# CEMC at Home

## Grade 4/5/6 - Friday, April 17, 2020

## Toothpick Triangles

In this activity, we will explore how many different triangles we can make if our triangles can only have side lengths that are equal to whole number factors of the number 24.

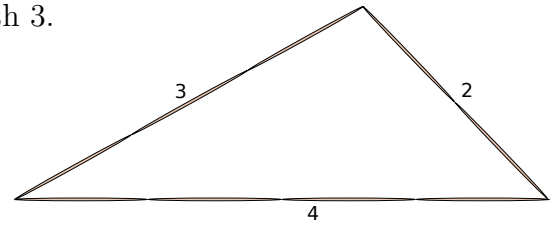
The whole number *factors* of any whole number $N$ are the whole numbers which divide evenly into $N$. For example, 12 has six whole number factors. They are 1, 2, 3, 4, 6, and 12.

**You Will Need:**

- A pencil and a piece of paper
- A flat surface to work on
- Around 30 toothpicks

**How To Play:**

1. Make a list of all whole number factors of 24.
2. Think of each toothpick as having a length of 1 unit. We will line up different numbers of toothpicks in straight lines, end-to-end, to make sides of triangles. If a side is made up of 3 toothpicks, then we will say this side has length 3.
3. Choose three different factors of 24. Using the toothpicks, try and create a triangle that has side lengths equal to these three factors of 24.




*For example, think about the three factors 2, 3 and 4. You will need 2 toothpicks to form a side of length 2, 3 toothpicks to form a side of length 3, and 4 toothpicks to form a side of length 4. These three sides can be arranged on a flat surface to form a triangle as shown above. If you start with the factors 2, 3, and 6 instead, a triangle cannot be formed. Can you figure out why?*

4. Form as many different triangles as you can which have side lengths equal to three different factors of 24. Make a list of the side lengths of each of the triangles you form.

   *You will have to play with the positions of the toothpick sides to see whether they fit together to form a triangle. You might find it helpful to tape the toothpicks together while you work with a particular side length.*

**Follow-up Questions:**

- There are groups of three factors of 24 that *cannot* be used to form a triangle. Did you discover some of these groups of factors? Why could you not use them to form triangles?
- Think about what you discovered while exploring the factors of 24. Can you find three other numbers between 10 and 50 with factors that can be used to form many different triangles? Are there numbers for which no triangles can be formed?

  *If you are allowed to use the same factor more than once to make the side lengths, then you can always make triangles! (Why?) If we want three different factors then it is not always possible.*

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**More info:**

Check out the CEMC at Home webpage on Friday, April 24 for a solution to Toothpick Triangles.