

An equilateral Triangle problem

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Angles:

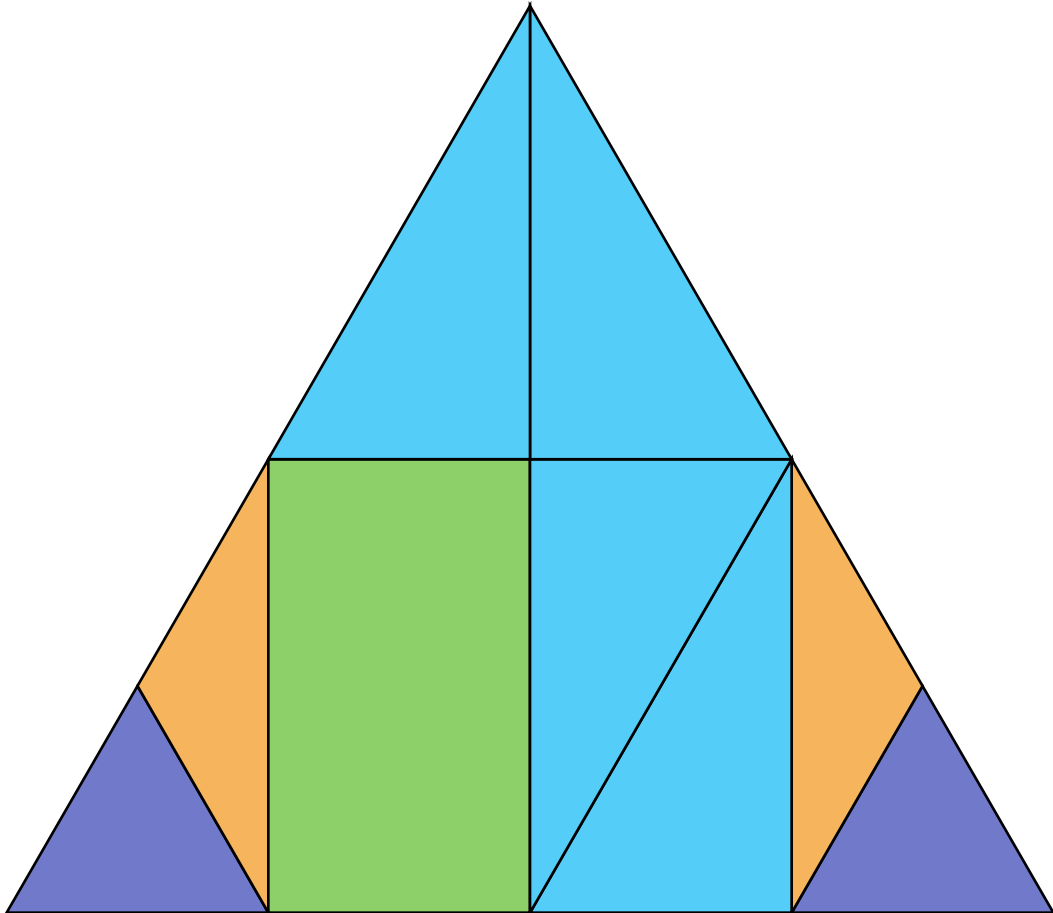


Fig. 1
Shapes with same colours are congruent

Shapes with the same colours in fig. 1 are congruent. We can easily note this because all their sides are equal. We can also observe the following:

- We are given that the largest triangle is equilateral
- We also know that the purple triangles are equilateral (Each side is $\frac{1}{4}$ th of the larger side)
- The blue triangles are right-angled triangles
- The orange triangles are isosceles triangles
- The green quadrilateral is a rectangle with all angles 90°

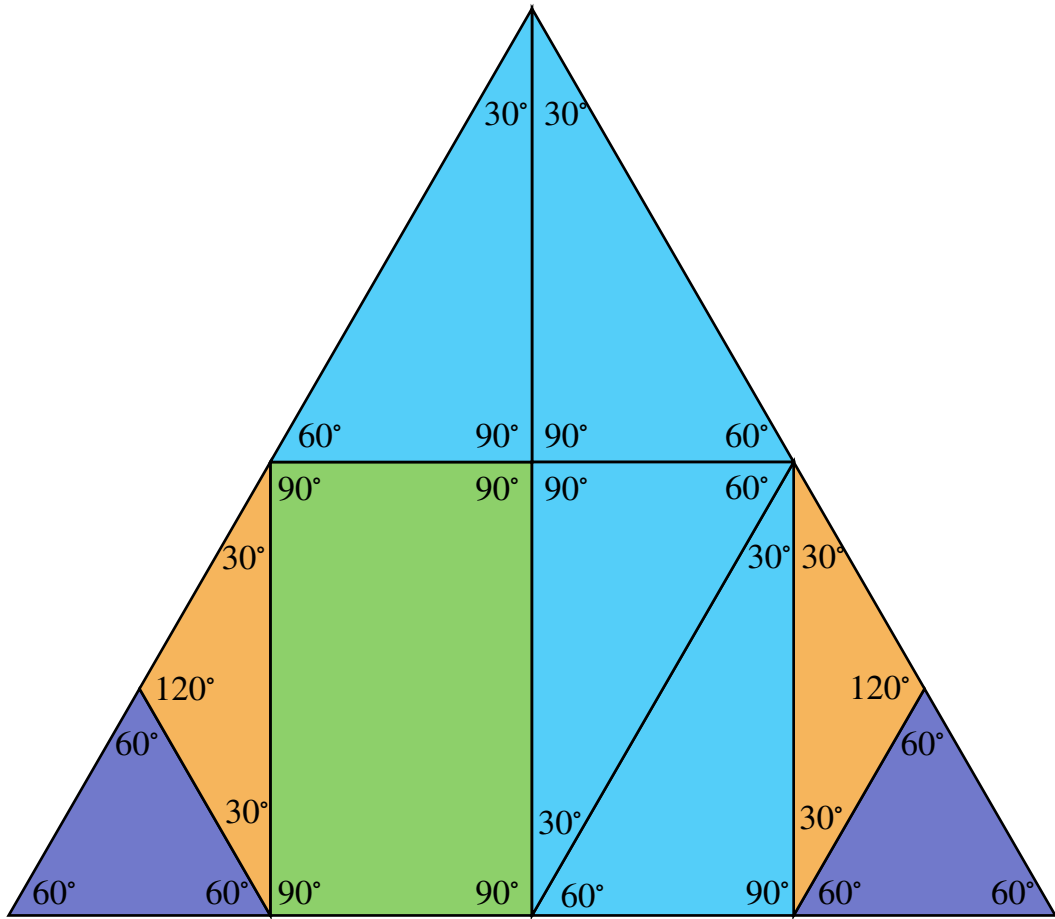
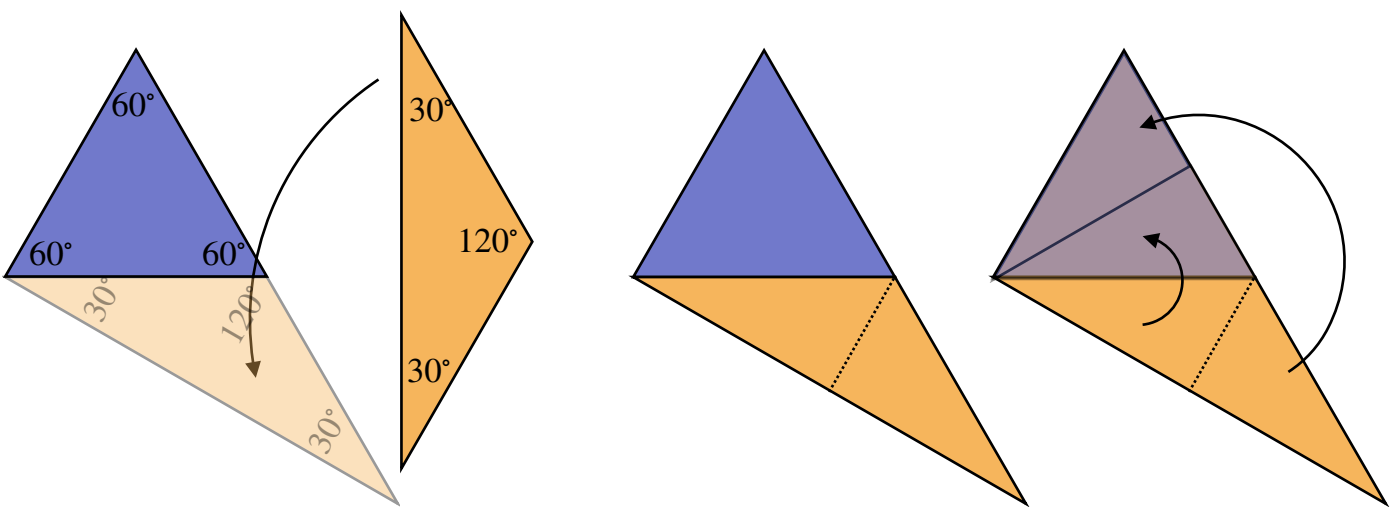


