Q.1 Write the following sets in set builder form.

(i) $\{1,2,3,...,1000\}$

Solution:

$\{x \mid x \in ¥ \wedge x \leq 1000\}$ **Answer**

(ii) $\{0,1,2,3,...,100\}$

Solution:

$\{x \mid x \in W \wedge x \leq 100\}$ **Answer**

(iii) $\{0,\pm1,\pm2,...,\pm1000\}$ **(SGD 2021)**

Solution:

$\{x \mid x \in ¢ \wedge -1000 \leq x \leq 1000\}$ **Answer**

(iv) $\{0,-1,-2,-3,...,-500\}$

Solution:

$\{x \mid x \in ¢ \wedge -500 \leq x \leq 0\}$ **Answer**

(v) $\{100,101,102,...,400\}$

Solution:

$\{x \mid x \in ¥ \wedge 100 \leq x \leq 400\}$ **Answer**

(vi) $\{-100,-101,-102,...,-500\}$

Solution:

$\{x \mid x \in ¢ \wedge -500 \leq x \leq -100\}$ **Answer**

(vii) {Peshawar, Lahore, Karachi, Quetta}

Solution: $\{x \mid x$ is a capital of a province of Pakistan$\}$ **Answer**

(viii) {January, June, July}

Solution: $\{x \mid x$ is a month that starts with J$\}$ **Answer**

(ix) The set of all odd natural numbers

Solution:

$\{x \mid x \in O \wedge x > 0\}$ **Answer**

(x) The set of all rational numbers

Solution: $\{x \mid x \in ¤\}$ **Answer**

(xi) The set of all real numbers between 1 and 2.

Solution: $\{x \mid x \in ¡ \wedge 1 < x < 2\}$ **Ans.**

(xii) The set of all integers between -100 and 1000

Solution:

$\{x \mid x \in ¢ \wedge -100 < x < 1000\}$ **Ans.**

Q.2 Write each of the following sets in the descriptive and tabular forms.

(i) $\{x \mid x \in ¥ \wedge x \leq 10\}$

(MTN 2021, RWP 2022, GRW 2022)

Descriptive: The set of first ten natural numbers

Tabular: $\{1,2,3,...,10\}$ **Answer**

(ii) $\{x \mid x \in N \wedge 4 < x < 12\}$

(RWP 2023)

Descriptive: The set of natural numbers between 4 and 12.

Tabular: $\{5,6,7,...,11\}$ **Answer**

(iii) $\{x \mid x \in \not\subset \wedge -5 < x < 5\}$

Descriptive: Set of integers between –5 and 5

Tabular: $\{0, \pm 1, \pm 2, \pm 3, \pm 4\}$ **Ans.**

(iv) $\{x \mid x \in E \wedge 2 < x \leq 4\}$

Descriptive: The set of even integers greater than 2 and less than or equal to 4

Tabular: $\{4\}$ **Answer**

(v) $\{x \mid x \in P \wedge x < 12\}$

(MTN 2022, LHR 2022, 23, GRW 2023)

Descriptive: The set of prime numbers less than 12

Tabular: $\{2, 3, 5, 7, 11\}$ **Answer**

(vi) $\{x \mid x \in O \wedge 3 < x < 12\}$

(FSD 2021, BWP 2021)

Descriptive: The set of odd integers between 3 and 12.

Tabular: $\{5, 7, 9, 11\}$ **Answer**

(vii) $\{x \mid x \in E \wedge 4 \leq x \leq 10\}$

(BWP 2022)

Descriptive: The set of even integers from 4 up to 10.

Tabular: $\{4, 6, 8, 10\}$ **Answer**

(viii) $\{x \mid x \in E \wedge 4 < x < 6\}$

Descriptive: The set of even integers between 4 and 6.

Tabular: ϕ **Answer**

(ix) $\{x \mid x \in O \wedge 5 \leq x \leq 7\}$

(DGK 2021)

Descriptive: The set of odd integers from 5 up to 7.

Tabular: $\{5, 7\}$ **Answer**

(x) $\{x \mid x \in O \wedge 5 \leq x < 7\}$

Descriptive: The set of odd integers greater than or equal to 5 and less than 7.

Tabular: $\{5\}$ **Answer**

(xi) $\{x \mid x \in N \wedge x + 4 = 0\}$

(MTN 2023)

Descriptive: The set of natural numbers x satisfying $x + 4 = 0$

Tabular: ϕ **Answer**

(xii) $\{x \mid x \in ¤ \wedge x^2 = 2\}$

(GRW 2021)

Descriptive: The set of rational numbers x satisfying $x^2 = 2$.

Tabular: ϕ **Answer**

(xiii) $\{x \mid x \in ¡ \wedge x = x\}$

Descriptive: The set of real numbers x satisfying $x = x$.

Tabular: ¡ **Answer**

(xiv) $\{x \mid x \in ¤ \wedge x = -x\}$

Descriptive: The set of rational numbers x satisfying $x = -x$.

Tabular: $\{0\}$ **Answer**

(xv) $\{x \mid x \in ¡ \wedge x \neq x\}$

(DGK 2023)

Descriptive: The set of real numbers x satisfying $x \neq x$.

Tabular: ϕ **Answer**

(xvi) $\{x \mid x \in ¡ \wedge x \notin ¤\}$

Descriptive: The set of real numbers x which are not rational.

Tabular: Q' **Answer**

Q.3 Which of the following sets are finite and which of these are infinite?

(i) The set of students of your class.

Solution: finite

(ii) The set of all schools in Pakistan.

Solution: finite

(iii) The set of natural numbers between 3 and 10.

