EXERCISE 9.3 PAGE NO: 9.17

Solve the following equations and verify your answer:

1. (2x-3) / (3x+2) = -2/3

Solution:

We have,

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

Let us perform cross-multiplication we get,

3(2x - 3) = -2(3x + 2)

6x – 9 = -6x – 4

When rearranged,

6x + 6x = 9 – 4

12x = 5

x = 5/12

Now let us verify the given equation,

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

By substituting the value of 'x' we get,

(2(5/12) - 3) / (3(5/12) + 2) = -2/3

((5/6)-3) / ((5/4) + 2) = -2/3

((5-18)/6) / ((5+8)/4) = -2/3

(-13/6) / (13/4) = -2/3

(-13/6) × (4/13) = -2/3

-4/6 = -2/3

-2/3 = -2/3

Hence, the given equation is verified

2. (2-y) / (y+7) = 3/5

Solution:

We have,

(2-y) / (y+7) = 3/5

Let us perform cross-multiplication we get,

5(2-y) = 3(y+7)

10 – 5y = 3y + 21

When rearranged,

10 – 21 = 3y + 5y

8y = - 11

y = -11/8

Now let us verify the given equation,
(2-y) / (y+7) = 3/5
By substituting the value of 'x' we get,
(2 – (-11/8)) / ((-11/8) + 7) = 3/5
((16+11)/8) / ((-11+56)/8) = 3/5
(27/8) / (45/8) = 3/5
(27/8) × (8/45) = 3/5
27/45 = 3/5
3/5 = 3/5
Hence, the given equation is verified

3. (5x - 7) / (3x) = 2
Solution:
We have,
(5x - 7) / (3x) = 2
Let us perform cross-multiplication we get,
5x – 7 = 2(3x)
5x – 7 = 6x
5x – 6x = 7
-x = 7
x = -7

Now let us verify the given equation,
(5x - 7) / (3x) = 2
By substituting the value of 'x' we get,
(5(-7) - 7) / (3(-7)) = 2
(-35 - 7) / -21 = 2
-42/-21 = 2
2 = 2
Hence, the given equation is verified

4. (3x+5) / (2x + 7) = 4
Solution:
We have,
(3x+5) / (2x + 7) = 4
Let us perform cross-multiplication we get,
3x + 5 = 4(2x+7)
3x + 5 = 8x + 28

3x – 8x = 28 – 5
-5x = 23
x = -23/5

Now let us verify the given equation,
(3x+5) / (2x + 7) = 4
By substituting the value of 'x' we get,
(3(-23/5) + 5) / (2(-23/5) + 7) = 4
(-69/5 + 5) / (-46/5 + 7) = 4
(-69+25)/5 / (-46+35)/5 = 4
-44/5 / -11/5 = 4
-44/5 × 5/-11 = 4
44/11 = 4
4 = 4
Hence, the given equation is verified

5. (2y + 5) / (y + 4) = 1
Solution:
We have,
(2y + 5) / (y + 4) = 1
Let us perform cross-multiplication we get,
2y + 5 = y + 4
2y – y = 4 – 5
y = -1

Now let us verify the given equation,
(2y + 5) / (y + 4) = 1
By substituting the value of 'y' we get,
(2(-1) + 5) / (-1 + 4) = 1
(-2+5) / 3 = 1
3/3 = 1
1 = 1
Hence, the given equation is verified

6. (2x + 1) / (3x - 2) = 5/9
Solution:
We have,
(2x + 1) / (3x - 2) = 5/9
Let us perform cross-multiplication we get,

9(2x + 1) = 5(3x - 2)
18x + 9 = 15x – 10
18x – 15x = -10 – 9
3x = -19
x = -19/3

Now let us verify the given equation,
(2x + 1) / (3x - 2) = 5/9
By substituting the value of ‘x’ we get,
(2(-19/3) + 1) / (3(-19/3) - 2) = 5/9
(-38/3 + 1) / (-57/3 - 2) = 5/9
(-38 + 3)/3 / (-57 - 6)/3 = 5/9
-35/3 / -63/3 = 5/9
-35/3 × 3/-63 = 5/9
-35/-63 = 5/9
5/9 = 5/9
Hence, the given equation is verified

