

EXERCISE 9.1

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Solve each of the following equations and also verify your solution:

1. $9\frac{1}{4} = y - 1\frac{1}{3}$

Solution:

We have,

$$9\frac{1}{4} = y - 1\frac{1}{3}$$

$$37/4 = y - 4/3$$

Upon solving we get,

$$y = 37/4 + 4/3$$

By taking LCM for 4 and 3 is 12

$$y = (37 \times 3)/12 + (4 \times 4)/12$$

$$= 111/12 + 16/12$$

$$= (111 + 16)/12$$

$$= 127/12$$

$$\therefore y = 127/12$$

2. $5x/3 + 2/5 = 1$

Solution:

We have,

$$5x/3 + 2/5 = 1$$

$$5x/3 = 1 - 2/5 \text{ (by taking LCM)}$$

$$= (5-2)/5$$

By using cross-multiplication we get,

$$5x/3 = 3/5$$

$$5x = (3 \times 3)/5$$

$$x = 9/(5 \times 5)$$

$$= 9/25$$

$$\therefore x = 9/25$$

3. $x/2 + x/3 + x/4 = 13$

Solution:

We have,

$$x/2 + x/3 + x/4 = 13$$

let us take LCM for 2, 3 and 4 which is 12

$$(x \times 6)/12 + (x \times 4)/12 + (x \times 3)/12 = 13$$

$$6x/12 + 4x/12 + 3x/12 = 13$$

$$(6x+4x+3x)/12 = 13$$

$$13x/12 = 13$$

By using cross-multiplication we get,

$$13x = 12 \times 13$$

$$x = 156/13$$

$$= 12$$

$$\therefore x = 12$$

$$4. \quad x/2 + x/8 = 1/8$$

Solution:

We have,

$$x/2 + x/8 = 1/8$$

let us take LCM for 2 and 8 which is 8

$$(x \times 4)/8 + (x \times 1)/8 = 1/8$$

$$4x/8 + x/8 = 1/8$$

$$5x/8 = 1/8$$

By using cross-multiplication we get,

$$5x = 8/8$$

$$5x = 1$$

$$x = 1/5$$

$$\therefore x = 1/5$$

$$5. \quad 2x/3 - 3x/8 = 7/12$$

Solution:

We have,

$$2x/3 - 3x/8 = 7/12$$

By taking LCM for 3 and 8 is 24

$$(2x \times 8)/24 - (3x \times 3)/24 = 7/12$$

$$16x/24 - 9x/24 = 7/12$$

$$(16x - 9x)/24 = 7/12$$

$$7x/24 = 7/12$$

By using cross-multiplication we get,

$$7x \times 12 = 7 \times 24$$

$$x = (7 \times 24)/(7 \times 12)$$

$$= 24/12$$

$$= 2$$

$$\therefore x = 2$$

$$6. \quad (x + 2)(x + 3) + (x - 3)(x - 2) - 2x(x + 1) = 0$$

Solution:

We have,

$$(x + 2)(x + 3) + (x - 3)(x - 2) - 2x(x + 1) = 0$$

Upon expansion we get,

$$x^2 + 5x + 6 + x^2 - 5x + 6 - 2x^2 - 2x = 0$$

$$-2x + 12 = 0$$

By dividing the equation using -2 we get,

$$x - 6 = 0$$

$$x = 6$$

$$\therefore x = 6$$

7. $x/2 - 4/5 + x/5 + 3x/10 = 1/5$

Solution:

We have,

$$x/2 - 4/5 + x/5 + 3x/10 = 1/5$$

upon solving we get,

$$x/2 + x/5 + 3x/10 = 1/5 + 4/5$$

by taking LCM for 2, 5 and 10 which is 10

$$(x \times 5)/10 + (x \times 2)/10 + (3x \times 1)/10 = 5/5$$

$$5x/10 + 2x/10 + 3x/10 = 1$$

$$(5x + 2x + 3x)/10 = 1$$

$$10x/10 = 1$$

$$x = 1$$

$$\therefore x = 1$$

8. $7/x + 35 = 1/10$

Solution:

We have,

$$7/x + 35 = 1/10$$

$$7/x = 1/10 - 35$$

$$= ((1 \times 1) - (35 \times 10))/10$$

$$= (1 - 350)/10$$

$$7/x = -349/10$$

By using cross-multiplication we get,

$$x = -70/349$$

$$\therefore x = -70/349$$

9. $(2x-1)/3 - (6x-2)/5 = 1/3$

Solution:

We have,

$$(2x-1)/3 - (6x-2)/5 = 1/3$$

By taking LCM for 3 and 5 which is 15

$$((2x-1) \times 5)/15 - ((6x-2) \times 3)/15 = 1/3$$

$$(10x - 5)/15 - (18x - 6)/15 = 1/3$$

$$(10x - 5 - 18x + 6)/15 = 1/3$$

$$(-8x + 1)/15 = 1/3$$

By using cross-multiplication we get,

$$(-8x + 1)3 = 15$$

$$-24x + 3 = 15$$

$$-24x = 15 - 3$$

$$-24x = 12$$

$$x = -12/24$$

$$= -1/2$$

$$\therefore x = -1/2$$

$$10. 13(y - 4) - 3(y - 9) - 5(y + 4) = 0$$

Solution:

We have,

$$13(y - 4) - 3(y - 9) - 5(y + 4) = 0$$

Upon expansion we get,

$$13y - 52 - 3y + 27 - 5y - 20 = 0$$

$$13y - 3y - 5y = 52 - 27 + 20$$

$$5y = 45$$

$$y = 45/5$$

$$= 9$$

$$\therefore y = 9$$

$$11. 2/3(x - 5) - 1/4(x - 2) = 9/2$$

Solution:

We have,

$$2/3(x - 5) - 1/4(x - 2) = 9/2$$

Upon expansion we get,

$$2x/3 - 10/3 - x/4 + 2/4 = 9/2$$

$$2x/3 - 10/3 - x/4 + 1/2 = 9/2$$

$$2x/3 - x/4 = 9/2 + 10/3 - 1/2$$

By taking LCM for (3 and 4 is 12) (2 and 3 is 6)

$$(2x \times 4)/12 - (x \times 3)/12 = (9 \times 3)/6 + (10 \times 2)/6 - (1 \times 3)/6$$

$$8x/12 - 3x/12 = 27/6 + 20/6 - 3/6$$

$$(8x - 3x)/12 = (27 + 20 - 3)/6$$

$$5x/12 = 44/6$$

By using cross-multiplication we get,

$$5x \times 6 = 44 \times 12$$

$$30x = 528$$

$$x = 528/30$$

$$= 264/15$$

$$= 88/5$$

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EXERCISE 9.2

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Solve each of the following equations and also check your results in each case:

1. $(2x+5)/3 = 3x - 10$

Solution:

$$(2x+5)/3 = 3x - 10$$

Let us simplify,

$$(2x+5)/3 - 3x = -10$$

By taking LCM

$$(2x + 5 - 9x)/3 = -10$$

$$(-7x + 5)/3 = -10$$

By using cross-multiplication we get,

$$-7x + 5 = -30$$

$$-7x = -30 - 5$$

$$-7x = -35$$

$$x = -35/-7$$

$$= 5$$

Let us verify the given equation now,

$$(2x+5)/3 = 3x - 10$$

By substituting the value of 'x' we get,

$$(2 \times 5 + 5)/3 = 3(5) - 10$$

$$(10+5)/3 = 15-10$$

$$15/3 = 5$$

$$5 = 5$$

Hence, the given equation is verified

2. $(a-8)/3 = (a-3)/2$

Solution:

$$(a-8)/3 = (a-3)/2$$

By using cross-multiplication we get,

$$(a-8)2 = (a-3)3$$

$$2a - 16 = 3a - 9$$

$$2a - 3a = -9 + 16$$

$$-a = 7$$

$$a = -7$$

Let us verify the given equation now,

$$(a-8)/3 = (a-3)/2$$

By substituting the value of 'a' we get,

$$(-7 - 8)/3 = (-7 - 3)/2$$

$$-15/3 = -10/2$$

$$-5 = -5$$

Hence, the given equation is verified

$$3. (7y + 2)/5 = (6y - 5)/11$$

Solution:

$$(7y + 2)/5 = (6y - 5)/11$$

By using cross-multiplication we get,

$$(7y + 2)11 = (6y - 5)5$$

$$77y + 22 = 30y - 25$$

$$77y - 30y = -25 - 22$$

$$47y = -47$$

$$y = -47/47$$

$$y = -1$$

Let us verify the given equation now,

$$(7y + 2)/5 = (6y - 5)/11$$

By substituting the value of 'y' we get,

$$(7(-1) + 2)/5 = (6(-1) - 5)/11$$

$$(-7 + 2)/5 = (-6 - 5)/11$$

$$-5/5 = -11/11$$

$$-1 = -1$$

Hence, the given equation is verified

$$4. x - 2x + 2 - 16/3x + 5 = 3 - 7/2x$$

Solution:

$$x - 2x + 2 - 16/3x + 5 = 3 - 7/2x$$

Let us rearrange the equation

$$x - 2x - 16x/3 + 7x/2 = 3 - 2 - 5$$

By taking LCM for 2 and 3 which is 6

$$(6x - 12x - 32x + 21x)/6 = -4$$

$$-17x/6 = -4$$

By cross-multiplying

$$-17x = -4 \times 6$$

$$-17x = -24$$

$$x = -24/-17$$

$$x = 24/17$$

Let us verify the given equation now,

$$x - 2x + 2 - 16/3x + 5 = 3 - 7/2x$$

By substituting the value of 'x' we get,

$$24/17 - 2(24/17) + 2 - (16/3)(24/17) + 5 = 3 - (7/2)(24/17)$$

$$24/17 - 48/17 + 2 - 384/51 + 5 = 3 - 168/34$$

By taking 51 and 34 as the LCM we get,

$$(72 - 144 + 102 - 384 + 255)/51 = (102 - 168)/34$$

$$-99/51 = -66/34$$

$$-33/17 = -33/17$$

Hence, the given equation is verified

$$5. \frac{1}{2}x + 7x - 6 = 7x + \frac{1}{4}$$

Solution:

$$\frac{1}{2}x + 7x - 6 = 7x + \frac{1}{4}$$

Let us rearrange the equation

$$\frac{1}{2}x + 7x - 7x = \frac{1}{4} + 6 \text{ (by taking LCM)}$$

$$\frac{1}{2}x = (1 + 24)/4$$

$$\frac{1}{2}x = 25/4$$

By cross-multiplying

$$4x = 25 \times 2$$

$$4x = 50$$

$$x = 50/4$$

$$x = 25/2$$

Let us verify the given equation now,

$$\frac{1}{2}x + 7x - 6 = 7x + \frac{1}{4}$$

By substituting the value of 'x' we get,

$$(\frac{1}{2})(\frac{25}{2}) + 7(\frac{25}{2}) - 6 = 7(\frac{25}{2}) + \frac{1}{4}$$

$$25/4 + 175/2 - 6 = 175/2 + 1/4$$

By taking LCM for 4 and 2 is 4

$$(25 + 350 - 24)/4 = (350 + 1)/4$$

$$351/4 = 351/4$$

Hence, the given equation is verified

$$6. \frac{3}{4}x + 4x = \frac{7}{8} + 6x - 6$$

Solution:

