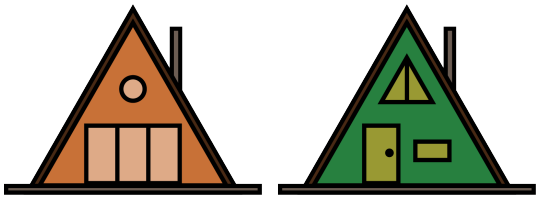
Problem of the Week
Problem B and Solution
What's Arkie's Angle?

Problem

Arkie Tekt has been designing A-frame houses for years. All his designs are in the shape of equilateral triangles with a horizontal base and two sides that meet at the top.



Arkie Tekt wants to create a more unique design, and has proposed three different A-frame designs.

Sketch each design using a ruler and protractor, with a scale of 1 cm = 1 m. Then measure any unknown interior angles (to the nearest degree) and side lengths (to the nearest millimetre or $\frac{1}{10}$ cm), and record these measurements on your diagram. Note that a *base angle* means an interior angle between the floor and the wall.

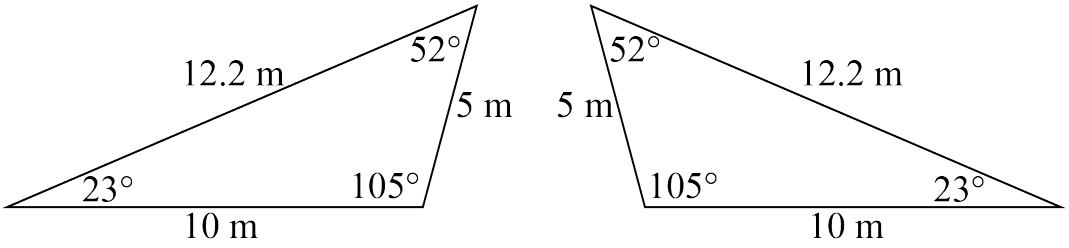
1. **Scalene Design:** The floor is 10 m wide, one base angle is 105°, and one of the walls has length equal to 5 m.
2. **Right-Angled Design:** The left wall is perpendicular to the floor, and both the floor and the left wall are 5 m in length.
3. **Isosceles Design:** The floor is 8 m in length, the perimeter of the design is 22 m, and one of the base angles is the same as the interior angle at the roof peak.

Extension: Arkie's partner likes the base angle given in the scalene design, but would prefer that the side walls be of the same length. Do you think this would work? Explain why or why not.

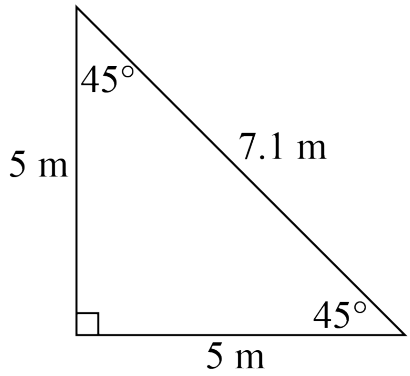
Solution

A sketch of each design is shown, however they are not drawn to scale. Note that there are two possibilities for the scalene and the isosceles designs.

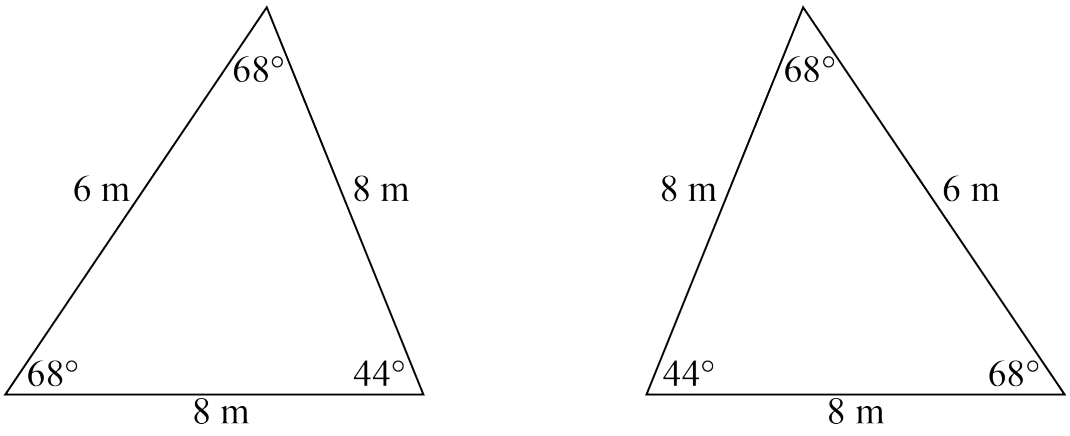
1. **Scalene Design:**



2. **Right-Angled Design:**



3. **Isosceles Design:**



Solution to Extension:

If the side walls were the same length, then the triangle would be isosceles with two equal base angles. The given base angle is 105°. However
$105° + 105° = 210°$, and $210° > 180°$ which is the sum of the angles in triangle. Thus, this design would not work.