7. (1 – 9y) / (19 – 3y) = 5/8
Solution:
We have,
(1 – 9y) / (19 – 3y) = 5/8
Let us perform cross-multiplication we get,
8(1- 9y) = 5(19-3y)
8 – 72y = 95 – 15y
8 – 95 = 72y – 15y
57y = -87
y = -87/57
= -29/19

Now let us verify the given equation,
(1 – 9y) / (19 – 3y) = 5/8
By substituting the value of ‘y’ we get,
(1 – 9(-29/19)) / (19 – 3(-29/19)) = 5/8
(19+261)/19 / (361+87)/19 = 5/8
280/19 × 19/448 = 5/8
280/ 448 = 5/8
5/8 = 5/8
Hence, the given equation is verified

8. 2x / (3x + 1) = 1
Solution:
We have,
2x / (3x + 1) = 1
Let us perform cross-multiplication we get,
2x = 1(3x + 1)
2x = 3x + 1
2x – 3x = 1
-x = 1
x = -1

Now let us verify the given equation,
2x / (3x + 1) = 1
By substituting the value of 'x' we get,
2(-1) / (3(-1) + 1) = 1
-2 /(-3+1) = 1
-2/-2 = 1
1 = 1
Hence, the given equation is verified

9. y – (7 – 8y)/9y - (3 + 4y) = 2/3
Solution:
We have,
y – (7 – 8y)/9y - (3 + 4y) = 2/3
(y – 7 + 8y) / (9y – 3 - 4y) = 2/3
(-7 + 9y) / (5y - 3) = 2/3
Let us perform cross-multiplication we get,
3(-7 + 9y) = 2(5y - 3)
-21 + 27y = 10y – 6
27y – 10y = 21 – 6
17y = 15
y = 15/17

Now let us verify the given equation,
y – (7 – 8y)/9y - (3 + 4y) = 2/3
By substituting the value of 'y' we get,
15/17 – (7-8(15/17))/ 9(15/17) – (3 + 4(15/17)) = 2/3
15/17 – (7 – 120/17) / 135/17 – (3 + 60/17) = 2/3
15/17 – ((119-120)/17) / 135/17 – ((51+60)/17) = 2/3

15/17 – (-1/17) / 135/17 - (111/17) = 2/23
((15 + 1)/17) / ((135-111)/17) = 2/3
16/17 / 24/17 = 2/3
16/24 = 2/3
2/3 = 2/3
Hence, the given equation is verified

10. 6/ 2x – (3 – 4x) = 2/3
Solution:
We have,
6/ 2x – (3 – 4x) = 2/3
6/(2x – 3 + 4x) = 2/3
6/(6x - 3) = 2/3
Let us perform cross-multiplication we get,
3(6) = 2(6x - 3)
18 = 12x – 6
12x = 18 + 6
12x = 24
x = 24/12
= 2

Now let us verify the given equation,
6/ 2x – (3 – 4x) = 2/3
6/(6x - 3) = 2/3
By substituting the value of ‘x’ we get,
6/ (6(2) - 3) = 2/3
6/(12-3) = 2/3
6/9 = 2/3
2/3 = 2/3
Hence, the given equation is verified

11. 2/3x – 3/2x = 1/12
Solution:
We have,
2/3x – 3/2x = 1/12
By taking LCM for 2 and 3 which is 6
4-9/6x = 1/12
-5/6x = 1/12
By cross-multiplying we get,

12(-5) = 1 (6x)
-60 = 6x
x = -60/6
= -10

Now let us verify the given equation,
2/3x – 3/2x = 1/12
By substituting the value of 'x' we get,
2/3(-10) – 3/2(-10) = 1/12
2/-30 – 3/-20 = 1/12
-4+6/60 = 1/12
5/60 = 1/12
1/12 = 1/12
Hence, the given equation is verified