$$\frac{3}{4}x + 4x = \frac{7}{8} + 6x - 6$$

Let us rearrange the equation

$$\frac{3}{4}x + 4x - 6x = \frac{7}{8} - 6$$

By taking 4 and 8 as LCM

$$(3x + 16x - 24x)/4 = (7 - 48)/8$$

$$-5x/4 = -41/8$$

By cross-multiplying

$$-5x(8) = -41(4)$$

$$-40x = -164$$

$$x = -164/-40$$

$$= 82/20$$

$$= 41/10$$

Let us verify the given equation now,

$$\frac{3}{4}x + 4x = \frac{7}{8} + 6x - 6$$

By substituting the value of 'x' we get,

$$(\frac{3}{4})(\frac{41}{10}) + 4(\frac{41}{10}) = \frac{7}{8} + 6(\frac{41}{10}) - 6$$

$$\frac{123}{40} + \frac{164}{10} = \frac{7}{8} + \frac{246}{10} - 6$$

$$(\frac{123 + 656}{40}) = (\frac{70 + 1968 - 480}{80})$$

$$\frac{779}{40} = \frac{1558}{80}$$

$$\frac{779}{40} = \frac{779}{40}$$

Hence, the given equation is verified

$$7. \frac{7x}{2} - \frac{5x}{2} = \frac{20x}{3} + 10$$

Solution:

$$\frac{7x}{2} - \frac{5x}{2} = \frac{20x}{3} + 10$$

Let us rearrange the equation

$$\frac{7x}{2} - \frac{5x}{2} - \frac{20x}{3} = 10$$

By taking LCM for 2 and 3 is 6

$$(21x - 15x - 40x)/6 = 10$$

$$-34x/6 = 10$$

By cross-multiplying

$$-34x = 60$$

$$x = 60/-34$$

$$= -30/17$$

Let us verify the given equation now,

$$\frac{7x}{2} - \frac{5x}{2} = \frac{20x}{3} + 10$$

By substituting the value of 'x' we get,

$$(\frac{7}{2})(\frac{-30}{17}) - (\frac{5}{2})(\frac{-30}{17}) = (\frac{20}{3})(\frac{-30}{17}) + 10$$

$$-210/34 + 150/34 = -600/51 + 10$$

$$-30/17 = (-600+510)/51$$

$$= -90/51$$

$$-30/17 = -30/17$$

Hence, the given equation is verified

8. $(6x+1)/2 + 1 = (7x-3)/3$

Solution:

$$(6x+1)/2 + 1 = (7x-3)/3$$

$$(6x + 1 + 2)/2 = (7x - 3)/3$$

By cross-multiplying

$$(6x + 3)3 = (7x - 3)2$$

$$18x + 9 = 14x - 6$$

$$18x - 14x = -6 - 9$$

$$4x = -15$$

$$x = -15/4$$

Let us verify the given equation now,

$$(6x+1)/2 + 1 = (7x-3)/3$$

By substituting the value of 'x' we get,

$$(6(-15/4) + 1)/2 + 1 = (7(-15/4) - 3)/3$$

$$(3(-15/2) + 1)/2 + 1 = (-105/4 - 3)/3$$

$$(-45/2 + 1)/2 + 1 = (-117/4)/3$$

$$(-43/4) + 1 = -117/12$$

$$(-43+4)/4 = -39/4$$

$$-39/4 = -39/4$$

Hence, the given equation is verified

9. $(3a-2)/3 + (2a+3)/2 = a + 7/6$

Solution:

$$(3a-2)/3 + (2a+3)/2 = a + 7/6$$

Let us rearrange the equation

$$(3a-2)/3 + (2a+3)/2 - a = 7/6$$

By taking LCM for 2 and 3 which is 6

$$((3a-2)2 + (2a+3)3 - 6a)/6 = 7/6$$

$$(6a - 4 + 6a + 9 - 6a)/6 = 7/6$$

$$(6a + 5)/6 = 7/6$$

$$6a + 5 = 7$$

$$6a = 7-5$$

$$6a = 2$$

$$a = 2/6$$

$$a = 1/3$$

Let us verify the given equation now,

$$(3a-2)/3 + (2a+3)/2 = a + 7/6$$

By substituting the value of 'a' we get,

$$(3(1/3)-2)/3 + (2(1/3) + 3)/2 = 1/3 + 7/6$$

$$(1-2)/3 + (2/3 + 3)/2 = (2+7)/6$$

$$-1/3 + (11/3)/2 = 9/6$$

$$-1/3 + 11/6 = 3/2$$

$$(-2+11)/6 = 3/2$$

$$9/6 = 3/2$$

$$3/2 = 3/2$$

Hence, the given equation is verified

$$10. x - (x-1)/2 = 1 - (x-2)/3$$

Solution:

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

Let us rearrange the equation

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

By taking LCM for 2 and 3 which is 6

$$(6x - (x-1)3 + (x-2)2)/6 = 1$$

$$(6x - 3x + 3 + 2x - 4)/6 = 1$$

$$(5x - 1)/6 = 1$$

By cross-multiplying

$$5x - 1 = 6$$

$$5x = 6 + 1$$

$$x = 7/5$$

Let us verify the given equation now,

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

By substituting the value of 'x' we get,

$$7/5 - (7/5 - 1)/2 = 1 - (7/5 - 2)/3$$

$$7/5 - (2/5)/2 = 1 - (-3/5)/3$$

$$7/5 - 2/10 = 1 + 3/15$$

$$(14 - 2)/10 = (15+3)/15$$

$$12/10 = 18/15$$

$$6/5 = 6/5$$

Hence, the given equation is verified

11. $\frac{3x}{4} - \frac{(x-1)}{2} = \frac{(x-2)}{3}$

Solution:

$$\frac{3x}{4} - \frac{(x-1)}{2} = \frac{(x-2)}{3}$$

Let us rearrange the equation

$$\frac{3x}{4} - \frac{(x-1)}{2} - \frac{(x-2)}{3} = 0$$

By taking LCM for 4, 2 and 3 which is 12

$$\frac{(9x - (x-1)6 - (x-2)4)}{12} = 0$$

$$\frac{(9x - 6x + 6 - 4x + 8)}{12} = 0$$

$$\frac{(-x + 14)}{12} = 0$$

By cross-multiplying

$$-x + 14 = 0$$

$$x = 14$$

Let us verify the given equation now,

$$\frac{3x}{4} - \frac{(x-1)}{2} = \frac{(x-2)}{3}$$

By substituting the value of 'x' we get,

$$\frac{3(14)}{4} - \frac{(14-1)}{2} = \frac{(14-2)}{3}$$

$$\frac{42}{4} - \frac{13}{2} = \frac{12}{3}$$

$$\frac{(42 - 26)}{4} = 4$$

$$\frac{16}{4} = 4$$

$$4 = 4$$

Hence, the given equation is verified

12. $\frac{5x}{3} - \frac{(x-1)}{4} = \frac{(x-3)}{5}$

Solution:

$$\frac{5x}{3} - \frac{(x-1)}{4} = \frac{(x-3)}{5}$$

Let us rearrange the equation

$$\frac{5x}{3} - \frac{(x-1)}{4} - \frac{(x-3)}{5} = 0$$

By taking LCM for 3, 4 and 5 which is 60

$$\frac{((5x \times 20) - (x-1)15 - (x-3)12)}{60} = 0$$

$$\frac{(100x - 15x + 15 - 12x + 36)}{60} = 0$$

$$\frac{(73x + 51)}{60} = 0$$

By cross-multiplying

$$73x + 51 = 0$$

$$x = -51/73$$

Let us verify the given equation now,

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

By substituting the value of 'x' we get,

$$(20x - (x-1)3)/12 = (-51/73 - 3)/5$$

$$(20x - 3x + 3)/12 = (-270/73)/5$$

$$(17x + 3)/12 = -270/365$$

$$(17(-51/73) + 3)/12 = -54/73$$

$$(-867/73 + 3)/12 = -54/73$$

$$((-867 + 219)/73)/12 = -54/73$$

$$(-648)/876 = -54/73$$

$$-54/73 = -54/73$$

Hence, the given equation is verified

$$13. (3x+1)/16 + (2x-3)/7 = (x+3)/8 + (3x-1)/14$$

Solution:

$$(3x+1)/16 + (2x-3)/7 = (x+3)/8 + (3x-1)/14$$

Let us rearrange the equation

$$(3x+1)/16 + (2x-3)/7 - (x+3)/8 - (3x-1)/14 = 0$$

By taking LCM for 16, 7, 8 and 14 which is 112

$$((3x+1)7 + (2x-3)16 - (x+3)14 - (3x-1)8)/112 = 0$$

$$(21x + 7 + 32x - 48 - 14x - 42 - 24x + 8)/112 = 0$$

$$(21x + 32x - 14x - 24x + 7 - 48 - 42 + 8)/112 = 0$$

$$(15x - 75)/112 = 0$$

By cross-multiplying

$$15x - 75 = 0$$

$$15x = 75$$

$$x = 75/15$$

$$= 5$$

Let us verify the given equation now,

$$(3x+1)/16 + (2x-3)/7 = (x+3)/8 + (3x-1)/14$$

By substituting the value of 'x' we get,

$$(3(5)+1)/16 + (2(5)-3)/7 = (5+3)/8 + (3(5)-1)/14$$

$$(15+1)/16 + (10-3)/7 = 8/8 + (15-1)/14$$

$$16/16 + 7/7 = 8/8 + 14/14$$

$$1 + 1 = 1 + 1$$

$$2 = 2$$

Hence, the given equation is verified

14. $(1-2x)/7 - (2-3x)/8 = 3/2 + x/4$

Solution:

$$(1-2x)/7 - (2-3x)/8 = 3/2 + x/4$$

Let us rearrange the equation

$$(1-2x)/7 - (2-3x)/8 - x/4 = 3/2$$

By taking LCM for 7, 8 and 4 which is 56

$$((1-2x)8 - (2-3x)7 - 14x)/56 = 3/2$$

$$(8 - 16x - 14 + 21x - 14x)/56 = 3/2$$

$$(-9x - 6)/56 = 3/2$$

By cross-multiplying

$$2(-9x-6) = 3(56)$$

$$-18x - 12 = 168$$

$$-18x = 168+12$$

$$-18x = 180$$

$$x = 180/-18$$

$$x = -10$$

Let us verify the given equation now,

$$(1-2x)/7 - (2-3x)/8 = 3/2 + x/4$$

By substituting the value of 'x' we get,

$$(1-2(-10))/7 - (2-3(-10))/8 = 3/2 + (-10)/4$$

$$(1+20)/7 - (2+30)/8 = 3/2 - 5/2$$

$$21/7 - 32/8 = 3/2 - 5/2$$

$$3 - 4 = -2/2$$

$$-1 = -1$$

Hence, the given equation is verified

15. $(9x+7)/2 - (x - (x-2)/7) = 36$

Solution:

$$(9x+7)/2 - (x - (x-2)/7) = 36$$

Let us simplify the given equation into simple form

$$(9x+7)/2 - (7x-x+2)/7 = 36$$

$$(9x+7)/2 - (6x+2)/7 = 36$$

By taking LCM for 2 and 7 is 14

$$(7(9x+7) - 2(6x+2))/14 = 36$$

$$(63x+49 - 12x - 4)/14 = 36$$

$$(51x + 45)/14 = 36$$

By cross-multiplying

$$51x + 45 = 36(14)$$

$$\begin{aligned}51x + 45 &= 504 \\51x &= 504 - 45 \\51x &= 459 \\x &= 459/51 \\&= 9\end{aligned}$$