Solution: finite

(iv) The set of rational numbers between 3 and 10.

Solution: infinite

(v) The set of real numbers between 0 and 1.

Solution: infinite

(vi) The set of rationales between 0 and 1.

Solution: infinite

The set of whole numbers between 0 and 1.

Solution: finite

(vii) The set of all leaves of trees in Pakistan.

Solution: finite

(viii) $P(N)$

Solution: infinite

(ix) $P\{a,b,c\}$

Solution: finite

(x) $\{1,2,3,4,...\}$

Solution: infinite

(xi) $\{1,2,3,...,100000000\}$

Solution: finite

(xii) $\{x \mid x \in ¡ \wedge x \neq x\}$

Solution: finite

(xiii) $\{x \mid x \in ¡ \wedge x^2 = -16\}$

Solution: finite

(xiv) $\{x \mid x \in ¤ \wedge x^2 = 5\}$

Solution: finite

(xv) $\{x \mid x \in ¤ \wedge 0 \leq x \leq 1\}$

Solution: infinite

Q.4 Write two proper subsets of each of the following sets.

(i) $\{a,b,c\}$

(MTN 2021, 22, DGK 2021, RWP 2021, GRW 2023)

Solution: $\{a,b\}, \{b,c\}$

(ii) $\{0,1\}$

Solution: $\{0\}, \{1\}$

(iii) $\sqsubset$

Solution: $\{1\},\{2\}$

(iv) $\sqsubset$

Solution: $\{0\},\{-1,0\}$

(v) $\sqsubset$

Solution: $\{0\},\left\{\frac{1}{2},\frac{1}{4}\right\}$

(vi) ¡

Solution: $\left\{\frac{1}{2}\right\},\left\{\frac{1}{\sqrt{2}}\right\}$

(vii) W

Solution: $\{0,1\},\{2,3\}$

(viii) $\{x \mid x \in ¤ \wedge 0 < x \leq 2\}$

Solution: $\left\{1,\frac{1}{2}\right\},\left\{\frac{1}{3},\frac{2}{5}\right\}$

Q.5 Is there any set which has no proper subset? If so, name that set.

Solution: Yes. The empty set has no proper subset.

Q.6 **What is the difference between $\{a,b\}$ and $\{\{a,b\}\}$? (SHW 2023)**

Solution: The set $\{a,b\}$ has two elements a and b while the set $\{\{a,b\}\}$ has only one element $\{a,b\}$.

Q.7 **Which of the following sentences are true and which of them are false?**

(i) $\{1,2\}=\{2,1\}$ Ans : True

Q.8 **What is the number of elements of power set of each of the following sets?**

(i) $\{\ \}$ Ans : $2^0=1$

(ii) $\{0,1\}$ Ans : $2^2=4$

(iii) $\{1,2,3,4,5,6,7\}$

Ans: $2^7=128$

(iv) $\{0,1,2,3,4,5,6,7\}$

Ans: $2^8=256$

(v) $\{a,\{b,c\}\}$ Ans : $2^2=4$

(vi) $\{\{a,b\},\{b,c\},\{d,e\}\}$

Ans : $2^3=8$

Q.9 **Write down the power set of each of the following sets.**

(i) $\{9,11\}$ **(GRW 2022, RWP 2023)**

Solution: Let $A=\{9,11\}$

$P(A)=\{\phi,\{9\},\{11\},\{9,11\}\}$

(ii) $\{+,-,\times,\div\}$ **(SGD 2023)**

Solution: Let $A=\{+,-,\times,\div\}$

$P(A)=\{\phi,\{+\},\{-\},\{\times\},\{\div\},\{+,-\}\{+,\times\}$
$,\{+,\div\},\{-,\times\},\{-,\div\},\{\times,\div\},\{+,-,\times\},$
$\{+,-,\div\},\{-,\times,\div\},\{+,\times,\div\},\{+,-,\times,\div\}\}$

(iii) $\{\phi\}$

Solution: Let $A=\{\phi\}$

(ii) $\phi\subseteq\{\{a\}\}$ Ans : True

(iii) $\{a\}\subseteq\{\{a\}\}$ Ans : False

(iv) $\{a\}\in\{\{a\}\}$ Ans : True

(v) $a\in\{\{a\}\}$ Ans : False

(vi) $\phi\in\{\{a\}\}$ Ans : False

$P(A)=\{\phi,\{\phi\}\}$

(iv) $\{a,\{b,c\}\}$ **(SGD 2021, 22, RWP 2022, GRW 2022)**

Solution: Let $A=\{a,\{b,c\}\}$

$P(A)=\{\phi,\{a\},\{\{b,c\}\},\{a,\{b,c\}\}\}$

Q.10 Which pairs of sets are equivalent? Which of them are also equal?

(i) $\{a,b,c\},\{1,2,3\}$

Solution: Equivalent but not equal.

(ii) The set of first ten whole numbers, $\{0,1,2,3,...,9\}$

Solution: Equivalent and equal.

(iii) Set of angles of a quadrilateral *ABCD*, set of sides of same quadrilateral.

Solution: Equivalent but not equal.

(iv) Set of sides of hexagon *ABCDEF*, Set of angles of same hexagon.

Solution: Equivalent but not equal.

(v) $\{1,2,3,4,...\},\{2,4,6,8,...\}$

Solution: Equivalent but not equal.

(vi) $\{1,2,3,4,...\},\left\{1,\frac{1}{2},\frac{1}{3},\frac{1}{4},...\right\}$

Solution: Equivalent but not equal.

(vii) $\{5,10,15,...,55555\},\{5,10,15,20,...\}$

Solution: Neither Equivalent nor equal.