

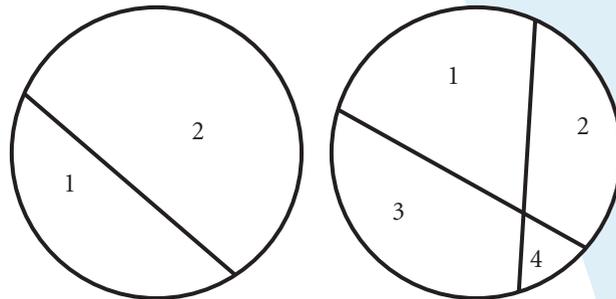
Cutting the Pie

PROBLEM OF THE WEEK

1

You can sometimes organize information from experiments into In-Out tables to help you understand what's happening in the experiment.

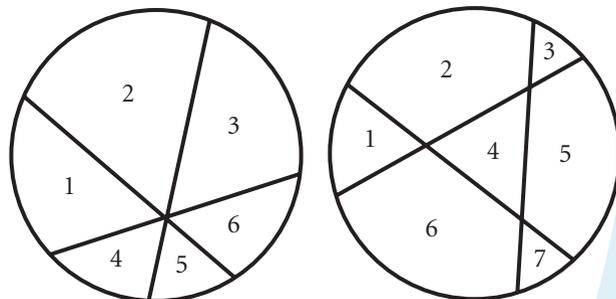
The diagrams show the results of a pie-cutting experiment. In the first picture, one cut across the pie has created two pieces. In the next, two cuts have created a total of four pieces.



Notice that the cuts do not necessarily go through the center of the pie, but they do have to be straight and go all the way across the pie. In addition, the pieces do not have to be the same size or shape.

The two diagrams below show different possible results from making three cuts in the pie.

In the first case, the three cuts produced six pieces. In the second case, the three cuts produced seven pieces. It's also possible to produce five or even only four pieces from three cuts.



You should be able to convince yourself that seven is the largest number of pieces that can be created by three cuts across the pie. The purpose of the pie-cutting experiment is to answer this question.

What is the largest number of pieces that can be produced from a given number of cuts?

continued ▶

The information from the diagrams has been organized into the In-Out table.

| Number of cuts | Maximum number of pieces |
|----------------|--------------------------|
| 1 | 2 |
| 2 | 4 |
| 3 | 7 |
| 4 | ? |
| 5 | ? |

Your task is to extend and analyze this table.

1. Find the largest number of pieces you can get from four cuts and from five cuts. Put those numbers into the table.
2.
 - a. Try to find a pattern describing what is happening in the table.
 - b. Use your pattern to find the largest possible number of pieces from ten cuts.
 - c. Try to explain *why* this pattern is occurring.
3. Try to find a rule for the In-Out table. If you used a variable for the input, how could you write the output as a formula in terms of that variable?

○ *Write-up*

1. *Problem Statement*
2. *Process*: Include important diagrams you used while working on this problem.
3. *Solution*: Include these things.
 - Your In-Out table as far as you took it
 - Any patterns you found in the table, expressed in words, in symbols, or both
 - Your answer for the largest possible number of pieces after ten cuts
 - Explanations for your answers
4. *Extensions*
5. *Self-assessment*