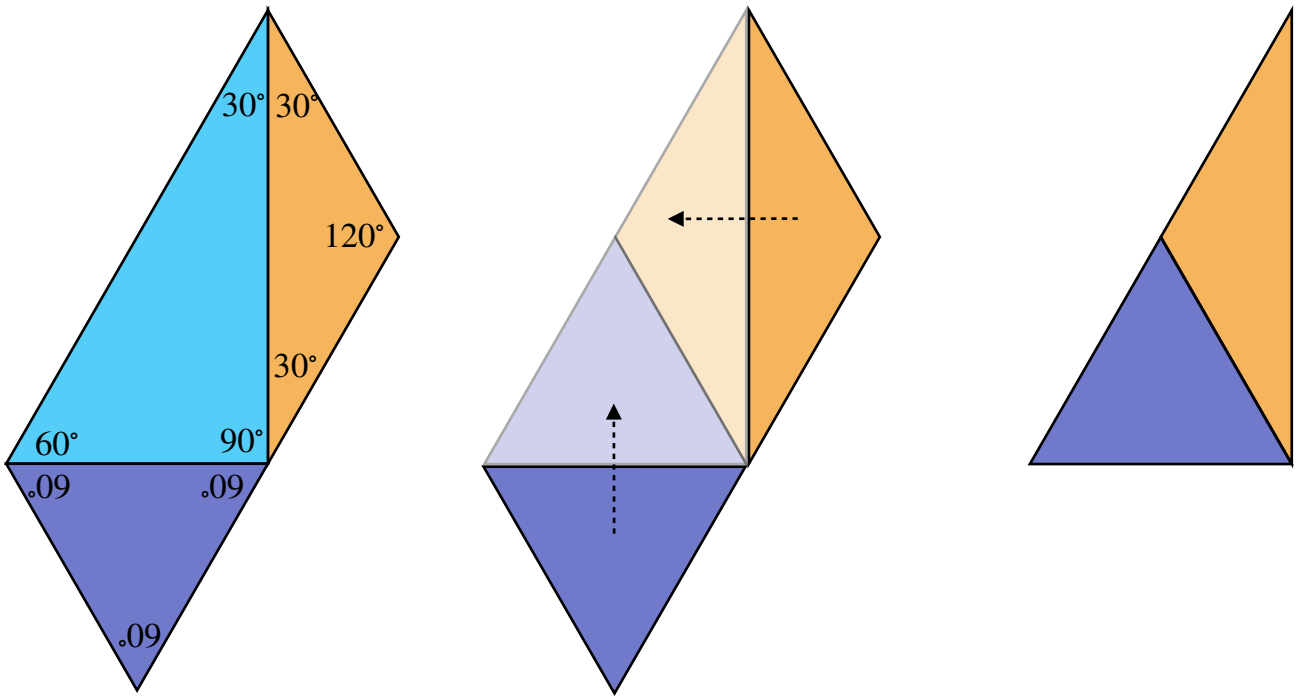
Fig. 2
All angles

We can complete the angles using the information given and some angle chasing

Areas:



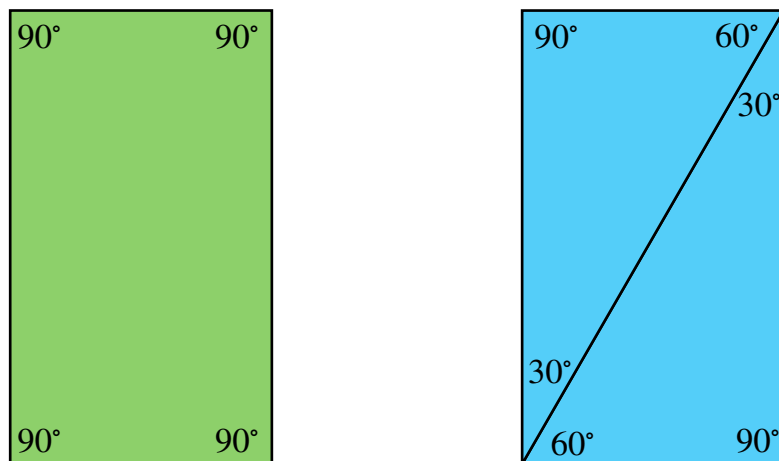
The orange triangle can be flipped into a way that it matches the area of purple triangle. The area of it is 1, thus the area of the orange triangle is also 1



The orange triangle and the purple triangle can be used to make the blue triangle by flipping into a way that it matches the area.

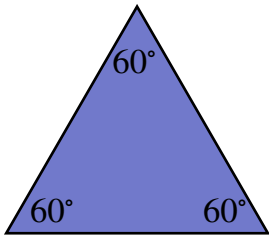
$$\begin{aligned}
 [\text{blue triangle}] &= [\text{orange triangle}] + [\text{purple triangle}] \\
 [\text{blue triangle}] &= 1 + 1 \\
 [\text{blue triangle}] &= 2
 \end{aligned}$$

Area of blue triangle is 2

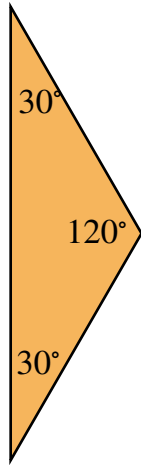


Area of Green rectangle is equivalent to 2 blue triangles

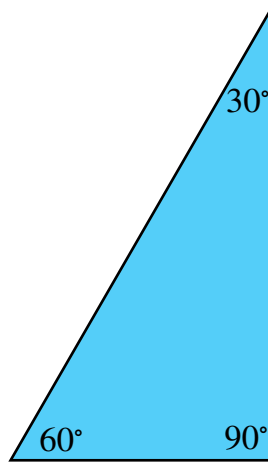
$$\begin{aligned}
 \text{Green rectangle} &= 2(2) \\
 \text{Green rectangle} &= 4
 \end{aligned}$$



