CHAPTER 7

LINEAR EQUATIONS

1. Verify by substitution that:

(i) x = 4 is the root of 3x – 5 = 7

(ii) x = 3 is the root of 5 + 3x = 14

(iii) x = 2 is the root of 3x – 2 = 8x – 12

(iv) x = 4 is the root of (3x/2) = 6

(v) y = 2 is the root of y – 3 = 2y – 5

(vi) x = 8 is the root of (1/2)x + 7 = 11

Solution:

(i) Given x = 4 is the root of 3x – 5 = 7

Now, substituting x = 4 in place of ‘x’ in the given equation, we get

= 3(4) – 5 = 7

= 12 – 5 = 7

7 = 7

Since, LHS = RHS

Hence, x = 4 is the root of 3x – 5 = 7.

(ii) Given x = 3 is the root of 5 + 3x = 14.

Now, substituting x = 3 in place of ‘x’ in the given equation, we get

= 5 + 3(3) = 14

= 5 + 9 = 14

14 = 14

Since, LHS = RHS

Hence, x = 3 is the root of 5 + 3x = 14.

(iii) Given x = 2 is the root of 3x – 2 = 8x – 12.

Now, substituting x = 2 in place of ‘x’ in the given equation, we get

= 3(2) – 2 = 8(2) – 12

= 6 – 2 = 16 – 12

4 = 4

Since, LHS = RHS

Hence, x = 2 is the root of 3x – 2 = 8x – 12.

(iv) Given x = 4 is the root of 3x/2 = 6.

Now, substituting x = 4 in place of ‘x’ in the given equation, we get

= (3 × 4)/2 = 6

= (12/2) = 6

6 = 6

Since, LHS = RHS

Hence, x = 4 is the root of (3x/2) = 6.

(v) Given y = 2 is the root of y – 3 = 2y – 5.

Now, substituting y = 2 in place of ‘y’ in the given equation, we get

= 2 – 3 = 2(2) – 5

= -1 = 4 – 5

-1 = -1

Since, LHS = RHS

Hence, y = 2 is the root of y – 3 = 2y – 5.

(vi) Given x = 8 is the root of (1/2)x + 7 = 11.

Now, substituting x = 8 in place of ‘x’ in the given equation, we get

= (1/2) (8) + 7 =11

= 4 + 7 = 11

= 11 = 11

Since, LHS = RHS

Hence, x = 8 is the root of 12x + 7 = 11.

2. Solve each of the following equations by trial – and – error method:

(i) x + 3 =12

(ii) x -7 = 10

(iii) 4x = 28

(iv) (x/2) + 7 = 11

(v) 2x + 4 = 3x

(vi) (x/4) = 12

(vii) (15/x) = 3

(vii) (x/18) = 20

Solution:

(i) Given x + 3 =12

Here LHS = x +3 and RHS = 12

x	LHS	RHS	Is LHS = RHS
1	1 + 3 = 4	12	No
2	2 + 3 = 5	12	No
3	3 + 3 = 6	12	No
4	4 + 3 = 7	12	No

5	5 + 3 = 8	12	No
6	6 + 3 = 9	12	No
7	7 + 3 = 10	12	No
8	8 + 3 = 11	12	No
9	9 + 3 = 12	12	Yes

Therefore, if x = 9, LHS = RHS.

Hence, x = 9 is the solution to this equation.

(ii) Given x -7 = 10

Here LHS = x -7 and RHS = 10

x	LHS	RHS	Is LHS = RHS
9	9 – 7 = 2	10	No
10	10 -7 = 3	10	No
11	11 – 7 = 4	10	No
12	12 – 7 = 5	10	No
13	19 – 7 = 6	10	No
14	14 – 7 = 7	10	No
15	15 – 7 = 8	10	No
16	16 – 7 = 9	10	No
17	17 – 7 = 10	10	Yes

Therefore if x = 17, LHS = RHS

Hence, x = 17 is the solution to this equation.

(iii) Given 4x = 28

Here LHS = 4x and RHS = 28

x	LHS	RHS	Is LHS = RHS
1	4 × 1 = 4	28	No
2	4 × 2 = 8	28	No
3	4 × 3 = 12	28	No
4	4 × 4 = 16	28	No
5	4 × 5 = 20	28	No
6	4 × 6 = 24	28	No
7	4 × 7 = 28	28	Yes

Therefore if x = 7, LHS = RHS

Hence, x = 7 is the solution to this equation.

