

GAYAZA HIGH SCHOOL

S.3 MATH WORKSHEET FOUR ON SETS PART I 2020

PREREQUISITE KNOWLEDGE:

- NUMBERS
- INTERGERS

SETS PART I

In modern mathematics, just about everything rests on the very important concept of the **set**. A set is just a collection of elements, or members. For instance, you could have a set of friends: $F = \{\text{Moses, Kenny, Edward, William, Elsam}\}$ or a set of numbers: $Y = \{-3.4, 12, 9999\}$.

In this worksheet on sets we will solve 12 different types of questions. The questions on sets are basically related on;

- Elements of set and notation of a set.
- Representation of a set.
- Cardinal number of a set.
- Types and pairs of set.

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

(a) The collection of all the days in a week beginning with the letter 'T'	(b) The collection of all difficult questions in the chapter on sets.
(c) The collection of girls in your class.	(d) The collection of all rivers in India.
(e) The collection of all active teachers in the school.	(f) The collection of all integers more than -3.

RECALL:

If x is an element of a set A , we write $x \in A$, and if x is not an element of A we write $x \notin A$.

So, using the sets defined above,

$-862 \in \mathbf{Z}$, since -862 is an integer, and $2.9 \notin \mathbf{M}$, since 2.9 is not greater than 33 .

2. If,

$$A = \{3, 5, 7, 9\}$$

$$B = \{2, 4, 6, 8, 10\}$$

$$C = \{12, 14, 18, 20, 24\}$$

$$D = \{21, 26, 31, 36\}$$

(a) State whether true or false.

(i) $13 \in C$	(ii) $6 \notin A$	(iii) $9 \notin A$	(iv) $24 \in C$
(v) $31 \in D$	(vi) $36 \notin D$	(vii) $20 \notin C$	(viii) $9 \in A$

(b) Fill in the blanks.

(i) $3 \in \underline{\hspace{1cm}}$	(ii) $4 \underline{\hspace{1cm}} B$	(iii) $26 \underline{\hspace{1cm}} C$	(iv) $8 \in \underline{\hspace{1cm}}$
(v) $5 \underline{\hspace{1cm}} A$	(vi) $6 \underline{\hspace{1cm}} C$	(vii) $21 \underline{\hspace{1cm}} D$	(viii) $18 \underline{\hspace{1cm}} B$

RECALL:

There are two methods of representing a set:

- (i) **Roster or tabular form**
- (ii) **Set-builder form.**

Roster or tabular form: In roster form, all the elements of a set are listed, the elements are being separated by commas and are enclosed within braces $\{ \}$.

For Example: $Z =$ the set of all integers $= \{ \dots, -3, -2, -1, 0, 1, 2, 3, \dots \}$

Set-builder form: In the set builder form, all the elements of the set, must possess a single property to become the member of that set.

For Example: $Z = \{x : x \text{ is an integer}\}$

You can read $Z = \{x : x \text{ is an integer}\}$ as "The set Z equals all the values of x such that x is an integer."

$M = \{x : x > 3\}$

(This last notation means "all real numbers x such that x is greater than 3." So, for example, 3.1 is in the set M , but 2 is not. The colon ":" means "such that".)

3. Write the following sets in the roster form.

(a) $A =$ The set of all even numbers less than 12	(b) $B =$ The set of all prime numbers greater than 1 but less than 29
(c) $C =$ The set of integers lying between -2 and 2	(d) $D =$ The set of letters in the word LOYAL
(e) $E =$ The set of vowels in the word CHOICE	(f) $F =$ The set of all factors of 36
(g) $G = \{x : x \in \mathbb{N}, 5 < x < 12\}$	(h) $H = \{x : x \text{ is a multiple of 3 and } x < 21\}$
(i) $I = \{x : x \text{ is perfect cube } 27 < x < 216\}$	(j) $J = \{x : x = 5n - 3, n \in \mathbb{W}, \text{ and } n < 3\}$
(k) $M = \{x : x \text{ is a positive integer and } x^2 < 40\}$	(l) $N = \{x : x \text{ is a positive integer and is a divisor of 18}\}$
(m) $P = \{x : x \text{ is an integer and } x + 1 = 1\}$	(n) $Q = \{x : x \text{ is a color in the rainbow}\}$

