

**Exercise 1.1**

Use **five sentences or less to answer each of the following questions completely.**

1. To address the problem of traffic in a big city, several straight roads are being constructed. It was noted that two roads will have at most one junction, three roads will have at most three junctions, and so on.

a. Complete the table below. Identify the pattern on the maximum number of junctions for each given number of straight roads.

<b>No. of roads</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>No. of intersections (at most)</b>	<b>1</b>	<b>3</b>	<b>6</b>	<b>10</b>	<b>15</b>

b. At most, how many junctions are expected to be constructed if there are seven roads in the city?

- There would be a total of twenty-one junctions that are expected to be constructed if there are seven roads in the city.

2. Why are numbers important in our life? Explain your answer.

- Numbers are vital in one's life because it is one of the major factors that make the world go. A huge chunk of the human knowledge we know today are because of numbers. Inventions made to provide human convenience and pleasure were made possible due to detailed computations. In addition, numbers are constantly being applied in real life scenarios. In many concepts we know today, numbers are usually involved.

3. Other than those mentioned in the section, enumerate five (5) situations where you have to use numbers.

- As a student, allocating your allowance properly to various sections such as food, school supplies, and savings is an example wherein numbers are used.
- Choosing to buy a cheaper shirt rather than a more expensive one because of its price exemplifies the comparison of certain values.
- Paying for bills in the household such as electricity and water also involves numbers.
- Airports limit the weight of the baggage that passengers may bring onto the trip is an example.
- Different occupations have varying paying rates. Some jobs may have higher paying rates than others. This is a clear example of the involvement of numbers.

4. Other than those mentioned in the section, describe the three other patterns of shapes that you see in nature. Discuss briefly the "mathematics" behind such patterns.

- Honeycombs are built hexagons by the bees to fully aid them in their responsibilities. They can hold the queen bee's eggs and store the pollen and honey the worker bees bring to the hive— Circles would not work because they would leave gaps and hexagons are a more stable shape than squares or triangles.
- The pattern of butterfly wings illustrates the mathematical concept of symmetry. Similarly, sunflowers also exhibit this behaviour.

5. Identify and describe at least one pattern that you observe in your locality or within your nearby environment.

- I notice a certain process being done in our community once a week. During every Sunday at 8:30 in the morning, the garbage truck roams around the subdivision to collect garbage from houses. At our local church, the bell rings every 6PM to signify the beginning of the last Eucharistic mass for the day. These scenarios are examples of practices that happen within our community at a specific time and/or day.

## Assignment

Read the articles and watch the video clips below. Then, complete the statements that follow.

- Chapters 1 to 4 of Nature's Numbers by Ian Stewart
- Nature by Numbers

<https://www.youtube.com/watch?v=kkGeOWYOFoA>

One episode of the American television series *Numbers*

<https://www.youtube.com/channel/UCm0UJByEQHfKVnNFMXg9R1Q>

1. Three things that I significantly learned from this video clip:

- Mathematics is nature's language. It is its method of communicating with humanity.
- Patterns found in nature have mathematical basis or foundation.
- According to mathematics, human instincts are not always correct.

2. Three things that are still unclear to me:

- Despite being natural, patterns found in nature have a corresponding mathematical explanation. I cannot comprehend this concept.
- I do not understand how majority of the aspects of the human knowledge can have a respective mathematical basis.
- I have trouble understanding why some mathematical concepts may seem easy to comprehend but can become complex.

3. I used to think that mathematics is merely just a subject found in any educational institution. However, upon watching the video clips and reading the articles, I retract my previous statement. Math is found everywhere and is constantly applied in our daily lives. A huge portion of the human knowledge involves numbers. Humans require the use of numbers since it is essential in everything we know right now.

4. Three questions that I want to ask about the video clips:

- How were the Greeks able to determine the golden ratio?
- What experiment was done to discover the Fibonacci sequence?
- Why is the Monty Hall problem causing a number of people baffled?

### **Tower of Hanoi**

It was invented by Edouard Lucas in 1883. It is a puzzle consisting of three pegs and a number of disks of distinct diameters.

The puzzle requires that all the disks be moved from the first peg to the third peg such that the largest disk is on the bottom, the next larger disk is placed on the top of the largest disk and so on and that only one disk be moved at a time. All pegs may be used.

Determine the minimum number of moves to transfer the disks from the first peg to the third peg.

<b>No. of Disks</b>	<b>No. of Moves</b>
<b>1</b>	<b>128</b>
<b>2</b>	<b>192</b>
<b>3</b>	<b>224</b>
<b>4</b>	<b>240</b>
<b>5</b>	<b>248</b>
<b>6</b>	<b>252</b>
<b>7</b>	<b>254</b>
<b>8</b>	<b>255</b>

## Assignment

**Watch the video and complete the statements that follow.**

- *Fractals – The Color of Infinity*

1. Three things that I significantly learned from the video clip:

- The Mandelbrot set is highly regarded as a geometric figure whose patterns are infinite which is why a number of people perceive it as the thumbprint of God.
- The simplest formulas yield the most complicated results.
- Fractals are geometric figures in which more details are revealed as one continues to magnify on it more.

2. Three things that are still unclear to me:

- I do not understand how the Mandelbrot set was discovered.
- I cannot comprehend the realization that nature deals not in smooth continuous objects but in fractals.
- I do not grasp the practical value of fractals despite the aesthetics they bring to the table.

3. I used to think that no figure can produce numerous patterns. However, upon learning the Mandelbrot set, I was able to grasp that such a figure exists. Through the aid of modern computers, man was able to unravel this discovery. The Mandelbrot set could be discovered in any point of history but due to the state of technology during those times, it was extremely unlikely.

4. Three questions that I want to ask about the video clips:

- Why is the Mandelbrot set infinite by nature?
- How is fractal geometry being applied throughout the physical sciences as a way of describing data?
- Is there concrete proof to support Planck length and its supporting details?

