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By: Anand Prakash Srivastava



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of the
Solved
Sample Question
Papers**

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Sample

QUESTION PAPER - 1

(Solved)

QUANTITATIVE METHODS

M.E.C.-203

Time: 3 Hours]

[Maximum Marks : 100
Weightage: 70%

Note: Answer questions from each section as directed.

SECTION-A

Q. 1. (a) Tell which one of the following is a convex set, within set of real numbers.

(i) $[4, 5[= \{x: 4 \leq x < 5\}$, (ii) $[1, 4] \cup [7, 11[= \{x: 1 \leq x \leq 4\} \cup \{x: 7 \leq x < 11\}$

Ans. Ref.: See Chapter-1, Page No. 5, Q. No. 7.

(b) Arjun is twice as old as Rahim. Five years ago, Arjun's age was three times Rahim's age. Find their present ages.

Ans. Ref.: See Chapter-2, Page No. 10, Q. No. 7.

Q. 2. For each of the following relations on the set $x = \{1, 2, 3\}$, tell whether it is symmetric, not-symmetric or anti-symmetric:

(i) $\{(1, 1), (2, 2), (3, 3)\}$

(ii) $\{(1, 2), (2, 3), (1, 3)\}$

(iii) $\{(1, 2), (2, 1), (1, 3), (3, 1)\}$

Ans. Ref.: See Chapter-3, Page No. 20, Q. No. 2.

Q. 3. A truck rental company, charges a rental fee of Rs. 25 plus Rs. 0.30 per mile for driving between 0 and 500 miles for the standard-sized truck. For the same truck, the company charges Rs. 100 plus Rs. 0.15 per mile for driving more than 500 miles, but less than 1000 miles. Write a step function that represents the situation.

Ans. Ref.: See Chapter-4, Page No. 32, Q. No. 5.

Q. 4. Consider the national income model given by:

$$Y = C + I + G$$

$$c = a + b(Y - T) \quad (a > 0, 0 < b < 1)$$

$$T = d + tY \quad (d > 0, 0 < t < 1)$$

Solve this model for the variables Y, C and T by matrix inversion.

Ans. Ref.: See Chapter-5, Page No. 48, Q. No. 5.

SECTION-B

Q. 5. Define the terms: eigen-value, eigen-vector and characteristic equations.

Ans. Ref.: See Chapter-7, Page No. 56, Q. No. 1.

Q. 6. The demand equation for a certain product is $p = 6 - 1/2x$ rupees. Find the level of production that results in maximum revenue.

Ans. Ref.: See Chapter-11, Page No. 83, Q. No. 2.

Q. 7. While solving the integration problem, how do you decide to use: (a) Substitution, and (b) Integration by parts?

Ans. Ref.: See Chapter-12, Page No. 93, Q. No. 7.

Q. 8. Give an example of each of the following:

(a) A bounded sequence is not monotonic.

(b) A monotonically increasing sequence is not bounded.

(c) A sequence which is both monotonic and bounded.

Ans. Ref.: See Chapter-13, Page No. 106, Q. No. 10.

Q. 9. (a) Determine all the numbers c which satisfy the conclusions of the Mean Value Theorem for the following function $f(y) = y^3 + 2y^2 - y$ on $[-1, 2]$.

Ans. Ref.: See Chapter-14, Page No. 118, Q. No. 8.

(b) Show that (R^n, dT) is a metric space, where, $R^2 = R \times R$, and d_T , the Taxicab distance, is defined as follows.

For $x = (x_1, x_2)$, and $y = (y_1, y_2)$,

$$dT(x, y) = |x_1 - y_1| + |x_2 - y_2|.$$

Ans. Ref.: See Chapter-15, Page No. 125, Q. No. 1.

Q. 10. Do you think the idea of quasi concavity is weaker than the idea of concavity?

Ans. Ref.: See Chapter-18, Page No. 144, Q. No. 2.

Q. 11. What is a difference equation? Distinguish it from a differential equation.

Ans. Ref.: See Chapter-20, Page No. 158, Q. No. 1.

Q. 12. Explain the dynamics of price adjustment process in a single market. What happens if $Q < 0$?

Ans. Ref.: See Chapter-21, Page No. 163, Q. No. 2.



Sample

QUESTION PAPER - 2

(Solved)

QUANTITATIVE METHODS

M.E.C.-203

Time: 3 Hours]

[Maximum Marks : 100
Weightage: 70%

Note: Answer questions from each section as directed.