4. Write each of the following in set builder form.

(a) $A = \{5, 10, 15, 20\}$	(b) $B = \{1, 2, 3, 6, 9, 18\}$	(c) $C = \{P, R, I, N, C, A, L\}$	(d) $D = \{0\}$
(e) $E = \{ \}$	(f) $F = \{0, 1, 2, 3, \dots, 19\}$	(g) $G = \{-8, -6, -4, -2\}$	(h) $H = \{\text{Jan, June, July}\}$
(i) $I = \{a, e, i, o, u\}$	(j) $J = \{a, b, c, d, \dots, z\}$	(k) $K = \{\frac{1}{1}, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}\}$	(l) $L = \{1, 3, 5, 7, 9\}$

RECALL

Cardinal number of a set.

The **number** of distinct elements in a finite **set** is called its **cardinal number**. It is denoted as $n(A)$ and read as 'the **number** of elements of the **set**'.

For example: **Set** $A = \{2, 4, 5, 9, 15\}$ has 5 elements, i.e. $n(A) = 5$

5. Write the cardinal number for each of the following.

(a) $X =$ The set of months in a year	(b) $Y =$ The set of letters in the word INTELLIGENT
(c) $Z =$ The set of prime numbers from 2 to 11	(d) $P = \{x : x \text{ is an even prime number}\}$
(e) $Q = \{x : x \text{ is a quadrilateral having 5 sides}\}$	(f) $R = \{x : x \in I, -5 < x < 2\}$
(g) $S = \{x \mid x \in W, x + 2 < 9\}$	(h) $T = \{x \mid x \text{ is a prime number which is a divisor of } 60\}$
(i) $V = \{x : x \text{ is a 2-digit number such that the sum of digits is } 6\}$	(j) $W =$ The set of hours in a day

RECALL

If a **set** has a starting and end point both then it is **finite** but if it does not have a starting or end point, then it is **infinite set**.

If a **set** has a **limited number of elements**, then it is **finite** but if its **number of elements is unlimited** then it is **infinite**.

6. Classify the following as finite and infinite sets.

(a) $A = \{x : x \in N \text{ and } x \text{ is even}\}$	(b) $B = \{x : x \in N \text{ and } x \text{ is composite}\}$
(c) $C = \{x : x \in N \text{ and } 3x - 2 = 0\}$	(d) $D = \{x : x \in N \text{ and } x^2 = 9\}$
(e) $E = \{\text{The set of numbers which are multiples of } 3\}$	(f) $G = \{\text{The set of letters in the English alphabet}\}$
(g) $H = \{\text{The set of persons living in a house}\}$	(h) $I = \{x \mid x \in I, x < -2\}$
(i) $J = \{x \mid x \in P, p \text{ is a prime number}\}$	(I) $K =$ The set of fractions with numerator 3.

RECALL

You can also have a set which has no elements at all. This special set is called **the empty set or null set**, and we write it with the special symbol \emptyset or $\{\}$.

A **singleton**, also known as a **unit set**, is a **set** with exactly one element. For example, the **set** $\{\text{null}\}$ is a **singleton** containing the element null.