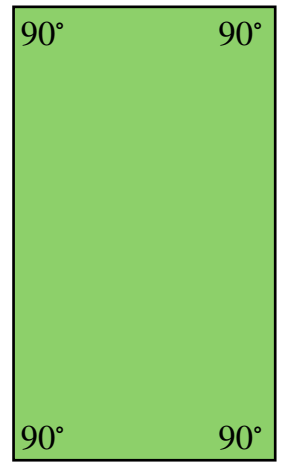
Area = 1



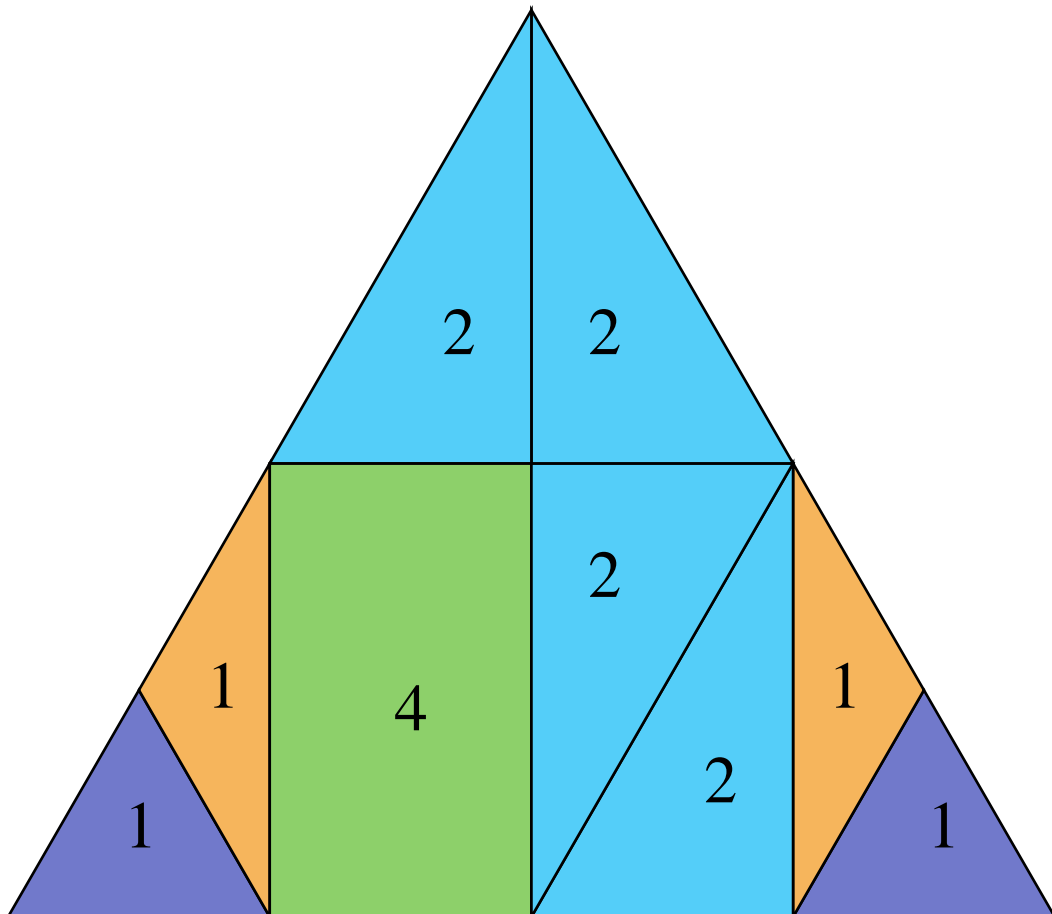
Area = 1



Area = 2



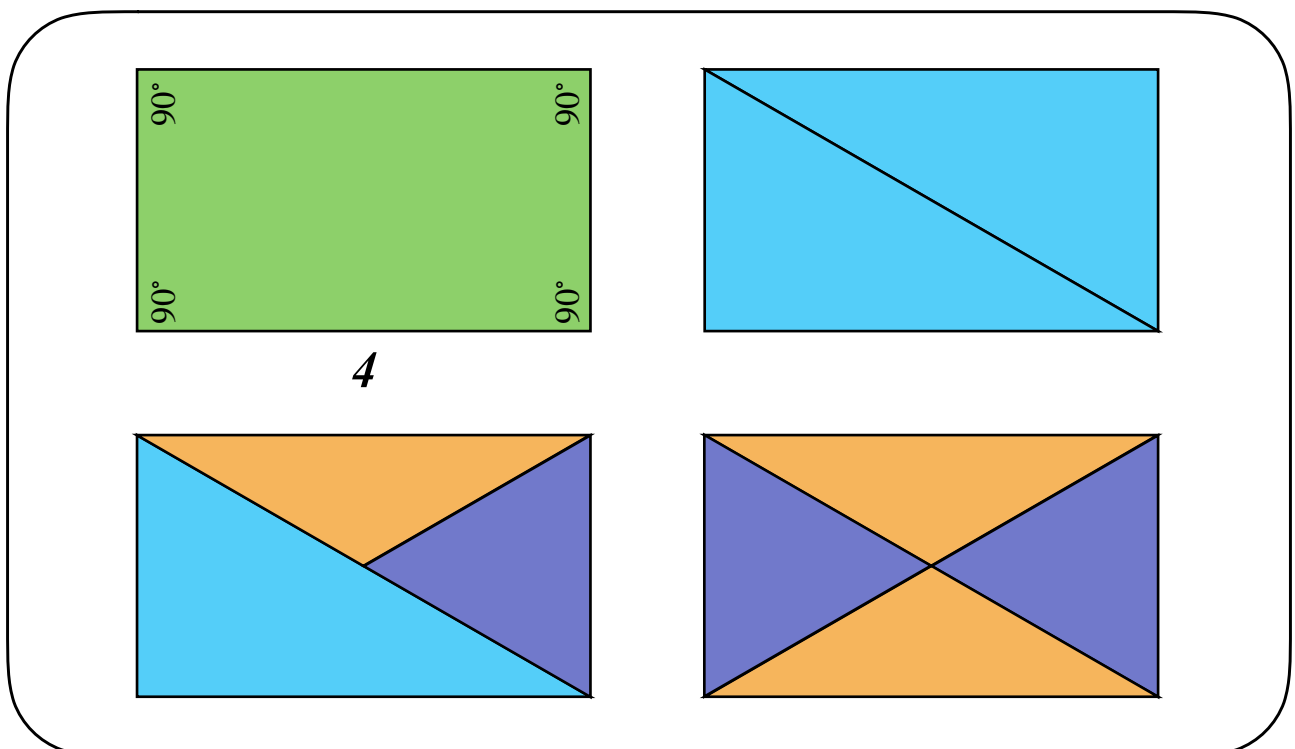
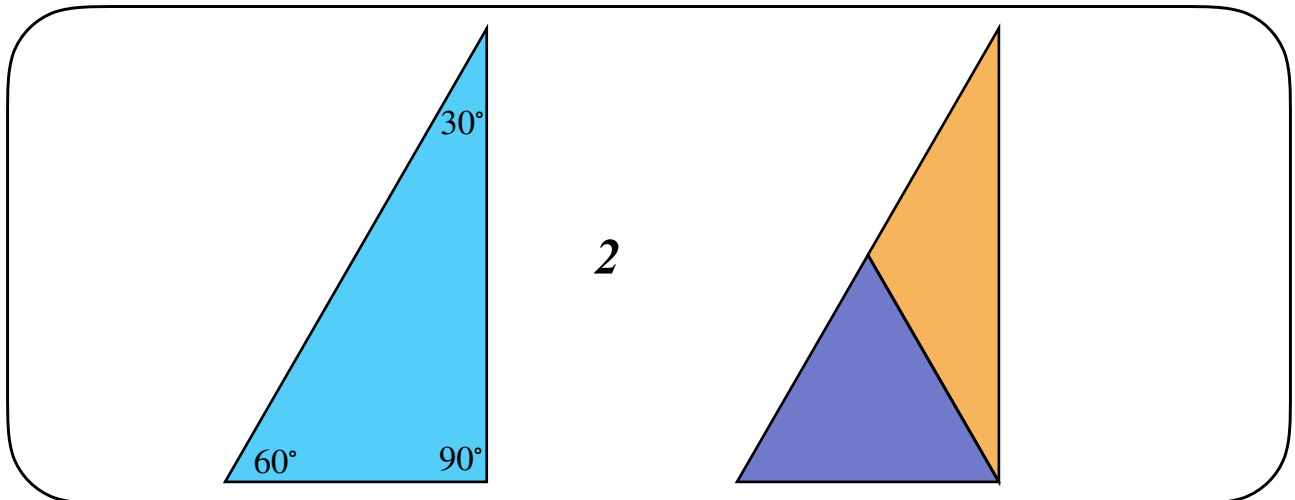
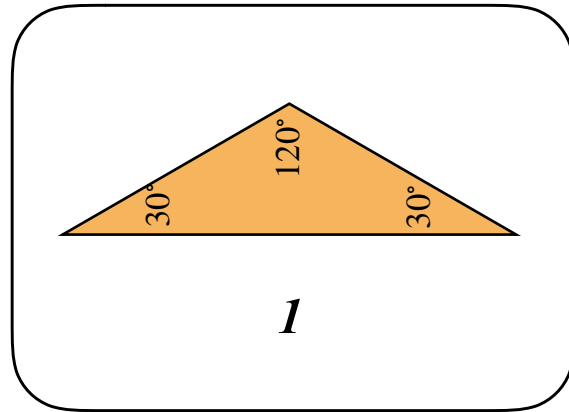
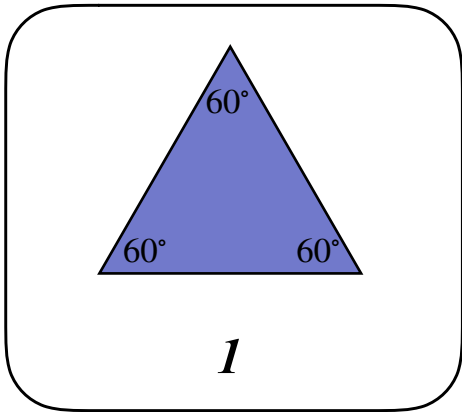
Area = 4



