**THE CUTTING PROBLEM**

**NAME**

**Introduction**

The problem to be solved is to see how many pieces you can cut a circle into the N number of cuts. This involves drawing lines over a circle to see how many shapes you can turn that circle into. The aim of this report is to create an algebraic equation to solve how many pieces for any number of cuts.

**Methods**

To solve the problem, we solved the problem up to the 6th iteration as shown in Table 1 by using word to manually input the cuts on top of the circle to find the answer. Using this table, we found a pattern which made up the solution. Since this solution required to know the last number in the sequence it was decided to find an algebraic solution with no such drawback

Let *n* represent the number of cuts and P the number of pieces

**Observations**

Table 1: the outcome of manually collecting data

|  |  |
| --- | --- |
| n | Pn |
| 1 | 2 |
| 2 | 4 |
| 3 | 7 |
| 4 | 11 |
| 5 | 16 |
| 6 | 22 |

Diagram

Description automatically generated

**Solution**

**Numeric solution**

**The recurrence**

**Numeric solution**

|  |  |
| --- | --- |
| n | Pn |
| 1 | 2 |
| 2 | 4 |
| 3 | 7 |
| 4 | 11 |
| 5 | 16 |
| 6 | 22 |
| 7 | 29 |
| 8 | 37 |
| 9 | 46 |
| 10 | 56 |
| 11 | 67 |
| 12 | 79 |
| 13 | 92 |
| 14 | 106 |
| 15 | 121 |
| 16 | 137 |
| 17 | 154 |
| 18 | 172 |
| 19 | 191 |
| 20 | 211 |

Chart, line chart

Description automatically generated

**Algebraic Solution**

**How to sum up the numbers 1 to n**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **..** | **..** | **..** | **n-2** | **n-1** | **N** |
| **n** | **n-1** | **n-2** | **..** | **..** | **..** | **3** | **2** | **1** |
| **n+1** | **n+1** | **n+1** | **n+1** | **n+1** | **n+1** | **n+1** | **n+1** | **n+1** |

**This table equals.**

**We must divide this by 2 to only have one copy.**

**To apply this formula to the cutting problem you must add 1**

**Discussion**

As the number of cuts increase so does the number of pieces you can generate from those cuts exponentially approaching the limit of infinity. The formula assists greatly in finding this as it allows for very large numbers to be calculated which would be impossible to do manually. The shape of the object being cut does not matter in this equation as you can find a circle in every single regular polygon meaning you can make the same number of pieces with any regular polygon.

**Acknowledgements**

Acknowledge any help received other than from your partner or your teacher.

**References**

Needed only if you sourced information from elsewhere and these must be in APA format (see <https://libguides.murdoch.edu.au/APA/entries>)

**IMPORTANT NOTE:**

Your report is to be written in the first person: ‘I’ or ‘we’

Appendix 1

Table 2: Numerical solutions

|  |  |
| --- | --- |
| n | P\_n |
| 1 | 2 |
| =B5+1 | =B6+C5 |
| =B6+1 | =B7+C6 |
| =B7+1 | =B8+C7 |
| =B8+1 | =B9+C8 |
| =B9+1 | =B10+C9 |
| =B10+1 | =B11+C10 |
| =B11+1 | =B12+C11 |
| =B12+1 | =B13+C12 |
| =B13+1 | =B14+C13 |
| =B14+1 | =B15+C14 |
| =B15+1 | =B16+C15 |
| =B16+1 | =B17+C16 |
| =B17+1 | =B18+C17 |
| =B18+1 | =B19+C18 |
| =B19+1 | =B20+C19 |

Appendix 2