12. (3x + 5)/ (4x + 2) = (3x + 4)/(4x + 7)
Solution:
We have,
(3x + 5)/ (4x + 2) = (3x + 4)/(4x + 7)
(3x + 5)/ (4x + 2) - (3x + 4)/(4x + 7) = 0
By taking LCM as (4x + 2) (4x + 7)
((3x + 5) (4x + 7) – (3x + 4) (4x + 2)) / (4x + 2) (4x + 7) = 0
By cross-multiplying we get,
(3x + 5) (4x + 7) – (3x + 4) (4x + 2) = 0
(3x + 5) (4x + 7) – (3x + 4) (4x + 2) = 0
$12x^2 + 21x + 20x + 35 – 12x^2 – 6x – 16x – 8 = 0$
19x + 35 – 8 = 0
19x = -27
x = -27/19

Now let us verify the given equation,
(3x + 5)/ (4x + 2) = (3x + 4)/(4x + 7)
By substituting the value of 'x' we get,
(3(-27/19) +5) / (4(-27/19) + 2) = (3(-27/19) + 4) / (4(-27/19) + 7)
(-81/19 + 5) / (-108/19 + 2) = (-81/19 + 4) / (-108/19 + 7)
((-81+95)/19) / ((-108+38)/19) = ((-81+76)/19) / ((-108+133)/19)
14/19 / -70/19 = -5/19 / 25/19
-14/70 = -5/25
-1/5 = -1/5

Hence, the given equation is verified

13. (7x - 2) / (5x - 1) = (7x +3)/(5x + 4)
Solution:
We have,
(7x - 2) / (5x - 1) = (7x +3)/(5x + 4)
(7x - 2) / (5x - 1) - (7x +3)/(5x + 4) = 0
By taking LCM as (5x - 1) (5x + 4)
((7x-2) (5x+4) - (7x+3)(5x-1)) / (5x - 1) (5x + 4) = 0
By cross-multiplying we get,
(7x-2) (5x+4) - (7x+3)(5x-1) = 0
Upon simplification,
$35x^2 + 28x – 10x – 8 – 35x^2 + 7x – 15x + 3 = 0$
10x – 5 = 0
10x = 5
x = 5/10
= 1/2

Now let us verify the given equation,
(7x - 2) / (5x - 1) = (7x +3)/(5x + 4)
By substituting the value of ‘x’ we get,
(7(1/2) - 2) / (5(1/2) - 1) = (7(1/2) + 3) /(5(1/2) + 4)
(7/2 - 2) / (5/2 - 1) = (7/2 + 3) / (5/2 + 4)
((7-4)/2) / ((5-2)/2) = ((7+6)/2) / ((5+8)/2)
(3/2) / (3/2) = (13/2) / (13/2)
1 = 1
Hence, the given equation is verified

14. $((x+1)/(x+2))^2 = (x+2) / (x + 4)$
Solution:
We have,
$((x+1)/(x+2))^2 = (x+2) / (x + 4)$
$(x+1)^2 / (x+2)^2 - (x+2) / (x + 4) = 0$
By taking LCM as $(x+2)^2 (x+4)$
$((x+1)^2 (x+4) - (x+2) (x+2)^2) / (x+2)^2 (x+4) = 0$
By cross-multiplying we get,
$(x+1)^2 (x+4) - (x+2) (x+2)^2 = 0$
Let us expand the equation
$(x^2 + 2x + 1) (x + 4) – (x + 2) (x^2 + 4x + 4) = 0$

$x^3 + 2x^2 + x + 4x^2 + 8x + 4 – (x^3 + 4x^2 + 4x + 2x^2 + 8x + 8) = 0$
$x^3 + 2x^2 + x + 4x^2 + 8x + 4 – x^3 – 4x^2 – 4x – 2x^2 – 8x – 8 = 0$
$-3x – 4 = 0$
$x = -4/3$

