EXERCISE 6(A)

Question 1.
Write the following sets in roster (Tabular) form:
(i) $A_1 = \{x : 2x + 3 = 11\}$
Solution:
∴ 2x + 3 = 11
Shifting the terms 2x = 11 - 3 (Subtracting)
2x = 8
x = 8/2 → x = 4
∴ Given set in roster (Tabular) Form is $A_1 = \{4\}$

(ii) $A_2 = \{x : x^2 - 4x - 5 = 0\}$
Solution:
Given $x^2 - 4x - 5 = 0 \rightarrow x^2 - 5x + x - 5 = 0 \rightarrow x(x - 5) + 1(x - 5) = 0$
∴ Either x – 5 = 0 or x + 1 = 0
→x = 5 → x = −1
∴ Given set in roster (Tabular) Form is $A_2 = \{5, -1\}$

(iii) $A_3 = \{x : x \in Z, -3 \leq x < 4\}$
Solution:
Given $-3 \leq x < 4$
∴ x = -3, -2, -1, 0, 1, 2, 3
∴ Given set in roster (Tabular) form is
$A_3 = \{-3, -2, -1, 0, 1, 2, 3\}$

(iv) $A_4 = \{x :$ is a two digit number and sum of digits of x is 7$\}$
Solution:
∵ x is a two digit number and sum of digits of x is 7
∴ x = 16, 25, 34, 43, 52, 61, 70
∴ Given set in roster (Tabular) form is $A_4 = \{16, 25, 34, 43, 52, 61, 70\}$

(v) $A_5 = \{x : x = 4n, n \in W$ and $n < 4\}$
Solution:
Given x = 4n
When n=0, x=4×0
⇒ x = 0
n=1, x=4×1=4
⇒ x=4
n = 2, x = 4 × 2 = 8
⇒ x = 8
n = 3, x = 4 × 3
⇒ x = 12
∴ Given set in roster (Tabular) form is $A_5 = \{0, 4, 8, 12\}$

(vi) $A_6 = \{x : x = n/(n+2); n \in N \& n > 5\}$
Solution:
Given x = n/(n + 2)
When n = 6, x = 6/(6 + 2) [∵ n > 5] → x = 6/8 → x =3/4
When, n = 7, x = 7/(7 + 2) → x =7/9
When, n = 8, x = 8/(8 + 2) → x = 8/10 → x = 4/5
When, n = 9, x = 9/(9 + 2) → x = 9/11
∴ Given set in roster (Tabular) form is,
A_6 = {3/4, 7/9, 4/5, 9/11,…}

Question 2.
Write the following sets in set-builder (Rule Method) form:
(i) $B_1 = \{6, 9, 12, 15,…\}$
Solution:
x : x = 3n + 3; n ∈ N

(ii) $B_2 = \{11, 13, 17, 19\}$
Solution:
{x: x is a prime number between 10 and 20}

(iii) $B_3 = \{1/3, 3/5, 5/7, 7/9, 9/11,…\}$
Solution:
{x : x = n/(n + 2), where n is an odd natural number}

(iv) $B_4 = \{8, 27, 64, 125, 216\}$
Solution:
$=\{x : x = n^3; n \in N \text{ and } 2 \leq n \leq 6\}$

(v) $B_5 = \{-5, -4, -3, -2, -1\}$
Solution:
$=\{x : x \in Z, -5 \leq x \leq -1\}$

(vi) $B_6 = \{…, -6, -3, 0, 3, 6,…\}$
Solution:
= {x : x = 3n, n ∈ Z}

Question 3.
(i) Is {1, 2, 4, 16, 64} = {x : x is a factor of 32} ? Give reason.
Solution:
No, {1, 2, 4, 16, 64} ≠ {x : x is a factor of 32}.
Because 64 is not a factor of 32.

(ii) ls {x : x is a factor of 27} ≠ {3, 9, 27, 54}? Give reason.
Solution:
Yes, {x : x is a factor of 27} ≠ {3, 9, 27, 54}
Because 54 is not a factor of 27

(iii) Write the set of even factors of 124.
Solution:
1 × 124 = 124
2 × 62 = 124
4 × 31 = 124
Factors of 124 = 1, 2, 4, 31, 62, 124
Set of even factors of 124 = {2, 4, 62, 124}

(iv) Write the set of odd factors of 72.
Solution:
1 × 72 = 72
2 × 36 = 72
3 × 24 = 72
4 × 18 = 72
6 × 12 = 72
8 × 9 = 72
Factors of 72 = 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72
Set of odd factors of 72 = {1, 3, 9}

(v) Write the set of prime factors of 3234.
Solution:

2	3234
3	1617
7	539
7	77
	11

3234 = 2 × 3 × 7 × 7 × 11
∴ Set of prime factors of 3234 = {2, 3, 7, 11}

(vi) ls {x : $x^2 - 7x + 12 = 0$} = {3, 4}?
Solution:
$x^2 - 7x + 12 = 0 \rightarrow x^2 - 4x - 3x + 12 = 0 \rightarrow x(x - 4) - 3(x - 4) = 0 \rightarrow (x - 4)(x - 3) = 0$
∴ Either x – 4 = 0 or x-3=0
x – 4 = 0 ⇒ x=4
x – 3 = 0 ⇒ x = 3
∴{x : $x^2 - 7x + 12 = 0$} = {3, 4}, is true.