7. Identify the following as null set or singleton set.

(a) $A = \{x \mid x \in \mathbb{N}, 1 < x < 2\}$	(b) $P = \{\text{Point of intersection of two lines}\}$
(c) $C = \{x : x \text{ is an even prime number greater than } 2\}$	(d) $Q = \{x \mid x \text{ is an even prime number}\}$
(e) $E = \{x : x^2 = 9, x \text{ is even}\}$	(f) $R = \{\text{The set of whole numbers lying between 0 and 2}\}$
(g) $B = \{0\}$	(h) $D = \{\text{The set of largest 1 digit number}\}$
(i) $F = \{\text{The set of triangles having 4 sides}\}$	(j) $H = \{\text{The set of even numbers not divisible by 2}\}$

RECALL

Equal sets have the exact same elements in them, even though they could be out of order. **Equivalent sets** have different elements but have the same amount of elements. Therefore, if two **sets** have the same cardinality, they are **equivalent**.

8. From the sets given below, select the equal sets.

$A = \{3, 5, 9, 13\}$, $B = \{2, 3, 4, 5\}$, $C = \{5, 9, 13, 15\}$, $D = \{4, 2, 5, 3\}$, $E = \{-2, 2\}$, $F = \{o, b\}$, $G = \{2, -2\}$, $H = \{1, 2\}$

9. Which two sets A and B are equal? Give reasons to support your answer.

- (a) $A = \{x : x \text{ is a letter in the word SEAT}\}$ and $B = \{x : x \text{ is a letter in the word TASTE}\}$
- (b) $A = \{2, 6, 10, 14\}$ and $B = \{6, 2, 14, 16\}$
- (c) $A = \{1, 3, 5, 7, 9\}$ and $B = \{x : x \text{ is a positive odd integer } x \leq 9\}$
- (d) $A = \{0\}$ and $B = \{x : x > 15 \text{ and } x < 5\}$

10. Which of the following pairs of sets are equivalent or equal?

- (a) $A = \{x : x \in \mathbb{N}, x \leq 6\}$ and $B = \{x : x \in \mathbb{W}, 1 \leq x \leq 6\}$
- (b) $P = \{\text{The set of letters in the word 'plane'}\}$ and $Q = \{\text{The set of letters in the word 'plain'}\}$
- (c) $X = \{\text{The set of colors in the rainbow}\}$ and $Y = \{\text{The set of days in a week}\}$
- (d) $M = \{4, 8, 12, 16\}$ and $N = \{8, 12, 4, 16\}$
- (e) $A = \{x : x \in \mathbb{N}, x \leq 5\}$ and $B = \{x : x \in \mathbb{I}, 5 < x \leq 10\}$

Equal sets:	
Equivalent sets:	

RECALL

Two **sets** A and B are said to be **disjoint**, if they do not have any element in common.

Overlapping sets: Two **sets** A and B are said to be **overlapping** if they contain at least one element in common.

11. Find which of the following sets are disjoint or overlapping.

- (a) $A = \{\text{The set of boys in the school}\}$ and $B = \{\text{The set of girls in the school}\}$
- (b) $P = \{\text{The set of letters in the English alphabet}\}$ and $Q = \{\text{The set of vowels in the English alphabet}\}$
- (c) $X = \{x : x \text{ is an odd number, } x < 9\}$ and $Y = \{x : x \text{ is an even number, } x < 10\}$
- (d) $M = \{x : x \text{ is a factor of } 24\}$ and $N = \{x : x \text{ is a multiple of } 3, \text{ less than } 30\}$
- (e) $E = \{9, 99, 999\}$ and $F = \{1, 10, 100\}$
- (f) $G = \{\text{The set of letters in the word TAME}\}$ and $H = \{\text{The set of letters in the word MATE}\}$

Disjoint sets:	
Overlapping sets:	

12. State whether the following are true or false.

(a) The set of letters in the word MASTER is finite.	(b) The set of vowels in the word PLANET is an empty set.
(c) $\{0\}$ represents a null set.	(d) Equivalent sets are always equal.
(e) An empty set is a finite set.	(f) $10 \notin$ set of multiples of 5.
(g) $4 \in \{x : 4 \leq x \leq 10\}$	(h) If two sets are equal, they are also equivalent.

THE END.