Exercise 2.1

- **Prime Numbers**

    1. There are 25 prime numbers less than 100.
    2. The only even prime number is 2.
    3. No prime number greater than 5 ends with a 5.
    4. The set of prime numbers is infinite.
    5. The largest known prime number as of now is $2^{82,589,933}$ with 24,862,048 digits.
    6. How do you know if a number is prime?
    7. Why is it important to find the largest prime number?
    8. How do you prove a number is prime?
    9. Is there a largest prime number?
    10. Why is 1 not a prime number?

- **Fractions**

    1. $\frac{9/10}{den}$ is greater than $\frac{8}{9}$.
    2. An improper fraction is always 1 or greater than 1.
    3. A fraction is a numerical quantity that is not a whole number.
    4. A fraction is proper if the numerator is less than the denominator.
    5. Any integer number can be shown as a fraction.
    6. What is the difference between a fraction and a rational number?
    7. What are the equivalent fractions of $\frac{2}{3}$?
    8. How to solve fractions?
    9. Are fractions always less than 1?
    10. How can you tell which fraction is greater?

- **Complex Numbers**

    1. The 16th century Italian mathematician Gerolamo Cardano introduced complex numbers in his attempts to find solutions to cubic equations.
    2. The complex numbers cannot be ordered since the square of the imaginary unit i is -1.
    3. You can't compare two complex numbers in some cases.
    4. The product of two imaginary numbers is always a negative real number.
    5. The set of integers is closed under addition, multiplication, and exponentiation, but not division.
    6. Is $2i$ a complex number?
    7. Can complex numbers be ordered?
    8. Are all numbers complex?
    9. Can we compare two complex numbers?
    10. What is the real part of i^{i+5}?

Exercise 2.2

1. The set of the trivial subsets of a finite set.

2. The set of solutions of a quadratic equation.

3. The set of moons around planet mars.

4. The set of drops of water in ocean.

5. The set of sand grains on land.

Exercise 2.3

1. $\{2z + 1 : z \in Z^-\}$

2. $\{n \in N : 99 < n < 1000\}$

3. $\{\frac{x+1}{x} : x \in Z^*\}$

4. $\{(x, y, z) \in Q^3 : x^2 + y^2 + z^2 \leq 1\}$

5. $\{z \in C : |z| \geq 1\}$

6. $\{(x, y, z) \in R^3 : x^2 + y^2 + z^2 = 1\}$

7. $\{(x - a)^2 + (y - b)^2 = R^2 : a^2 + b^2 = R^2\}$

8. $\{y = \frac{k}{x} : k, x, y \in R\}$

9. $\{ax + by + 1 = 0 : \text{a,b values result in tangency.}\}$

Exercise 2.4

1. The set of rational points in the open unit interval.

2. The set of reciprocals of odd integers.

3. The set of rationals whose numerator is odd and its denominator is a power of 2.

4. The set of real roots of integer numbers excluding integers.

5. The imaginary axis in the complex plane, excluding the origin.

6. The set of complex numbers where sum of real and imaginary parts is less than 1.

7. The set of integer pairs whose first component divides the second.

8. The set of vectors in the three-dimensional space where at least one coordinate is zero.

9. The set of points in a euclidean space whose coordinates have zero sum.

10. The set of all integers divided by 2.