Activity 1: Tower of Hanoi

As the legend goes, there is a monastery in Hanoi with a great hall containing 3 tall pillars. Resting on the first pillar are 64 giant disks (or washers) - all different sizes, stacked from largest to smallest. The monks are charged with the following task: they must move the entire stack of disks to the third pillar. However, due to the size of the disks, the monks cannot move more than one at a time. Each disk must be placed on one of the pillars before the next disk is moved. And because the disks are so heavy and fragile, the monks may never place a larger disk on top of a smaller disk.

When the monks finally complete their task, the world shall come to an end. Your task: figure out how long before we need to start worrying about the end of the world.

1. First, let's find the minimum number of moves required for a smaller number of disks. Collect some data. Make a table.

2. Conjecture a formula for the minimum number of moves required to move n disks. Test your conjecture. How do you know your formula is correct?

3. If the monks were able to move one disk every second without every stopping, how long before the world ends?

Activity 2: Counting Paths

The goal: how many $1 \times n$ paths can you make using 1×1 and 1×2 tiles.

1. Again, start by collecting data: How many length 1 paths can you make? How many length 2? How many length 3? And so on.

2. Can you see a relationship between the number of length 3 paths, the number of length 4 paths, and the number of length 5 paths? Does this relationship work for length 4, 5, and 6 paths as well? Use this to find the number of length 10 paths.

3. Does the relationship you found in part 2 always hold? Why?

4. If you were to build all possible length 1 paths, all possible length 2 paths, and so on up to all possible length 5, how many paths will you have total? What if you go up to all paths of length n?