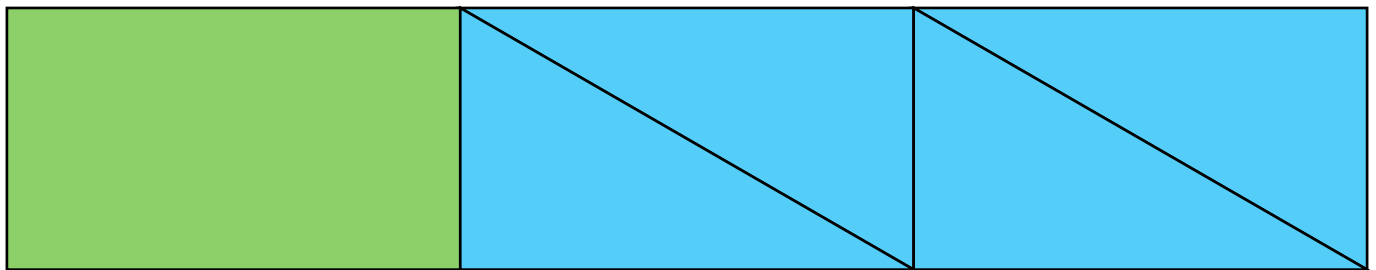
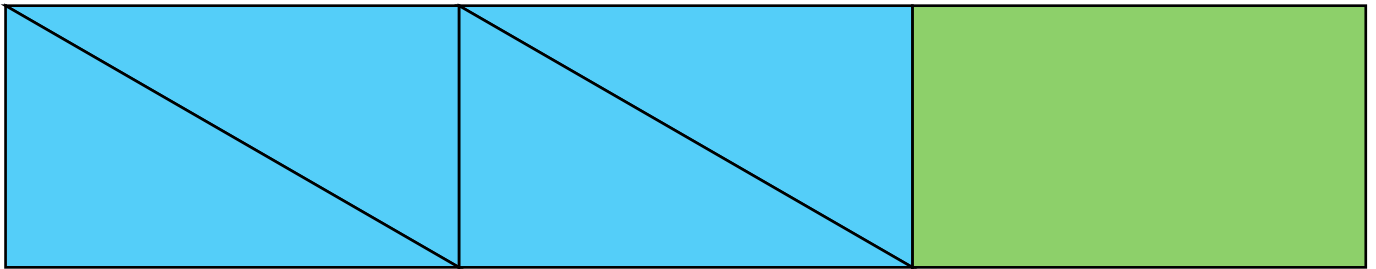
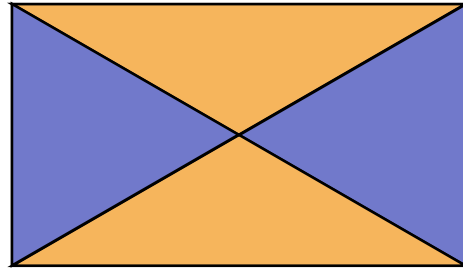
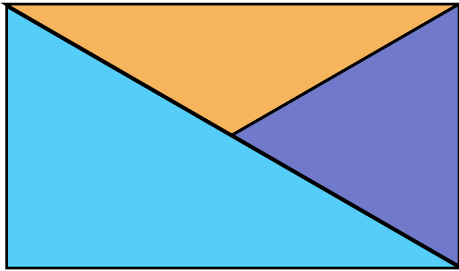
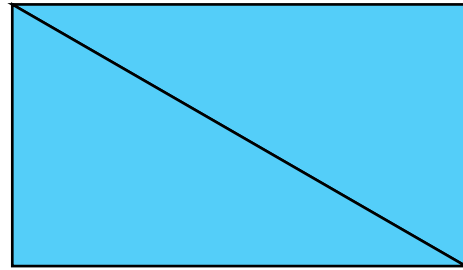
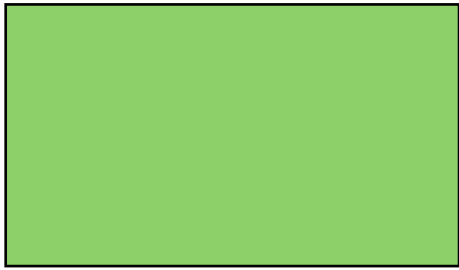
$$Area = 2(1) + 2(1) + 4(2) + 1(4) = 16$$

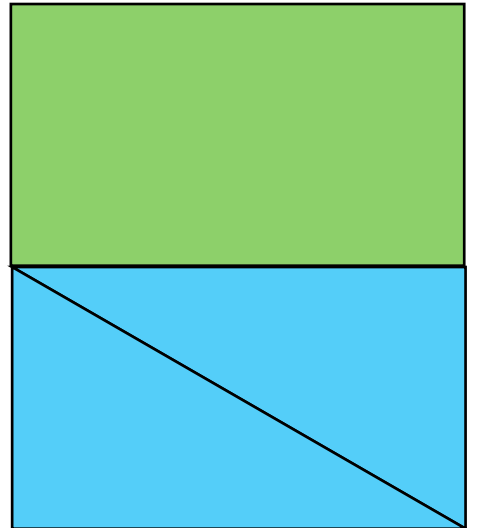
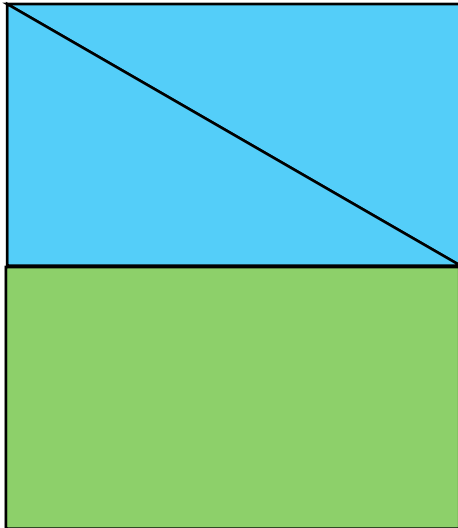
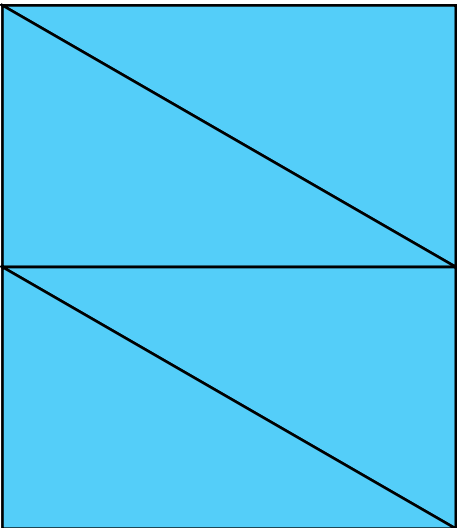
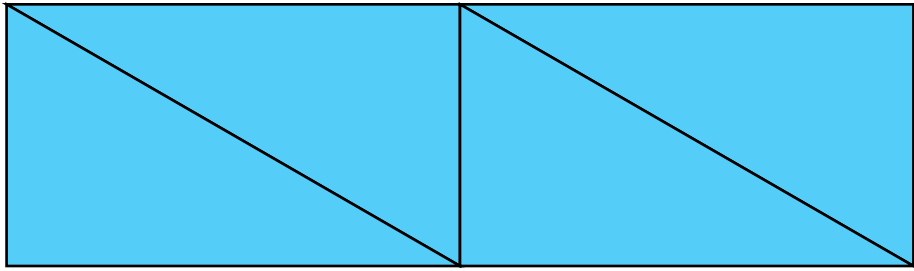
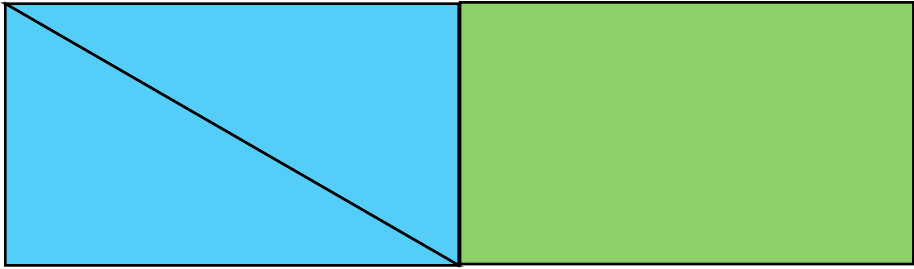
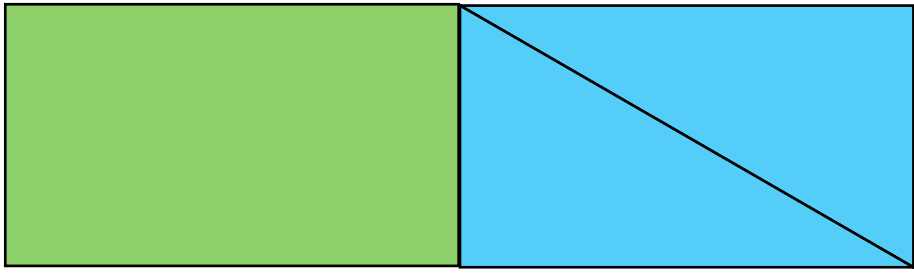
Key strategy:

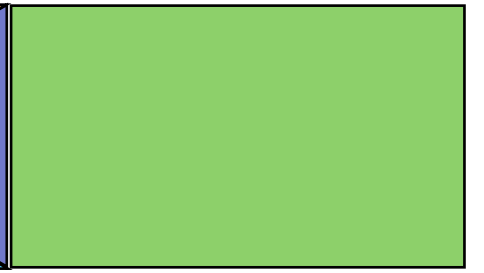
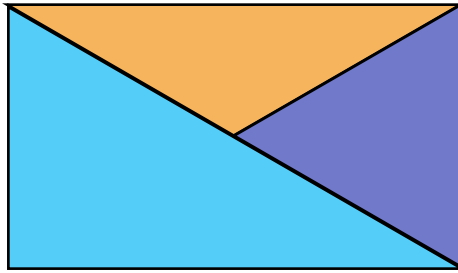
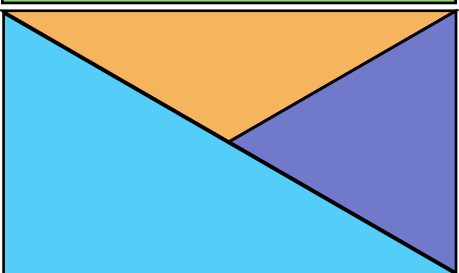
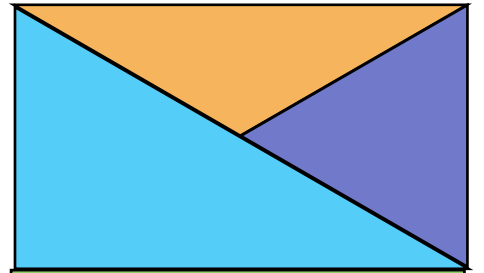
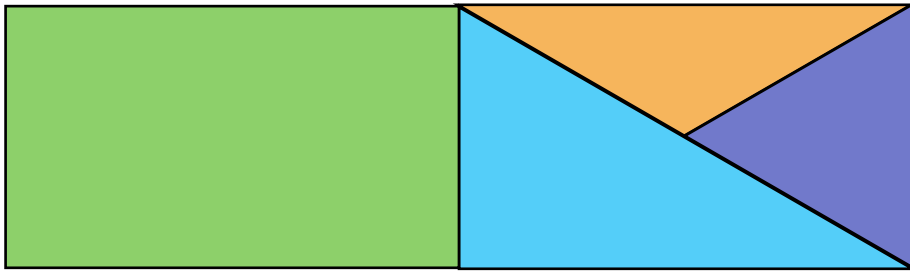
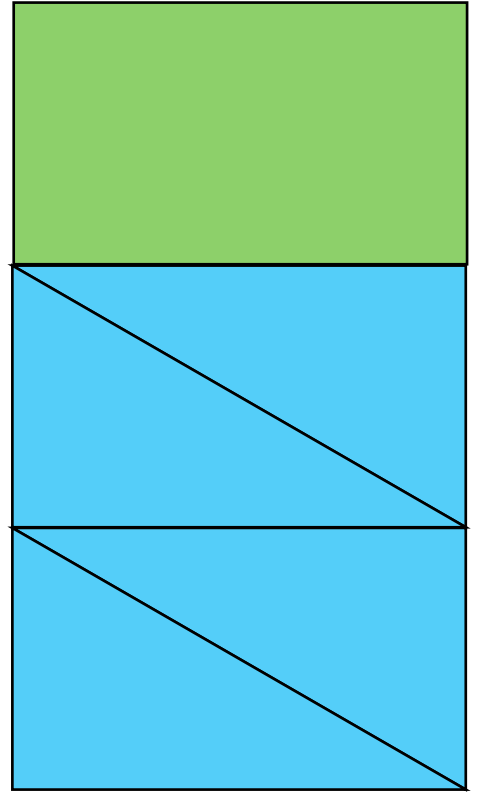
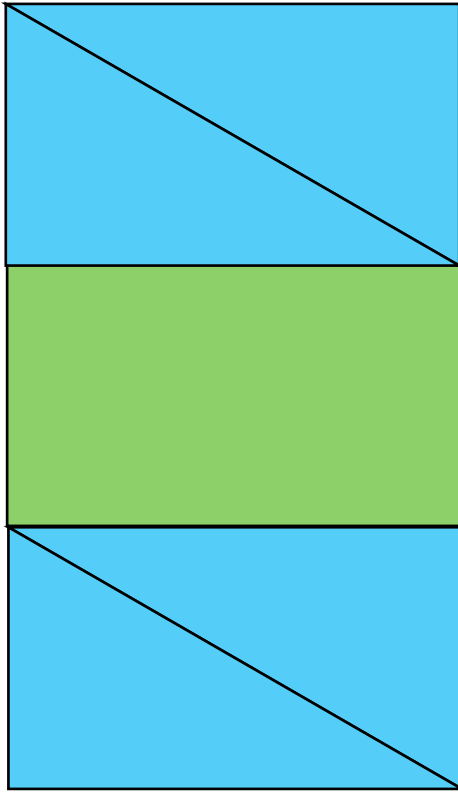
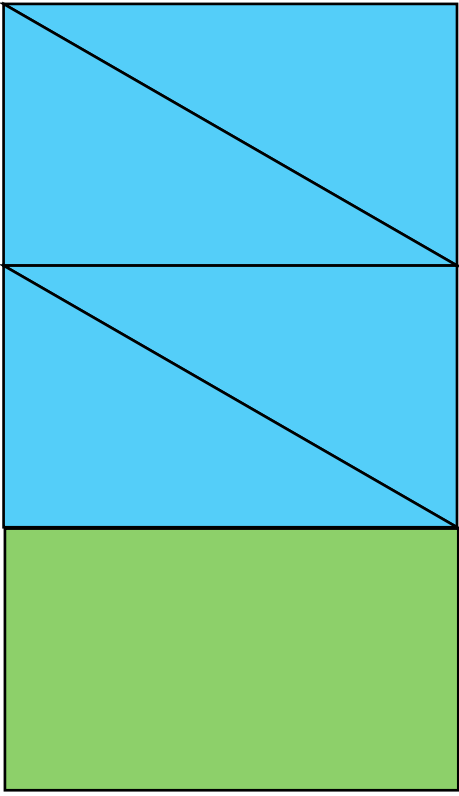
To make more trapezia we can find the more forms of each shape using different combinations of existing shapes