SECTION-A

Q. 1. (a) Let $U = \{u, v, w, x, y, z\}$

(i) Find the number of subsets of U.

(ii) Find the number of proper non-empty subsets of U.

Ans. Ref.: See Chapter-1, Page No. 6, Q. No. 9.

(b) Solve each of the following quadratic equations in one variable x:

(i) $x^2 + 6x + 9 = 0$

(ii) $x^2 + 6x + 3 = 0$

(iii) $x^2 + 6x + 12 = 0$

Ans. Ref.: See Chapter-2, Page No. 11, Q. No. 10.

Q. 2. Let R be a relation from $X = \{1, 2, 3, 4\}$, to $Y = \{1, 2, 3, 4\}$, with $R = \{(1, 2), (2, 1), (2, 3), (3, 1), (3, 2), (3, 4), (4, 3)\}$

(i) Give Graphic Representation of R.

(ii) Give Matrix Representation of R.

Ans. Ref.: See Chapter-3, Page No. 17, Q. No. 1.

Q. 3. Let f be a rational function defined by $f(x) = \frac{x+1}{x-1}$. Find the x and y intercepts of the graph of the function.

Ans. Ref.: See Chapter-4, Page No. 33, Q. No. 8.

Q. 4. If $U = [1 \ 0 \ 1]$, $V = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$,

$$X = \begin{bmatrix} 4 & 2 & -1 \\ -1 & 3 & 0 \\ 0 & 1 & 1 \end{bmatrix} \text{ and } Y = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}.$$

Then find (a) UV; (b) VU + X; (c) XY

Ans. Ref.: See Chapter-5, Page No. 48, Q. No. 6.

SECTION-B

Q. 5. Determine if the following integral is convergent or divergent. If it is convergent find its value.

$$\int_2^3 \frac{1}{x^3} dx$$

Ans. Ref.: See Chapter-12, Page No. 98, Q. No. 9.

Q. 6. Show that an Arithmetic Progression is recursively definable.

Ans. Ref.: See Chapter-13, Page No. 108, Q. No. 1.

Q. 7. Prove that the universal set X is a closed set.

Ans. Ref.: See Chapter-15, Page No. 126, Q. No. 6.

Q. 8. What is a difference equation? Distinguish it from a differential equation.

Ans. Ref.: See Chapter-20, Page No. 158, Q. No. 1.

Q. 9. (a) Explain the dynamics of price adjustment process in a single market. What happens if $Q < 0$?

Ans. Ref.: See Chapter-21, Page No. 163, Q. No. 2.

(b) Let J be the functional defined by:

$$J(y) = \int_0^1 (y'^2 + y^2 + 4ye') dt$$

With boundary conditions $y(0) = 0$ and $y(1) = 1$. Find the extremal (s) in interval $[0, 1]$ for $J(y)$.

Ans. Ref.: See Chapter-22, Page No. 168, Q. No. 1.

Q. 10. Explain Constant Elasticity of Inter-temporal Substitution (EIS) Utility Function.

Ans. Ref.: See Chapter-24, Page No. 184, Q. No. 2.

Q. 11. A fair coin is tossed twice. Let X be defined as the no. of heads shown. Find the range of X and its probability mass function PX.

Ans. Ref.: See Chapter-26, Page No. 197, Q. No. 1.

Q. 12. The overall percentage of failure in a certain examination is 40. What is the probability that out of a group of 6 candidates at least 4 passed examinations?

Ans. Ref.: See Chapter-27, Page No. 201, Q. No. 5.



Sample Preview of The Chapter

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QUANTITATIVE METHODS

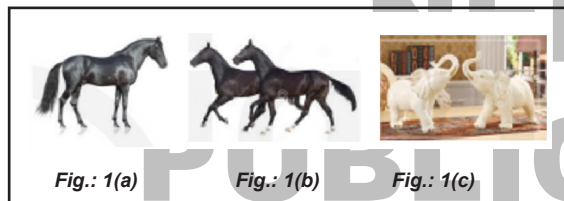
1

Fundamental Concepts of Mathematics

INTRODUCTION

The focus of the discussion in this chapter is on the two fundamental ideas in mathematics: (i) Number, which forms the basis of traditional mathematics, and (ii) Set, which is the base of contemporary mathematics.

Let's first comprehend the idea, phrase, name, symbol, and method of the quantity.