Now let us verify the given equation,
$((x+1)/(x+2))^2 = (x+2) / (x + 4)$
By substituting the value of 'x' we get,
$(x+1)^2 / (x+2)^2 = (x+2) / (x + 4)$
$(-4/3 + 1)^2 / (-4/3 + 2)^2 = (-4/3 + 2) / (-4/3 + 4)$
$((-4+3)/3)^2 / ((-4+6)/3)^2 = ((-4+6)/3) / ((-4+12)/3)$
$(-1/3)^2 / (2/3)^2 = (2/3) / (8/3)$
$1/9 / 4/9 = 2/3 / 8/3$
$1/4 = 2/8$
$1/4 = 1/4$
Hence, the given equation is verified

15. $((x+1)/(x-4))^2 = (x+8)/(x-2)$
Solution:
We have,
$((x+1)/(x-4))^2 = (x+8)/(x-2)$
$(x+1)^2 / (x-4)^2 - (x+8) / (x-2) = 0$
By taking LCM as $(x-4)^2 (x-2)$
$((x+1)^2 (x-2) – (x+8) (x-4)^2) / (x-4)^2 (x-2) = 0$
By cross-multiplying we get,
$(x+1)^2 (x-2) – (x+8) (x-4)^2 = 0$
Upon expansion we get,
$(x^2 + 2x + 1) (x-2) – ((x+8) (x^2 – 8x + 16)) = 0$
$x^3 + 2x^2 + x – 2x^2 – 4x – 2 – (x^3 – 8x^2 + 16x + 8x^2 – 64x + 128) = 0$
$x^3 + 2x^2 + x – 2x^2 – 4x – 2 – x^3 + 8x^2 – 16x – 8x^2 + 64x – 128 = 0$
$45x – 130 = 0$
$x = 130/45$
$= 26/9$

Now let us verify the given equation,
$((x+1)/(x-4))^2 = (x+8)/(x-2)$
$(x+1)^2 / (x-4)^2 = (x+8) / (x-2)$
By substituting the value of 'x' we get,
$(26/9 + 1)^2 / (26/9 - 4)^2 = (26/9 + 8) / (26/9 - 2)$

$((26+9)/9)^2 / ((26-36)/9)^2 = ((26+72)/9) / ((26-18)/9)$
$(35/9)^2 / (-10/9)^2 = (98/9) / (8/9)$
$(35/-10)^2 = (98/8)$
$(7/2)^2 = 49/4$
$49/4 = 49/4$
Hence, the given equation is verified

16. (9x-7)/(3x+5) = (3x-4)/(x+6)
Solution:
We have,
(9x-7)/(3x+5) = (3x-4)/(x+6)
(9x-7)/(3x+5) - (3x-4)/(x+6) = 0
By taking LCM as (3x+5) (x+6)
((9x-7) (x+6) - (3x-4) (3x+5)) / (3x+5) (x+6) = 0
By cross-multiplying we get,
(9x-7) (x+6) - (3x-4) (3x+5) = 0
Upon expansion we get,
$9x^2 + 54x – 7x – 42 – (9x^2 + 15x – 12x - 20) = 0$
44x – 22 = 0
44x = 22
x = 22/44
= 2/4
= 1/2

Now let us verify the given equation,
(9x-7)/(3x+5) = (3x-4)/(x+6)
By substituting the value of ‘x’ we get,
(9(1/2) - 7) / (3(1/2) + 5) = (3(1/2) - 4) / ((1/2) + 6)
(9/2 - 7) / (3/2 + 5) = (3/2 - 4) / (1/2 + 6)
((9-14)/2) / ((3+10)/2) = ((3-8)/2) / ((1+12)/2)
-5/2 / 13/2 = -5/2 / 13/2
-5/13 = -5/13
Hence, the given equation is verified

17. (x+2)/(x+5) = x/(x+6)
Solution:
We have,
(x+2)/(x+5) = x/(x+6)
(x+2)/(x+5) - x/(x+6) = 0