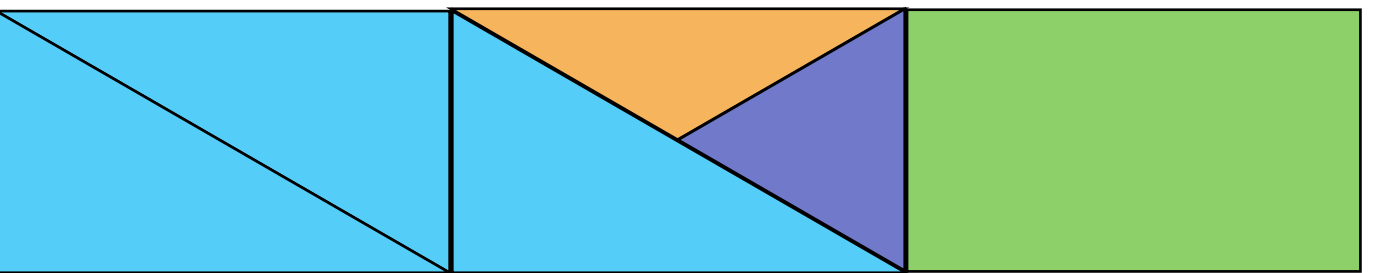
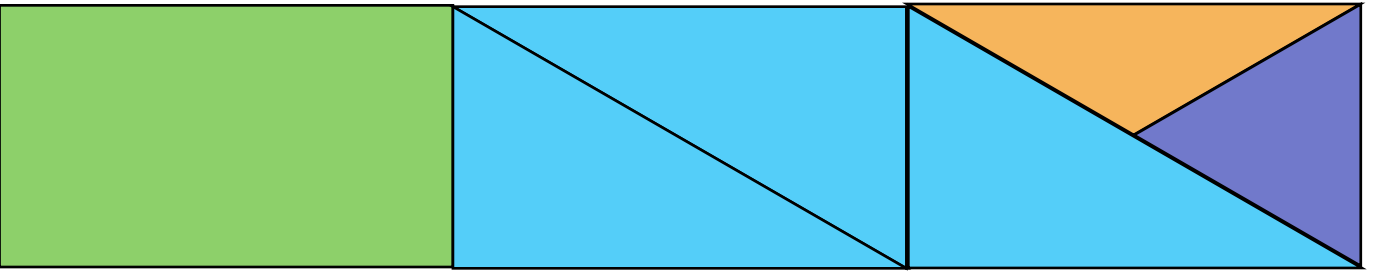
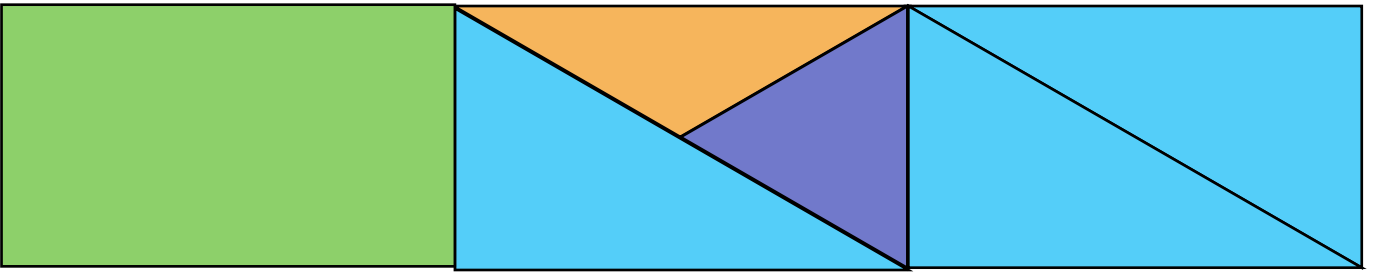
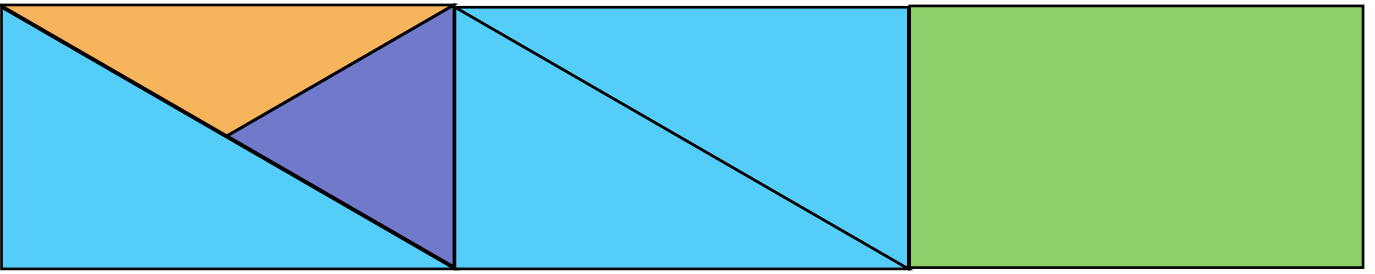


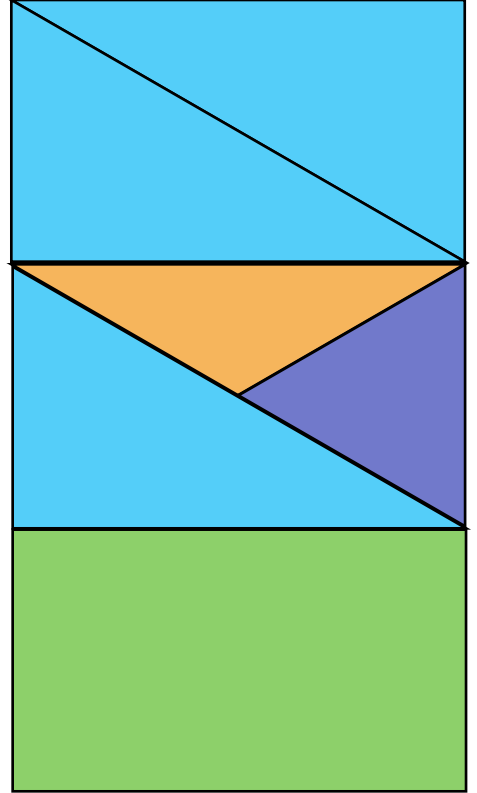
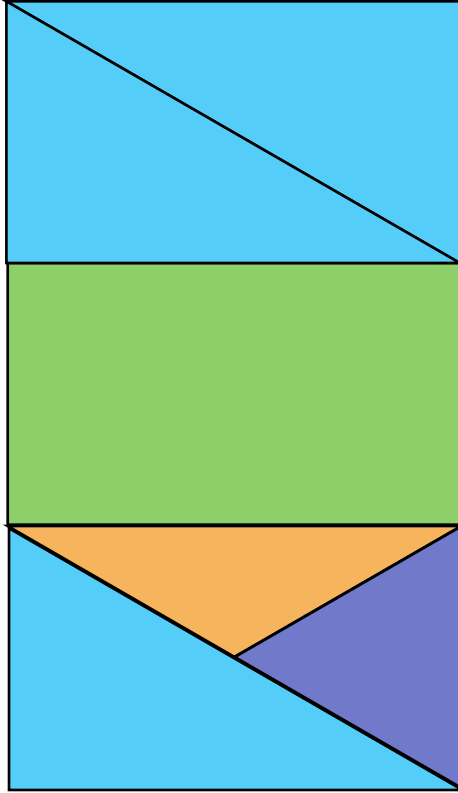
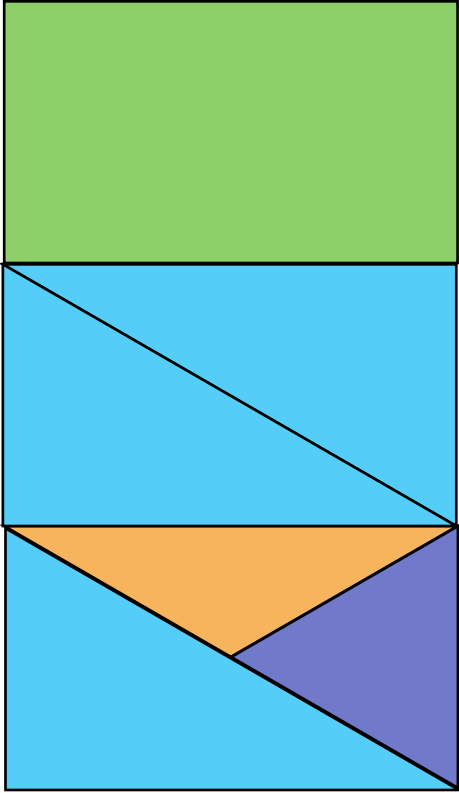
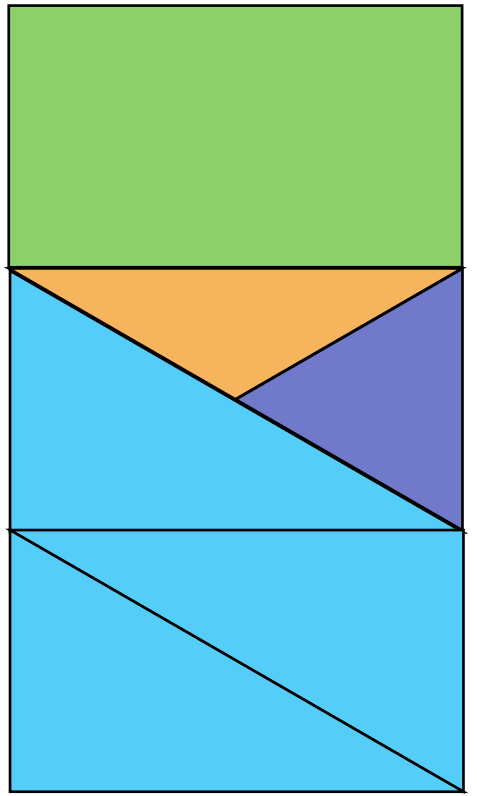
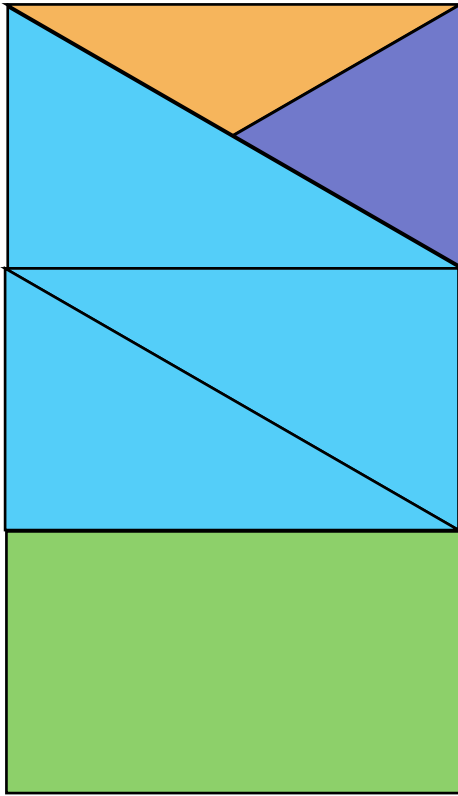
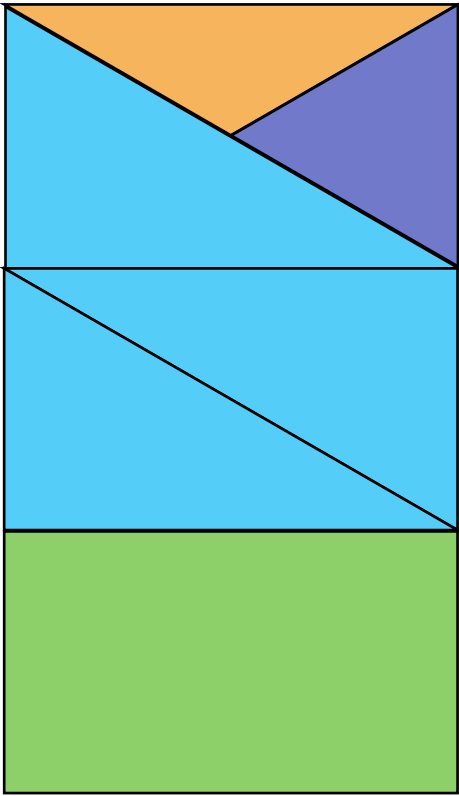
Different rectangles I could make:

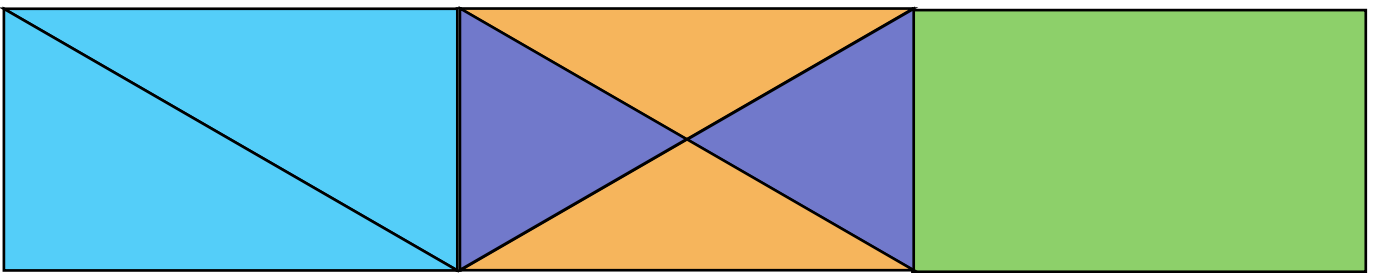
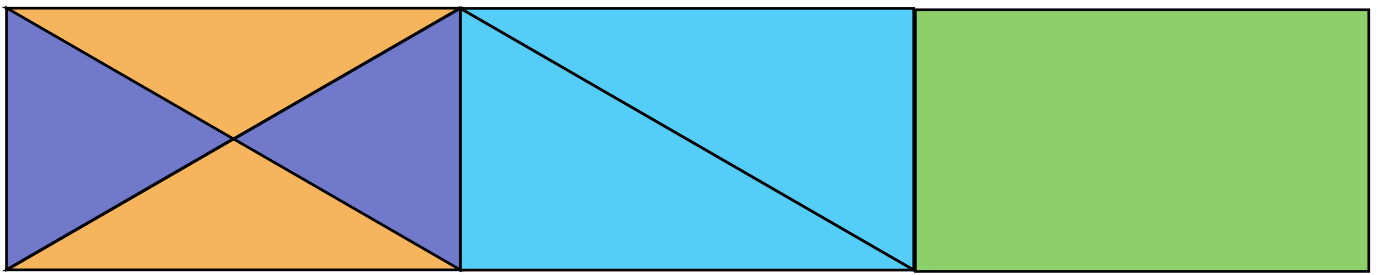
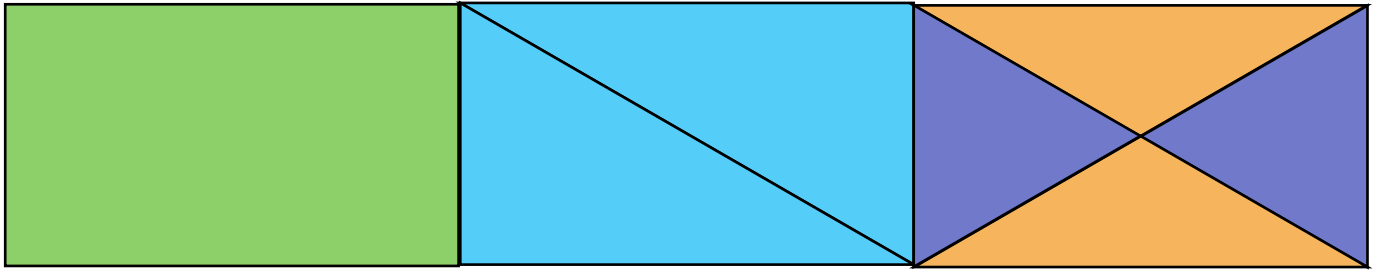
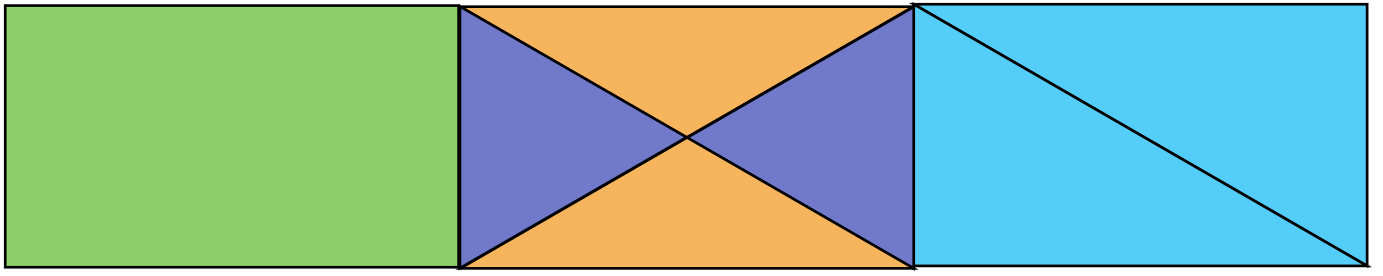


