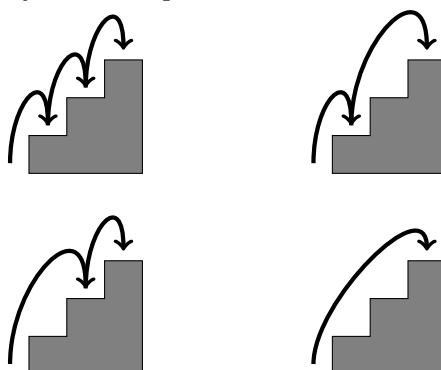# Some problems, looking for patterns
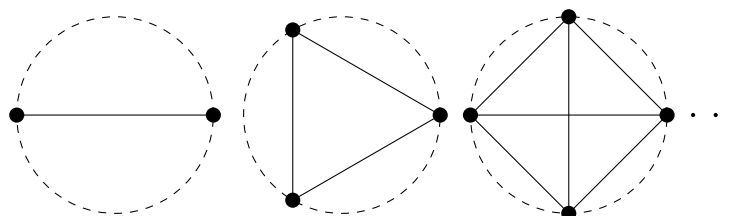
Peter Rowlett

1. **Twelve Steps**. How many different ways are there to walk up 12 steps, given that you can only walk up 1, 2 or 3 steps at a time? How would you go about answering for a staircase made of n steps?

   For example, here are the ways for 3 steps:

2. **Circle Regions**. Place n points on a circle and join them with lines. Into how many regions is the circle divided, in terms of n?

3. **Grumpy Mathematicians**. At a conference with large number of engineers and mathematicians there are n chairs in a row. The mathematicians had a big falling out over where to eat dinner last night and are feeling quite grumpy with each other. How many different ways can you fill those chairs such that no two mathematicians sit next to each other?
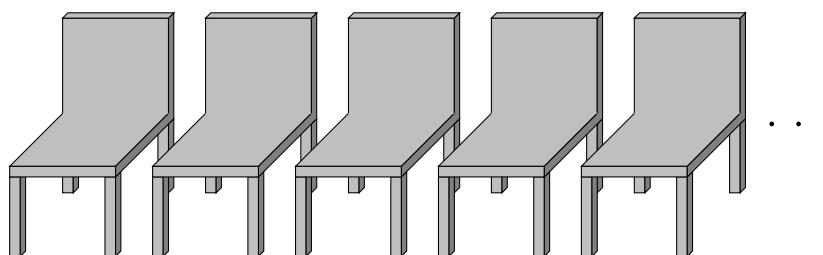
4. **Factorial Factor**. How many factors has $n!$? For example, $1! = 1$ has one factor, $3! = 3 \times 2 \times 1 = 6$ has four factors (1, 2, 3, 6).