By taking LCM as (x+5) (x+6)
((x+2) (x+6) – x(x+5)) / (x+5) (x+6) = 0
By cross-multiplying we get,
(x+2) (x+6) – x(x+5) = 0
Upon expansion,
$x^2 + 8x + 12 – x^2 – 5x = 0$
3x + 12 = 0
3x = -12
x = -12/3
= -4

Now let us verify the given equation,
(x+2)/(x+5) = x/(x+6)
By substituting the value of 'x' we get,
(-4 + 2) / (-4 + 5) = -4 / (-4 + 6)
-2/1 = -4 / (2)
-2 = -2
Hence, the given equation is verified

18. 2x – (7-5x) / 9x – (3+4x) = 7/6
Solution:
We have,
2x – (7-5x) / 9x – (3+4x) = 7/6
(2x – 7 + 5x) / (9x – 3 – 4x) = 7/6
(7x – 7) / (5x – 3) = 7/6
By cross-multiplying we get,
6(7x - 7) = 7(5x - 3)
42x – 42 = 35x – 21
42x – 35x = -21 + 42
7x = 21
x = 21/7
= 3

Now let us verify the given equation,
2x – (7-5x) / 9x – (3+4x) = 7/6
(7x – 7) / (5x – 3) = 7/6
By substituting the value of 'x' we get,
(7(3) -7) / (5(3) - 3) = 7/6
(21-7) / (15-3) = 7/6

14/12 = 7/6
7/6 = 7/6
Hence, the given equation is verified

19. (15(2-x) – 5(x+6)) / (1-3x) = 10
Solution:
We have,
15(2-x) – 5(x+6) / (1-3x) = 10
(30-15x) – (5x + 30) / (1-3x) = 10
By cross-multiplying we get,
(30-15x) – (5x + 30) = 10(1- 3x)
30- 15x – 5x – 30 = 10 – 30x
30- 15x – 5x – 30 + 30x = 10
10x = 10
x = 10/10
= 1

Now let us verify the given equation,
(15(2-x) – 5(x+6)) / (1-3x) = 10
By substituting the value of 'x' we get,
(15(2-1) – 5(1+6)) / (1- 3) = 10
(15 – 5(7))/-2 = 10
(15-35)/-2 = 10
-20/-2 = 10
10 = 10
Hence, the given equation is verified

20. (x+3)/(x-3) + (x+2)/(x-2) = 2
Solution:
We have,
(x+3)/(x-3) + (x+2)/(x-2) = 2
By taking LCM as (x-3) (x-2)
((x+3)(x-2) + (x+2) (x-3)) / (x-3) (x-2) = 2
By cross-multiplying we get,
(x+3)(x-2) + (x+2) (x-3) = 2 ((x-3) (x-2))
Upon expansion,
$x^2 + 3x – 2x – 6 + x^2 – 3x + 2x – 6 = 2(x^2 – 3x – 2x + 6)$
$2x^2 – 12 = 2x^2 – 10x + 12$
$2x^2 – 2x^2 + 10x = 12 + 12$

10x = 24
x = 24/10
= 12/5

Now let us verify the given equation,
(x+3)/(x-3) + (x+2)/(x-2) = 2
By substituting the value of 'x' we get,
(12/5 + 3)/(12/5 - 3) + (12/5 + 2)/(12/5 - 2) = 2
((12+15)/5)/((12-15)/5) + ((12+10)/5)/((12-10)/5) = 2
(27/5)/(-3/5) + (22/5)/(2/5) = 2
-27/3 + 22/2 = 2
((-27×2) + (22×3))/6 = 2
(-54 + 66)/6 = 2
12/6 = 2
2 = 2
Hence, the given equation is verified

21. $((x+2)(2x-3) – 2x^2 + 6)/(x-5) = 2$
Solution:
We have,
$((x+2)(2x-3) – 2x^2 + 6)/(x-5) = 2$
By cross-multiplying we get,
$(x+2)(2x-3) – 2x^2 + 6) = 2(x-5)$
$2x^2 – 3x + 4x – 6 – 2x^2 + 6 = 2x – 10$
$x = 2x – 10$
$x – 2x = -10$
$-x = -10$
$x = 10$