Number Concept: If one sees Figures 1(a) and 1(b) as being distinct from each other and Figures 1(b) and 1(c) as being comparable to each other, then one has number-sense, or the notion or concept of numbers (of at least up to 2). The number sense/concept reveals that despite the similarities between the two figures in Figures 1(a) and 1(b), such as the fact that both are about horses and even black horses, they are distinct in one important way. In a similar way, although having many differences – Fig. 1(b) is a photo of real black horses, whereas, Fig. 1(c) is a picture of marble white elephants (toys) – the two images have the quality of “twoness.” ‘Twoness’ is a notion.

Number name/Term: For the number of horses in Fig. 1(b), there are different names/terms in different languages: ‘two’ in English, ‘दो’ in Hindi, ‘zwei’ in German, ‘இரண்டு’ or ‘*Irantu*’ in Tamil.

Concept & Term: A concept's name is referred to as a “term.”

For example, the terms of “twoness” are represented by the phrases “two” and “.” For this **concept**, alternative words like “pair,” “couple” and even “twin” may occasionally be employed, even in English. The term “bank,” on the other hand, can be

used to describe two distinct ideas, namely, a river and “the place where money is deposited,” among other things.

Numeral/Number-Notation/Number-Symbol:

There are several well-known notations for the number “six,” including “6,” “VI,” and “.” Thus, 6 is a numeral and not a real number; it is the name of a number. However, it is misnomer as a number. It is customary in mathematics to refer to numerals as numbers. In place of the actual numerical, we will also typically use the phrase “number.”

Term, Notation and Definition: One of the mathematical expressions is “square root,” and the notation or symbol for it is $\sqrt{\quad}$. In addition, the definition of square-root reads, “For a given number x , its square-root y is a number that satisfies the equation $y \times y = x$, where the meaning of “ \times ” or multiplication is already known.”

Numeral System (or System of Numeration):

Numerous number systems – or, more properly, numeral systems – have been mentioned before, including the decimal, binary, and Roman numeral systems. The decimal number 41, for instance, can be written as ‘XLI’ in the Roman numeral system and ‘101001’ in the binary number system. The same statement may be used to represent several numbers depending on the number system. As an illustration, the symbol 111 stands for “One Hundred and Eleven” in the decimal number system, “Seven” in the binary number system, and “Three” in the unary number system.

CHAPTER AT A GLANCE

SET THEORY

Traditionally, the most basic and first topics covered in introductory mathematics were the concept of numbers and geometric concepts like “straight line”, “triangle”, and “square”.

Concept of Set

A set can be thought of as a grouping of items or entities, such as the names of animals, books,

numbers, geometric shapes, or any combination of these. A set's member or element is any object that is a part of the set.

Notations

Which is indicated by the symbol '{' comes first in the set notation, followed by one of the elements, such as 0, a comma, and a blank space. This pattern continues until the last element is written, which is then followed by the right brace, which is indicated by the symbol '}'. Typically, a set is given a name.

Forms of Set Representation

Two popular ways to represent sets are as follows:

(i) Tabular or Roster Form: This notation has been used up to this point to indicate a set. Each element or member in this form must be enclosed in braces, or there must be an adequate number of members to show a pattern.

(ii) Set-builder Form: The set-builder form uses these properties to denote the set as follows:

$S_{x < 10001} = \{x: x = y^2, y \text{ is an integer, and } x < 10001\}$

Relationships between Sets

Here, we show how to build each of these set relationships using a straightforward example. Later on, we'll look at some examples of building these relationships that are more complicated, especially with regard to the equality (=).

Notation, Definition and Examples

(i) If every element in both sets, X and Y, is also an element in X, then the two sets are said to be equal.

For "equality of sets X and Y," utilise the notation $X = Y$.

(ii) If each element in X is also an element in Y, then X is a subset of Y. We can also say "Y is a superset of X," "X is contained in Y," or "Y contains X" in place of "X is a subset of Y."

(iii) If **(i)** each element in X is an element of Y and **(ii)** there is at least one element in Y that does not belong to X, then X is a proper subset of Y. Then, Y is a proper superset of X, which is likewise true.

Establishing Set Relationship

Let's think about sets.

$A = \{x: x^2 + 3x + 2 = 0\}$, the set of solutions of the equation $x^2 + 3x + 2 = 0$.

