Exercise 1.1

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1. Which of the following are sets? Justify your Solution:.

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

(ii) The collection of ten most talented writers of India.

(iii) A team of eleven best-cricket batsmen of the world.

(iv) The collection of all boys in your class.

(v) The collection of all natural numbers less than 100.

(vi) A collection of novels written by the writer Munshi Prem Chand.

(vii) The collection of all even integers.

(viii) The collection of questions in this Chapter.

(ix) A collection of most dangerous animals of the world.

Solution:

(i) The collection of all months of a year beginning with the letter J is a well-defined collection of objects because one can definitely identify a month that belongs to this collection.
Hence, this collection is a set.

(ii) The collection of ten most talented writers of India is not a well-defined collection because the criteria for determining a writer's talent may vary from person to person.
Hence, this collection is not a set.

(iii) A team of eleven best cricket batsmen of the world is not a well-defined collection because the criteria for determining a batsman's talent may vary from person to person.
Hence, this collection is not a set.

(iv) The collection of all boys in your class is a well-defined collection because you can definitely identify a boy who belongs to this collection. Hence, this collection is a set.

(v) The collection of all natural numbers less than 100 is a well-defined collection because one can definitely identify a number that belongs to this collection.
Hence, this collection is a set.

(vi) A collection of novels written by the writer Munshi Prem Chand is a well-defined collection because one can definitely identify a book that belongs to this collection.

Hence, this collection is a set.

(vii) The collection of all even integers is a well-defined collection because one can definitely identify an even integer that belongs to this collection. Hence, this collection is a set.

(viii) The collection of questions in this chapter is a well-defined collection because one can definitely identify a question that belongs to this chapter. Hence, this collection is a set.

(ix) The collection of most dangerous animals of the world is not a well- defined collection because the criteria for determining the dangerousnessof an animal can vary from person to person.
Hence, this collection is not a set.

2. Let A = {1, 2, 3, 4, 5, 6}. Insert the appropriate symbol ∈or ∉ in the blank spaces:

(i) 5...A **(ii) 8...A** **(iii) 0...A**

(iv) 4...A **(v) 2...A** **(vi) 10...A**

Solution:

(i) $5 \in A$

(ii) $8 \notin A$

(iii) $0 \notin A$

(iv) $4 \in A$

(v) $2 \in A$

(vi) $10 \notin A$

3. Write the following sets in roster form:

(i) A = {x: x is an integer and $-3 < x < 7$}.

(ii) B = {x: x is a natural number less than 6}.

(iii) C = {x: x is a two-digit natural number such that the sum of its digits is 8}

(iv) D = {x: x is a prime number which is divisor of 60}.

(v) E = The set of all letters in the word TRIGONOMETRY.

(vi) F = The set of all letters in the word BETTER.

Solution:

(i) A = {x: x is an integer and $-3 < x < 7$}
The elements of this set are –2, –1, 0, 1, 2, 3, 4, 5, and 6 only. Therefore, the given set can be written in roster form as

A = {–2, –1, 0, 1, 2, 3, 4, 5, 6}

(ii) B = {x: x is a natural number less than 6} The elements of this set are 1, 2, 3, 4, and 5 only.
Therefore, the given set can be written in roster form as B = {1, 2, 3, 4, 5}

(iii) C = {x: x is a two-digit natural number such that the sum of its digits is 8} The elements of this set are 17, 26, 35, 44, 53, 62, 71, and 80 only.
Therefore, this set can be written in roster form as C = {17, 26, 35, 44, 53, 62, 71, 80}

(iv) D = {x: x is a prime number which is a divisor of 60} $60 = 2 \times 2 \times 3 \times 5$
The elements of this set are 2, 3, and 5 only.
Therefore, this set can be written in roster form as D = {2, 3, 5}.

(v) E = The set of all letters in the word TRIGONOMETRY
There are 12 letters in the word TRIGONOMETRY, out of which letters T, R, and O are repeated.
Therefore, this set can be written in roster form as E = {T, R, I, G, O, N, M, E, Y}

(vi) F = The set of all letters in the word BETTER
There are 6 letters in the word BETTER, out of which letters E and T are repeated.
Therefore, this set can be written in roster form as F = {B, E, T, R}

4. Write the following sets in the set-builder form:

(i) (3, 6, 9, 12) **(ii) {2, 4, 8, 16, 32}**

(iii) {5, 25, 125, 625} **(iv) {2, 4, 6 ...}**

(v) {1, 4, 9 ... 100}

Solution:

(i) $\{3, 6, 9, 12\} = \{x: x = 3n, n \in N \text{ and } 1 \leq n \leq 4\}$

(ii) {2, 4, 8, 16, 32}

It can be seen that $2 = 2^1$, $4 = 2^2$, $8 = 2^3$, $16 = 2^4$, and $32 = 2^5$.