Now let us verify the given equation,
$((x+2)(2x-3) – 2x^2 + 6)/(x-5) = 2$
By substituting the value of 'x' we get,
$((10+2)(2(10) - 3) – 2(10)^2 + 6)/ (10-5) = 2$
$(12(17) – 200 + 6)/5 = 2$
$(204 – 194)/5 = 2$
$10/5 = 2$
$2 = 2$
Hence, the given equation is verified

22. $(x^2 – (x+1)(x+2))/(5x+1) = 6$

Solution:

We have,

$(x^2 – (x+1)(x+2))/(5x+1) = 6$

By cross-multiplying we get,

$(x^2 – (x+1)(x+2)) = 6(5x+1)$

$x^2 – x^2 – 2x – x – 2 = 30x + 6$

$-3x – 2 = 30x + 6$

$30x + 3x = -2 – 6$

$33x = -8$

$x = -8/33$

Now let us verify the given equation,

$(x^2 – (x+1)(x+2))/(5x+1) = 6$

By substituting the value of 'x' we get,

$((-8/33)^2 – ((-8/33)+1)(-8/33 + 2))/(5(-8/33)+1) = 6$

$(64/1089 – ((-8+33)/33)((-8+66)/33)) / (-40+33)/33) = 6$

$(64/1089 – (25/33)(58/33)) / (-7/33) = 6$

$(64/1089 – 1450/1089) / (-7/33) = 6$

$((64-1450)/1089 / (-7/33)) = 6$

$-1386/1089 \times 33/-7 = 6$

$1386 \times 33 / 1089 \times -7 = 6$

$6 = 6$

Hence, the given equation is verified

23. $((2x+3) – (5x-7))/(6x+11) = -8/3$

Solution:

We have,

$((2x+3) – (5x-7))/(6x+11) = -8/3$

By cross-multiplying we get,

$3((2x+3) – (5x-7)) = -8(6x+11)$

$3(2x + 3 – 5x + 7) = -48x – 88$

$3(-3x + 10) = -48x – 88$

$-9x + 30 = -48x – 88$

$-9x + 48x = -88 – 30$

$39x = -118$

$x = -118/39$

Now let us verify the given equation,

((2x+3) – (5x-7))/(6x+11) = -8/3
By substituting the value of 'x' we get,
((2(-118/39) + 3) – (5(-118/39) - 7)) / (6(-118/39) + 11) = -8/3
((-336/39 + 3) – (-590/39 - 7)) / (-708/39 + 11) = -8/3
(((-336+117)/39) – ((-590-273)/39)) / ((-708+429)/39) = -8/3
(-219+863)/39 / (-279)/39 = -8/3
644/-279 = -8/3
-8/3 = -8/3
Hence, the given equation is verified

24. Find the positive value of x for which the given equation is satisfied:

(i) $(x^2 - 9)/(5+x^2) = -5/9$
Solution:
We have,
$(x^2 - 9)/(5+x^2) = -5/9$
By cross-multiplying we get,
$9(x^2 - 9) = -5(5+x^2)$
$9x^2 – 81 = -25 – 5x^2$
$9x^2 + 5x^2 = -25 + 81$
$14x^2 = 56$
$x^2 = 56/14$
$x^2 = 4$
$x = \sqrt{4}$
$= 2$

(ii) $(y^2 + 4)/(3y^2 + 7) = 1/2$
Solution:
We have,
$(y^2 + 4)/(3y^2 + 7) = 1/2$
By cross-multiplying we get,
$2(y^2 + 4) = 1(3y^2 + 7)$
$2y^2 + 8 = 3y^2 + 7$
$3y^2 – 2y^2 = 7 – 8$
$y^2 = -1$
$y = \sqrt{-1}$
$= 1$