(vii) 1s {x : $x^2 - 5x - 6 = 0$} = {2, 3}?
Solution:
$x^2 - 5x - 6 = 0 \rightarrow x^2 - 6x + x - 6 = 0 \Rightarrow x(x - 6) + 1(x - 6) = 0 \Rightarrow (x - 6)(x + 1) = 0$

∴ Either x – 6 = 0 Or x + 1 = 0 x – 6 = 0 → x = 6 x + 1 = 0 → x = −1
∴ {x : x^2 − 5x – 6 = 0} ≠ {2, 3}
i.e. {x : x^2 − 5x – 6 = 0} = {2, 3}is not true.

Question 4.
Write the following sets in Roster form:
(i) The set of letters in the word 'MEERUT'
(ii) The set of letters in the word 'UNIVERSAL'
(iii) A = {x : x = y + 3, y ∈ N and y > 3}
(iv) B = {p : p ∈ W and p^2 < 20}
(v) C = {x : x is composite number and 5 < x < 21}
Solution:
(i) Roster form of the set of letters in the word "MEERUT"= {m, e, r, u, t}
(ii) Roster form of the set of letters in the word "UNIVERSAL"= {u, n, i, v, e, r, s, a, l}
(iii) A = {x : x = y + 3, y ∈ N and y > 3}
x = y + 3
y = 4, 5, 6, 7, 8, 9, … [∵ y > 3]
When y = 4, x = 4 + 3 = 7
When y = 5, x = 5 + 3 = 8
When y = 6, x = 6 + 3 = 9
when y = 7, x = 7 + 3 = 10
when y = 8, x = 8 + 3 = 11
…… ……. ……
…… …….
∴ Roster form of the given set A= {7, 8, 9, 10, 11,…....}

(iv) B = {P : P ∈ W and P^2 < 20} P^2 = 0, 1, 4, 9, 16 [∵P^2 < 20]
When P^2 = 0 → P = √0 = 0
When P^2 = 1 → P = √1 = 1
When P^2 = 4 → P = √4 = 2
When P^2 = 9 → P = √9 = 3
When P^2 = 16 → P = √16 = 4
∴ Roster form of the given set B = {0, 1, 2, 3, 4}

(v) C = {x : x is composite number and 5 ≤ x ≤ 21)
5 ≤ x ≤ 21 means x = 5, 6, 7, 8, 9, 10,…... ,21
But we are given that x is a composite number, so we need to ignore prime numbers in between 5 and 21.
∴x = 6, 8, 9, 10, 12, 14, 15, 16, 18, 20, 21
∴ Roster form of the given set C = {6, 8, 9, 10, 12, 14, 15, 16, 18, 20, 21}

Question 5.
List the elements of the following sets:
(i) {x : x^2 − 2x – 3 = 0}
Solution:
Given x^2 − 2x – 3 = 0 → x^2 − 3x + x – 3 = 0 → x(x − 3) + 1(x − 3) = 0

⇒ (x + 1) (x - 3) = 0
∴ Either x – 3 = 0 or x + 1 = 0
x – 3 = 0 ⇒ x = 3
x + 1 = 0 ⇒ x = -1
∴ Elements of the set {x : x^2 − 2x – 3 = 0} are 3 and -1

(ii) {x : x = 2y + 5; y ∈ N and 2 ≤ y < 6}
Solution:
{x : x = 2y + 5; y ∈ N and 2 ≤ y < 6}
x = 2y + 5
y = 2, 3, 4, 5 [∵ 2 ≤ y < 6]
When y = 2, x = 2 × 2 + 5 = 4 + 5 = 9
When y = 3, x = 2 × 3 + 5 = 6 + 5 = 11
When y = 4x = 2 × 4 + 5 = 8 + 5 = 13
When y = 5, x = 2 × 5 + 5 = 10 + 5 = 15
∴ Elements of the given set {x : x = 2y + 5y ∈ N and 2 ≤ y < 6} are 9, 11, 13, 15.

(iii) {x : x is a factor of 24}
Solution:
Given {x : x is a factor of 24}
24 = 1 × 24
24 = 2 × 12
24 = 3 × 8
24 = 4 × 6
∴ Elements of the given set {x : x is a factor of 24}are 1, 2, 3, 4, 6, 8, 12, 24.

(iv) {x : x ∈ Z and x^2 ≤ 4}
Solution:
Given {x : x ∈ Z and x^2 ≤ 4} x = 4, 1, 0 [∵x2≤4]
When x^2 = 4 → x = ±√4 = ±2
When x^2 = 1→ x = ±√1 = ±1
When x^2 = 0 → x = √0 = 0
∴ Elements of the given set {x : x ∈ Z and x^2 ≤ 4} are −2, −1, 0, 1, 2

(v) {x : 3x – 2 ≤ 10, x ∈ N}
Solution:
Given 3x – 2 ≤ 10 → 3x ≤ 10 + 2 → 3x ≤ 12 → x ≤ 12/3 → x ≤ 4 ∴ x = 1, 2, 3, 4
∴ Elements of the given set {x : 3x – 2 ≤ 10, x ∈ N} are 1, 2, 3 and 4.

(vi) {x : 4 − 2x > −6, x ∈ Z}
Solution:
Given 4 - 2 x > -6
Subtracting 4 from both sides, we get
- 4 + 4 - 2 x > - 6 - 4
-2 x > -10
Adding 2x + 10 to both sides, we get

$-2x + 2x + 10 > -10 + 2x + 10$
$+ 10 > 2x$
$10/2 > x$
$5 > x$
∴ Elements of the given set $\{x : 4 - 2x > -6, x \in Z\}$ are 4, 3, 2, 1, 0, −1, −2,… .