$\therefore \{2, 4, 8, 16, 32\} = \{x: x = 2^n, n \in N \text{ and } 1 \leq n \leq 5\}$

(iii) {5, 25, 125, 625}

It can be seen that $5 = 5^1$, $25 = 5^2$, $125 = 5^3$, and $625 = 5^4$.

$\therefore \{5, 25, 125, 625\} = \{x: x = 5^n, n \in N \text{ and } 1 \leq n \leq 4\}$

(iv) {2, 4, 6 ...}

It is a set of all even natural numbers.

$\therefore \{2, 4, 6 \ldots\} = \{x: x \text{ is an even natural number}\}$

(v) $\{1, 4, 9 \ldots 100\}$

It can be seen that $1 = 1^2, 4 = 2^2, 9 = 3^2 \ldots 100 = 10^2$.

$\therefore \{1, 4, 9 \ldots 100\} = \{x: x = n^2, n \in N \text{ and } 1 \leq n \leq 10\}$

5. List all the elements of the following sets:

(i) $A = \{x: x \text{ is an odd natural number}\}$

(ii) $B = \{x: x \text{ is an integer}, -\frac{1}{2} < x < \frac{9}{2}\}$

(iii) $C = \{x: x \text{ is an integer}, x^2 \leq 4\}$

(iv) $D = \{x: x \text{ is a letter in the word "LOYAL"}\}$

(v) $E = \{x: x \text{ is a month of a year not having 31 days}\}$

(vi) $F = \{x: x \text{ is a consonant in the English alphabet which proceeds } k\}$.

Solution:

(i) $A = \{x: x \text{ is an odd natural number}\} = \{1, 3, 5, 7, 9 \ldots\}$

(ii) $B = \{x: x \text{ is an integer}; -\frac{1}{2} < x < \frac{9}{2}\}$

It can be seen that $-\frac{1}{2} = -0.5$ and $\frac{9}{2} = 4.5$

$\therefore = \{0, 1, 2, 3, 4\}$

(iii) $C = \{x: x \text{ is an integer}; x^2 \leq 4\}$

It can be seen that

$(-1)^2 = 1 \leq 4; (-2)^2 = 4 \leq 4; (-3)^2 = 9 > 4$

$0^2 = 0 \leq 4$

$1^2 = 1 \leq 4$

$2^2 = 4 \leq 4$

$3^2 = 9 > 4$

$\therefore C = \{-2, -1, 0, 1, 2\}$

(iv) $D = (x: x \text{ is a letter in the word "LOYAL"}) = \{L, O, Y, A\}$

(v) E = {x: x is a month of a year not having 31 days}

= {February, April, June, September, November}

(vi) F = {x: x is a consonant in the English alphabet which precedes k}

= {b, c, d, f, g, h, j}

6. Match each of the set on the left in the roster form with the same set on the right described in set-builder form:

(I) {1, 2, 3, 6}	**(A) {X: X IS A PRIME NUMBER AND A DIVISOR OF 6}**
(II) {2, 3}	**(B) {X: X IS AN ODD NATURAL NUMBER LESS THAN 10}**
(III) {M, A,T, H, E, I,C, S}	**(C) {X: X IS NATURAL NUMBER AND DIVISOR OF 6}**
(IV) {1, 3, 5, 7, 9}	**(D) {X: X IS A LETTER OF THE WORD MATHEMATICS}**

Solution:

(i) All the elements of this set are natural numbers as well as the divisors of 6.

Therefore, (i) matches with (c).

(ii) It can be seen that 2 and 3 are prime numbers. They are also the divisors of 6.

Therefore, (ii) matches with (a).

(iii) All the elements of this set are letters of the word MATHEMATICS. Therefore, (iii) matches with (d).

(iv) All the elements of this set are odd natural numbers less than 10. Therefore, (iv) matches with (b).