$B = \{-1, -2\}$, $C = \{-2\}$, $E = \{0, -1, -2\}$

Notation, Definition and Examples

(i) Easiest case is that of 'is not a subset of': In our case, $E \not\subseteq C$, as $0 \in E$, but $0 \notin C$. Similarly, $E \not\subseteq A$, as $0 \in E$, but 0 is not a root of $x^2 + 3x + 2 = 0$.

(ii) After that, we must $B \subseteq E$. Evaluate each component of B individually and demonstrate that it is a part of both B and E. In complicated circumstances, we choose one element at random rather than thinking about each element separately. Later on, the methods will be described.

(iii) In addition to what we have already accomplished in **(ii)** above, we also need to demonstrate the existence of an element of E that does not belong to B in order to demonstrate that B is a proper subset of E $B \subset E$. In this instance, $0 \in E$, but $0 \notin B$.

(iv) In order to demonstrate the equality (=) of two sets, case **(ii)** must be repeated twice with the roles of the sets reversed.

In our case, $A = B$, because -1, which belongs to B, is a root of $x^2 + 3x + 2 = 0$, hence, belongs to A. Similarly, -2, which belongs to B, is a root of $x^2 + 3x + 2 = 0$, hence, belongs to A. Conversely, as $x^2 + 3x + 2 = 0$ is a quadratic equation, it has exactly two roots, viz. -1, -2.

Some Special Sets: Universal Set, Null Set, Power Set and Convex Set

(a) Universal Set: The Universal set is one such collection and is often U. Consequently, by definition, every set x under consideration will be a subset of the Universal set U.

(b) The Empty or Null Set: The number of elements in a set may be zero. According to our definition of a set, the following is a set $S = \{x: x \text{ is an even integer, and } x^2 = 9\}$.

A null set is denoted by the standard notation \emptyset or by $\{ \}$.

Quantifiers and Logical Symbols/Operators

Quantifiers and Logical operators appear frequently throughout mathematics.

(a) Quantifiers

$(\forall x) x \in X$ denotes 'for all $x \in X$ ';

$(\exists x) x \in X$ denotes 'for some $x \in X$ ';

$(\nexists x \in X)$ 'there does not exist an x in X ' OR 'there is no x in X , which satisfies'.

(b) Logical Operators

$A \rightarrow B$ denotes 'If A then B',

' $A \leftrightarrow B$ denotes 'A if and only if B',

' $A \leftrightarrow B$ ' is equivalent to both $A \rightarrow B$ and $B \rightarrow A$ combined.

Some Conceptual Clarifications and Explanations

The various "Relation" notions are contrasted in this subsection & "Operation", Sets operations: union, intersection, difference, and complementation, further clarifications: Operation, operands, argument, inputs, value, result, and output contra operand.

Difference between the Concepts of 'Relation' and 'Operation'

Relation on a set x is a subset of cross-product of the x with itself n times, where n is the arity of the where n is the number of relations in the set. For instance, the relation is-male involves a single person, making it a relation of arity 1, whereas the relation is-mother-of involves two people, making it a relation of arity 2. A relation returns exactly one of "true" or "false" as a value.

FUNDAMENTAL CONCEPTS OF MATHEMATICS / 3

Operation on a set x is quite similar to that of relation. The arity of the operation is determined by the number of times an operation on x maps the cross-product of x with itself. However, it gives back one element of x itself as value.

Operations on Sets: Union, Intersection, Difference, Complementation

(a) Union $x \cup y$ of two sets x and y is defined as:

$x \cup y = \{x: x \in x \text{ or } x \in y\}$ Here, $x \in x$ or $x \in y$ also includes the case that x may belong to both of x and y .

For example, if $x = \{1, 2, 3, 4\}$ and $y = \{2, 3, 5, 8, 9\}$, then $x \cup y = \{1, 2, 3, 4, 5, 8, 9\}$

Elements, like 2 and 3, which are occurring in both x and y appear only once in $x \cup y$, as elements are not repeated in representation of a set.

(b) The Intersection $x \cap y$ of two sets x and y is defined as:

$x \cap y = \{x: x \in x \text{ and } x \in y\}$

For example, if $x = \{1, 2, 3, 4\}$ and $y = \{2, 5, 8, 3, 9\}$, then $x \cap y = \{2, 3\}$,

(c) The Difference $x - y$ of two sets x and y is defined as:

$x - y = \{x: x \in x \text{ and } x \notin y\}$

For example, if $x = \{1, 2, 3, 4\}$ and $y = \{2, 5, 8, 3, 9\}$, then $x - y = \{1, 4\}$ and $y - x = \{5, 8, 9\}$

(d) Unary Set operator 'Complement': x' denotes 'complement of x ': 'Complement of a set x ' is a specific instance of 'Difference of Two Sets'. We need to know the value of the Universal set U , which is the largest set being taken into account in the specific context, in order to define "complement of a set". If x is represented by x' and U stands for the Universal set under study, then x' 's complement is defined as $U - X$.