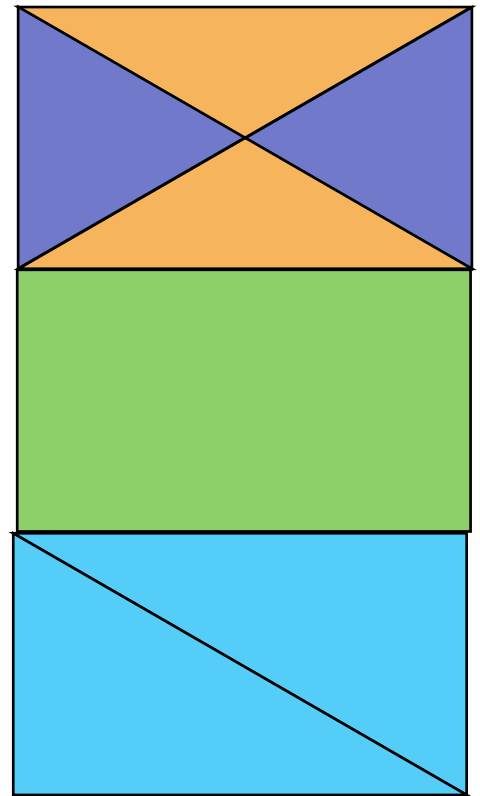
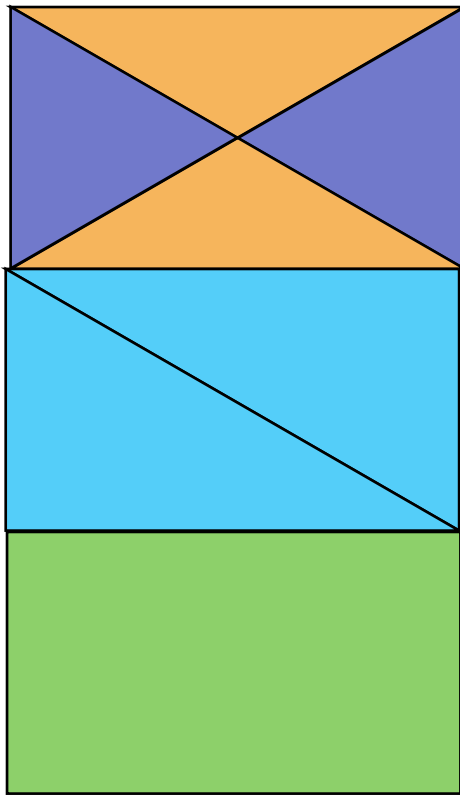
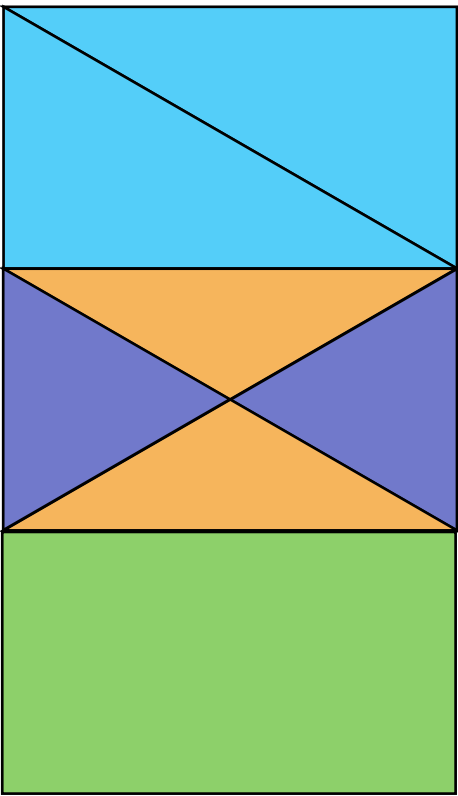
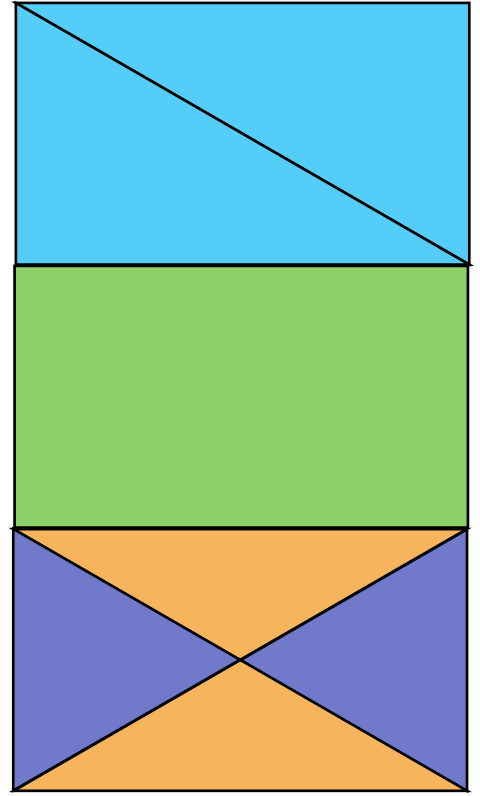
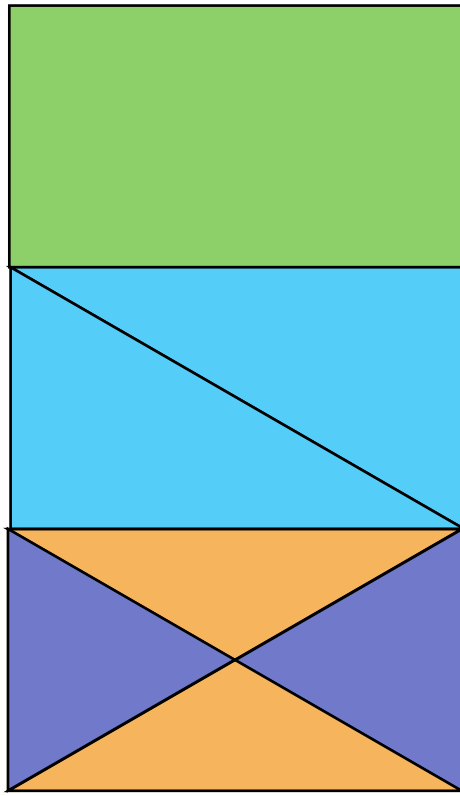
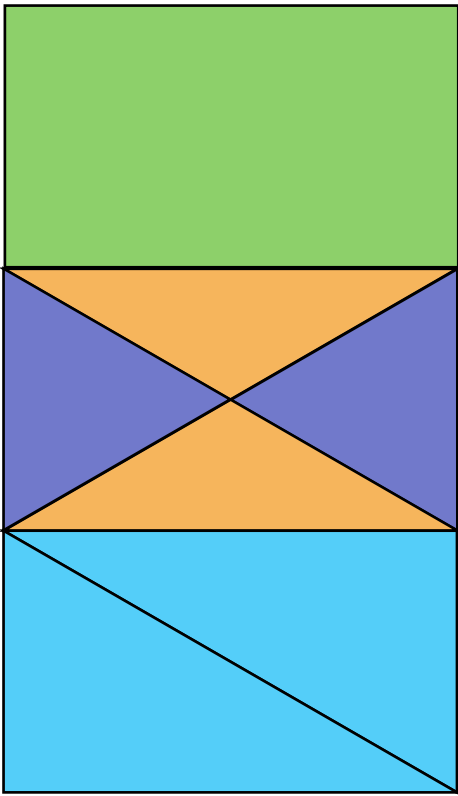


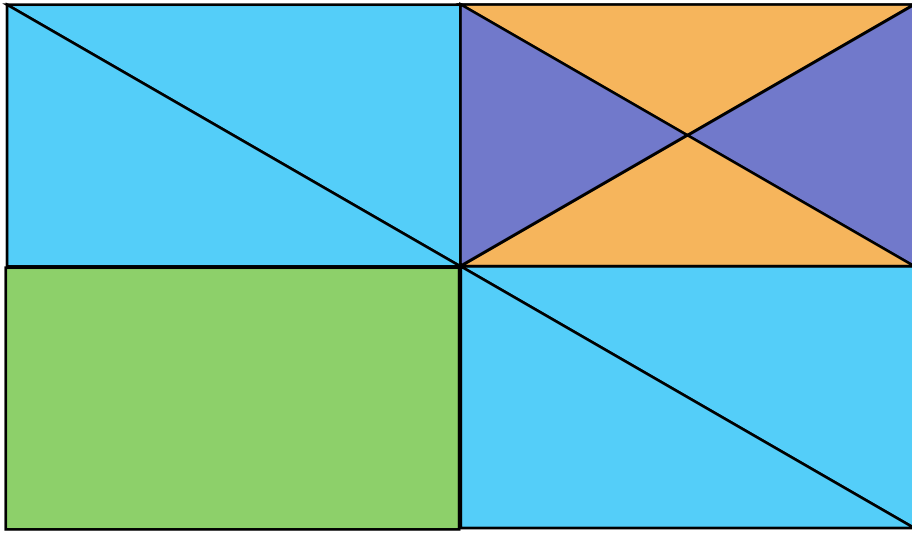












This arrangement could have many many
arrangements itself with reversing
rectangle and all with mix of everything