(iv) Given (x/2) + 7 = 11

Here LHS = (x/2) + 7 and RHS = 11

Since RHS is a natural number, (x/2) must also be a natural number, so we must substitute values of x that are multiples of 2.

x	LHS	RHS	Is LHS = RHS
2	(2/2) + 7 = 1 + 7 =8	11	No
4	(4/2) + 7 = 2 + 7 = 9	11	No
6	(6/2) + 7 = 3 + 7 = 10	11	No
8	(8/2) + 7 = 4 + 7 = 11	11	Yes

Therefore if x = 8, LHS = RHS

Hence, x = 8 is the solution to this equation.

(v) Given 2x + 4 = 3x

Here LHS = 2x + 4 and RHS = 3x

x	LHS	RHS	Is LHS = RHS
1	2 (1) + 4 = 2 + 4 = 6	3 (1) = 3	No
2	2 (2) + 4 = 4 + 4 = 8	3 (2) = 6	No
3	2 (3) + 4 = 6 + 4 = 10	3 (3) = 9	No
4	2 (4) + 4 = 8 + 4 = 12	3 (4) = 12	Yes

Therefore if x = 4, LHS = RHS

Hence, x = 4 is the solution to this equation.

(vi) Given (x/4) = 12

Here LHS = (x/4) and RHS = 12

Since RHS is a natural number, x/4 must also be a natural number, so we must substitute values of x that are multiples of 4.

x	LHS	RHS	Is LHS = RHS
16	(16/4) = 4	12	No
20	(20/4) = 5	12	No
24	(24/4) = 6	12	No
28	(28/4) = 7	12	No
32	(32/4) = 8	12	No
36	(36/4) = 9	12	No
40	(40/4) = 10	12	No
44	(44/4) = 11	12	No
48	(48/4) = 12	12	Yes

Therefore if x = 48, LHS = RHS

Hence, x = 48 is the solution to this equation.

(vii) Given (15/x) = 3

Here LHS = (15/x) and RHS = 3

Since RHS is a natural number, 15x must also be a natural number, so we must substitute values of x that are factors of 15.

x	LHS	RHS	Is LHS = RHS
1	(15/1) = 15	3	No
3	(15/3) = 5	3	No
5	(15/5) = 3	3	Yes

Therefore if x = 5, LHS = RHS

Hence, x = 5 is the solution to this equation.

(viii) Given (x/18) = 20

Here LHS = (x/18) and RHS = 20

Since RHS is a natural number, (x/18) must also be a natural number, so we must substitute values of x that are multiples of 18.

x	LHS	RHS	Is LHS = RHS
324	(324/18) = 18	20	No
342	(342/18) = 19	20	No
360	(360/18) = 20	20	Yes

Therefore if x = 360, LHS = RHS

Hence, x = 360 is the solution to this equation.

Exercise 8.2 Page No: 8.12

Solve each of the following equations and check your answers:

1. x – 3 = 5

Solution:

Given x – 3 = 5

Adding 3 to both sides, we get,

x – 3 + 3 = 5 + 3

x = 8

Verification:

Substituting x = 8 in LHS, we get

LHS = x – 3 and RHS = 5

LHS = 8 – 3 = 5 and RHS = 5

LHS = RHS

Hence, verified.

2. x + 9 = 13

Solution:

Given x + 9 = 13

Subtracting 9 from both sides, i.e., LHS and RHS, we get

x + 9 – 9 = 13 – 9

x = 4

Verification:

Substituting x = 4 on LHS, we get

LHS = 4 + 9 = 13 = RHS

LHS = RHS

Hence, verified.

3. x – (3/5) = (7/5)

Solution:

Given x – (3/5) = (7/5)

Add (3/5) to both sides, we get

x – (3/5) + (3/5) = (7/5) + (3/5)

x = (7/5) + (3/5)

x = (10/5)

x = 2

Verification:

Substitute x = 2 in LHS of given equation, then we get

2 – (3/5) = (7/5)

(10 – 3)/5 = (7/5)

(7/5) = (7/5)

LHS = RHS

Hence, verified

4. 3x = 0

Solution:

Given 3x = 0

On dividing both sides by 3 we get,

(3x/3) = (0/3)

x = 0

Verification:

Substituting x = 0 in LHS, we get

3 (0) = 0

And RHS = 0

Therefore LHS = RHS

Hence, verified.

5. (x/2) = 0

Solution:

Given x/2 = 0

Multiplying both sides by 2, we get

(x/2) × 2 = 0 × 2

x = 0

Verification:

Substituting x = 0 in LHS, we get

LHS = 0/2 = 0 and RHS = 0

LHS = 0 and RHS = 0

Therefore LHS = RHS

Hence, verified.

6. x – (1/3) = (2/3)

Solution:

Given x – (1/3) = (2/3)

Adding (1/3) to both sides, we get

x – (1/3) + (1/3) = (2/3) + (1/3)

x = (2 + 1)/3

x = (3/3)

x =1

Verification:

Substituting x = 1 in LHS, we get

1 – (1/3) = (2/3)

(3 – 1)/3 = (2/3)

(2/3) = (2/3)

Therefore LHS = RHS

Hence, verified.

