the squares of their corresponding sides (the hypotenuses):

$S_1 = a^2 \cdot k$
$S_2 = b^2 \cdot k$
$S \ = c^2 \cdot k \quad \text{where } k = \frac{1}{2} \cos\theta \sin\theta$

Substituting into $S = S_1 + S_2$:
$c^2 \cdot k = a^2 \cdot k + b^2 \cdot k$
$\Rightarrow \mathbf{c^2 = a^2 + b^2}$