More Clarifications

(i) Operands/Argument/Inputs; Value/result/output: In one of the examples above, we mentioned if $x = \{1, 2, 3, 4\}$ and $y = \{2, 3, 5, 8, 9\}$, then $x \cup y = \{1, 2, 3, 4, 5, 8, 9\}$.

The values $\{1, 2, 3, 4\}$ and $\{2, 3, 5, 8, 9\}$, which are given as inputs to the operation of union are generally called operands.

(ii) Operation vs. Operator: The two concepts of 'operation' and 'operator' are quite similar and are often confused for each other. For our purpose, the symbol for union, namely \cup , is called the operator.

**NUMBERS: FROM NATURAL TO COMPLEX
Some Standard Number Sets**

$N = \{1, 2, 3, \dots\}$ is called the set of natural/counting numbers.

$W = \{0, 1, 2, 3, \dots\}$ is called the set of whole numbers

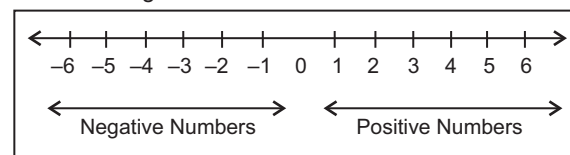
$Z = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$ is called the set of integers.

$Q = \{x: x = p/q \text{ with } q \neq 0, \text{ and } p, q \in Z\}$ is called the set of rational numbers.

R, The Set of Real Numbers

The geometric meaning of the set of real numbers symbolized by R and is described ahead:

Mark two separate locations on a straight line, designating the left mark as 0, and the right mark as 1. Then, it is possible to have each point on the straight line (stretched infinitely in both directions) correspond to a real integer.



Real Number Intervals

The set of all real numbers between 3 and 7.5 is designated by the interval $[3, 7.5]$, and it also includes both the boundary numbers 3 and 7.5. A closed interval is one such interval.

The set of all real numbers within the interval $[3, 7.5]$ (sometimes written as $(3, 7.5]$) is called numbers from 3 to 7.5, including 7.5, but not 3.

Complex Numbers

The set of complex numbers developed in context of attempts at solving equations of the type $x^2 + 1 = 0$, for which no real number solution exists. A new type of number i was introduced for which $i^2 = -1$ was assumed. Then C is defined as $C = \{z: z = x + i y: x, y \in R\}$.

Number Miscellany

Number (**Examples:** 3, -12, 8.7, $2/3$, $\sqrt{2}$, π , and $7 - 3i$, where 3 is a natural number, -12 is an integer, each of 8.7 and $2/3$ is a rational number, each of $\sqrt{2}$ and π is an irrational number. Each of the numbers 3, -12, 8.7, $2/3$, $\sqrt{2}$, π).

Properties of Real Numbers as Ordered Field

(a) R , the set of real numbers, satisfies the following properties (as a Field) w.r.t the two binary operations '+' and 'x':

1. Closure Properties: $x + y \in R$, and $x \times y \in R$,

2. Associative Properties: $(x + y) + z = x + (y + z)$; $(x \times y) \times z = x \times (y \times z)$

(b) R , the set of real numbers, additionally satisfies the following properties (as an Ordered Field) w.r.t the two binary operations '+' and 'x', and the binary relation '<':

DECIMAL REPRESENTATION OF RATIONAL AND IRRATIONAL NUMBERS

(i) The terminating decimal representation of rational: Think about $3/8$. We are aware that it is written as 0.375 in decimal notation. Due to the fact that it only has a finite amount of digits, this form is terminating.

(ii) Non-terminating recurring/repeating decimal representation of rational numbers: $7/3$ is written in decimal notation as 2.333..., where the digit 3 repeats itself indefinitely. This means that the decimal representation is non-terminating, yet the sequence only consists of one repeating digit, 3.

REAL NUMBER EXPONENTIATION

We know that the notation x^3 stands for $x \cdot x \cdot x$, i.e. x multiplied by itself three times. In general, for $n \in \mathbb{N}$, the notation x^n stands for $x \cdot x \dots (n \text{ times})$, i. e., x multiplied by itself n times. Then x is called the base of x^n and n is called the exponent or power of x^n .