7. x + (1/2) = (7/2)

Solution:

Given x + (1/2) = (7/2)

Subtracting (1/2) from both sides, we get

x + (1/2) – (1/2) = (7/2) – (1/2)

x = (7 – 1)/2

x = (6/2)

x = 3

Verification:

Substituting x = 3 in LHS, we get

3 + (1/2) = (7/2)

(6 + 1)/2 = (7/2)

(7/2) = (7/2)

Therefore LHS = RHS

Hence, verified.

8. 10 – y = 6

Solution:

Given 10 – y = 6

Subtracting 10 from both sides, we get

10 – y – 10 = 6 – 10

-y = -4

Multiplying both sides by -1, we get

-y × -1 = – 4 × – 1

y = 4

Verification:

Substituting y = 4 in LHS, we get

10 – y = 10 – 4 = 6 and RHS = 6

Therefore LHS = RHS

Hence, verified.

9. 7 + 4y = -5

Solution:

Given 7 + 4y = -5

Subtracting 7 from both sides, we get

7 + 4y – 7 = -5 -7

4y = -12

Dividing both sides by 4, we get

y = -12/ 4

y = -3

Verification:

Substituting y = -3 in LHS, we get

7 + 4y = 7 + 4(-3) = 7 – 12 = -5, and RHS = -5

Therefore LHS = RHS

Hence, verified.

10. (4/5) – x = (3/5)

Solution:

Given (4/5) – x = (3/5)

Subtracting (4/5) from both sides, we get

(4/5) – x – (4/5) = (3/5) – (4/5)

– x = (3 -4)/5

– x = (-1/5)

x = (1/5)

Verification:

Substituting x = (1/5) in LHS, we get

(4/5) – (1/5) = (3/5)

(4 -1)/5 = (3/5)

(3/5) = (3/5)

Therefore LHS =RHS

Hence, verified.

11. 2y – (1/2) = (-1/3)

Solution:

Given 2y – (1/2) = (-1/3)

Adding (1/2) from both the sides, we get

2y – (1/2) + (1/2) = (-1/3) + (1/2)

2y = (-1/3) + (1/2)

2y = (-2 + 3)/6 [LCM of 3 and 2 is 6]

2y = (1/6)

Now divide both the side by 2, we get

y = (1/12)

Verification:

Substituting y = (1/12) in LHS we get

2 (1/12) – (1/2) = (-1/3)

(1/6) – (1/2) = (-1/3)

(2 – 6)/12 = (-1/3) [LCM of 6 and 2 is 12]

(-4/12) = (-1/3)

(-1/3) = (-1/3)

Therefore LHS = RHS

Hence, verified.

12. 14 = (7x/10) – 8

Solution:

Given 14 = (7x/10) – 8

Adding 8 to both sides we get,

14 + 8 = (7x/10) – 8 + 8

22 = (7x/10)

Multiply both sides by 10 we get,

220 = 7x

x = (220/7)

Verification:

Substituting x = (220/7) in RHS we get,

14 = (7/10) × (220/7) – 8

14 = 22 -8

14 = 14

Therefore LHS = RHS.

Hence, verified.

13. 3 (x + 2) = 15

Solution:

Given 3 (x + 2) = 15

Dividing both sides by 3 we get,

3 (x + 2)/3 = (15/3)

(x + 2) = 5

Now subtracting 2 by both sides, we get

x + 2 -2 = 5 -2

x = 3

Verification:

Substituting x =3 in LHS we get,

3 (3 + 2) = 15

3 (5) = 15

15 = 15

Therefore LHS = RHS

Hence, verified.

14. (x/4) = (7/8)

Solution:

Given (x/4) = (7/8)

Multiply both sides by 4 we get,

(x/4) × 4 = (7/8) × 4

x = (7/2)

Verification:

Substituting x = (7/2) in LHS we get,

(7/2)/4 = (7/8)

(7/8) = (7/8)

Therefore LHS = RHS

Hence, verified.

15. (1/3) – 2x = 0

Solution:

Given (1/3) – 2x = 0

Subtract (1/3) from both sides we get,

(1/3) – 2x – (1/3) = 0 – (1/3)

– 2x = – (1/3)

2x = (1/3)

Divide both side by 2 we get,

2x/2 = (1/3)/2

x = (1/6)

Verification:

Substituting x = (1/6) in LHS we get,

(1/3) – 2 (1/6) = 0

(1/3) – (1/3) = 0

0 = 0

Therefore LHS = RHS

Hence, verified.