CHECK YOUR PROGRESS

Q. 1. Which of the following collections are sets? Justify your answer.

- (i) The collection of all the months of a year beginning with the letter M.
- (ii) The collection of all the months of a year beginning with the letter Z.
- (iii) The collection of ten most talented living writers of the world.
- (iv) A team of eleven most renowned football players of the world.
- (v) {1, 2, 2, 3}
- (vi) {1, 2, {2, 3}, 3}

Ans. (i) The collection of all the months of a year beginning with the letter M.

This is a set because it contains distinct elements: {March, May}

(ii) The collection of all the months of a year beginning with the letter Z.

This is an empty set because there are no months that start with the letter Z. An empty set is still a set.

(iii) The collection of ten most talented living writers of the world.

Whether this is a set, or not depends on whether there is a specific, agreed-upon list of the ten most talented living writers. If such a list exists and contains distinct writers, then it can be considered a set. If not, it may not be a set.

(iv) A team of eleven most renowned football players of the world.

Similar to (iii), whether this is a set or not depends on whether there is a specific, agreed-upon list of the eleven most renowned football players. If such a list exists and contains distinct players, then it can be considered a set. If not, it may not be a set.

(v) {1, 2, 2, 3}

This is not a set, because it contains duplicate elements (the number 2 appears twice). Sets cannot contain duplicate elements.

(vi) {1, 2, {2, 3}, 3}

This is not a set, because it contains a nested set ({2, 3}). Sets typically consist of individual, non-nested elements. If you remove the nested set, you have {1, 2, 3}, which is a valid set.

Q. 2. For each of the sets consisting of following members, write it in roster/tabular form and its cardinality:

(a) Positive prime integer factors of 180

(b) Solutions of the quadratic equation $x^2 - 3x - 10 = 0$

Ans. (a) Positive prime integer factors of 180: Prime factors of 180 are 2, 3, and 5. We are looking for positive prime integer factors, so the set can be represented as {2, 3, 5}

The cardinality of this set is the number of elements in it, which is 3. So, the cardinality is 3.

(b) Solutions of the quadratic equation $x^2 - 3x - 10 = 0$:

To find the solutions, we can solve the equation:

$$x^2 - 3x - 10 = 0$$

Factoring the equation:

$$(x - 5)(x + 2) = 0$$

Setting each factor equal to zero:

$$x - 5 = 0 \Rightarrow x = 5, \quad x + 2 = 0 \Rightarrow x = -2$$

The solutions to the equation are $x = 5$ and $x = -2$.

Representing the set of solutions in roster form: {5, -2}

The cardinality of this set is 2, as there are two elements in it. So, the cardinality is 2.

Q. 3. Tell which of the following is a set, and if it is a set, then:

(i) Write it in set builder form

(ii) Tell its cardinality.

(a) {6, 9, 12, 15, 18, 21, 24, 27}

(b) {2, 4, 8, 16, ...}

(c) {{1}, {1, 2}, {1, 2, 3}, ..., {1, 2, 3, 4...10}}

Ans. (a) {6, 9, 12, 15, 18, 21, 24, 27}

This is a set, because it contains distinct elements. It represents a set of positive multiples of 3, starting from 6.

(i) Set builder form: $\{x \mid x \text{ is a positive multiple of } 3\}$

(ii) **Cardinality:** There are 8 elements in this set, so the cardinality is 8.

(b) {2, 4, 8, 16, ...}

This is a set. It represents a geometric sequence where each element is a power of 2.

(i) Set builder form: $\{2^n \mid n \text{ is a non-negative integer}\}$

(ii) **Cardinality:** This set contains infinitely many elements because it includes all powers of 2, so the cardinality is infinite (∞).

(c) {{1}, {1, 2}, {1, 2, 3}, ..., {1, 2, 3, 4...10}}

This appears to be a set of sets where each set contains the numbers from 1 to some positive integer.

(i) Set builder form: $\{S \mid S \text{ is a set containing the numbers from } 1 \text{ to } n, \text{ where } n \text{ is a positive integer}\}$.

(ii) **Cardinality:** This set contains infinitely many sets because it includes sets containing numbers from 1 to various positive integers, so the cardinality is infinite (∞).

Q. 4. For the pair of sets x and y , state whether $x = y$ or not, along with explanation for your response.