Let us verify the given equation now,

$$(9x+7)/2 - (x - (x-2)/7) = 36$$

$$(9x+7)/2 - (6x+2)/7 = 36$$

By substituting the value of 'x' we get,

$$(9(9)+7)/2 - (6(9)+2)/7 = 36$$

$$(81+7)/2 - (54+2)/7 = 36$$

$$88/2 - 56/7 = 36$$

$$44 - 8 = 36$$

$$36 = 36$$

Hence, the given equation is verified

$$16. 0.18(5x - 4) = 0.5x + 0.8$$

Solution:

$$0.18(5x - 4) = 0.5x + 0.8$$

Let us rearrange the equation

$$0.18(5x - 4) - 0.5x = 0.8$$

$$0.90x - 0.72 - 0.5x = 0.8$$

$$0.90x - 0.5x = 0.8 + 0.72$$

$$0.40x = 1.52$$

$$x = 1.52/0.40$$

$$= 3.8$$

Let us verify the given equation now,

$$0.18(5x - 4) = 0.5x + 0.8$$

By substituting the value of 'x' we get,

$$0.18(5(3.8)-4) = 0.5(3.8) + 0.8$$

$$0.18(19-4) = 1.9 + 0.8$$

$$2.7 = 2.7$$

Hence, the given equation is verified

$$17. 2/3x - 3/2x = 1/12$$

Solution:

$$2/3x - 3/2x = 1/12$$

By taking LCM for $3x$ and $2x$ which is $6x$

$$((2 \times 2) - (3 \times 3))/6x = 1/12$$

$$(4-9)/6x = 1/12$$

$$-5/6x = 1/12$$

By cross-multiplying

$$6x = -60$$

$$x = -60/6$$

$$= -10$$

Let us verify the given equation now,

$$2/3x - 3/2x = 1/12$$

By substituting the value of 'x' we get,

$$2/3(-10) - 3/2(-10) = 1/12$$

$$-2/30 + 3/20 = 1/12$$

$$((-2 \times 2) + (3 \times 3))/60 = 1/12$$

$$(-4+9)/60 = 1/12$$

$$5/60 = 1/12$$

$$1/12 = 1/12$$

Hence, the given equation is verified

$$18. \quad 4x/9 + 1/3 + 13x/108 = (8x+19)/18$$

Solution:

$$4x/9 + 1/3 + 13x/108 = (8x+19)/18$$

Let us rearrange the equation

$$4x/9 + 13x/108 - (8x+19)/18 = -1/3$$

By taking LCM for 9, 108 and 18 which is 108

$$((4x \times 12) + 13x \times 1 - (8x+19)6)/108 = -1/3$$

$$(48x + 13x - 48x - 114)/108 = -1/3$$

$$(13x - 114)/108 = -1/3$$

By cross-multiplying

$$(13x - 114)3 = -108$$

$$39x - 342 = -108$$

$$39x = -108 + 342$$

$$39x = 234$$

$$x = 234/39$$

$$= 6$$

Let us verify the given equation now,

$$4x/9 + 1/3 + 13x/108 = (8x+19)/18$$

By substituting the value of 'x' we get,
 $4(6)/9 + 1/3 + 13(6)/108 = (8(6)+19)/18$
 $24/9 + 1/3 + 78/108 = 67/18$
 $8/3 + 1/3 + 13/18 = 67/18$
 $((8 \times 6) + (1 \times 6) + (13 \times 1))/18 = 67/18$
 $(48 + 6 + 13)/18 = 67/18$
 $67/18 = 67/18$
 Hence, the given equation is verified

19. $(45-2x)/15 - (4x+10)/5 = (15-14x)/9$

Solution:

$$(45-2x)/15 - (4x+10)/5 = (15-14x)/9$$

By rearranging

$$(45-2x)/15 - (4x+10)/5 - (15-14x)/9 = 0$$

By taking LCM for 15, 5 and 9 which is 45

$$((45-2x)3 - (4x+10)9 - (15-14x)5)/45 = 0$$

$$(135 - 6x - 36x - 90 - 75 + 70x)/45 = 0$$

$$(28x - 30)/45 = 0$$

By cross-multiplying

$$28x - 30 = 0$$

$$28x = 30$$

$$x = 30/28$$

$$= 15/14$$

Let us verify the given equation now,

$$(45-2x)/15 - (4x+10)/5 = (15-14x)/9$$

By substituting the value of 'x' we get,

$$(45-2(15/14))/15 - (4(15/14) + 10)/5 = (15 - 14(15/14))/9$$

$$(45 - 15/7)/15 - (30/7 + 10)/5 = (15-15)/9$$

$$300/105 - 100/35 = 0$$

$$(300-300)/105 = 0$$

$$0 = 0$$

Hence, the given equation is verified

20. $5(7x+5)/3 - 23/3 = 13 - (4x-2)/3$

Solution:

$$5(7x+5)/3 - 23/3 = 13 - (4x-2)/3$$

By rearranging

$$(35x + 25)/3 + (4x - 2)/3 = 13 + 23/3$$

$$(35x + 25 + 4x - 2)/3 = (39+23)/3$$

$$(39x + 23)/3 = 62/3$$

By cross-multiplying

$$(39x + 23)3 = 62(3)$$

$$39x + 23 = 62$$

$$39x = 62 - 23$$

$$39x = 39$$

$$x = 1$$

Let us verify the given equation now,

$$5(7x+5)/3 - 23/3 = 13 - (4x-2)/3$$

By substituting the value of 'x' we get,

$$(35x + 25)/3 - 23/3 = 13 - (4x-2)/3$$

$$(35+25)/3 - 23/3 = 13 - (4-2)/3$$

$$60/3 - 23/3 = 13 - 2/3$$

$$(60-23)/3 = (39-2)/3$$

$$37/3 = 37/3$$

$$1 = 1$$

Hence, the given equation is verified

$$21. (7x-1)/4 - 1/3(2x - (1-x)/2) = 10/3$$

Solution:

$$(7x-1)/4 - 1/3(2x - (1-x)/2) = 10/3$$

Upon expansion

$$(7x-1)/4 - (4x-1+x)/6 = 10/3$$

$$(7x-1)/4 - (5x-1)/6 = 10/3$$

By taking LCM for 4 and 6 is 24

$$((7x-1)6 - (5x-1)4)/24 = 10/3$$

$$(42x - 6 - 20x + 4)/24 = 10/3$$

$$(22x - 2)/24 = 10/3$$

By cross-multiplying

$$22x - 2 = 10(8)$$

$$22x - 2 = 80$$

$$22x = 80+2$$

$$22x = 82$$

$$x = 82/22$$

$$= 41/11$$

Let us verify the given equation now,

$$(7x-1)/4 - 1/3(2x - (1-x)/2) = 10/3$$

By substituting the value of 'x' we get,

$$(7x-1)/4 - (5x-1)/6 = 10/3$$

$$(7(41/11)-1)/4 - (5(41/11)-1)/6 = 10/3$$

$$(287/11 - 1)/4 - (205/11 - 1)/6 = 10/3$$

$$(287-11)/44 - (205-11)/66 = 10/3$$

$$276/44 - 194/66 = 10/3$$

$$69/11 - 97/33 = 10/3$$

$$((69 \times 3) - (97 \times 1))/33 = 10/3$$

$$(207 - 97)/33 = 10/3$$

$$110/33 = 10/3$$

$$10/3 = 10/3$$

Hence, the given equation is verified

$$22. 0.5(x-0.4)/0.35 - 0.6(x-2.71)/0.42 = x + 6.1$$

Solution:

$$0.5(x-0.4)/0.35 - 0.6(x-2.71)/0.42 = x + 6.1$$

Let us simplify

$$(0.5/0.35)(x - 0.4) - (0.6/0.42)(x - 2.71) = x + 6.1$$

$$(x - 0.4)/0.7 - (x - 2.71)/0.7 = x + 6.1$$

$$(x - 0.4 - x + 2.71)/0.7 = x + 6.1$$

$$-0.4 + 2.71 = 0.7(x + 6.1)$$

$$0.7x = 2.71 - 0.4 - 4.27$$

$$= -1.96$$

$$x = -1.96/0.7$$

$$= -2.8$$

Let us verify the given equation now,

$$0.5(x-0.4)/0.35 - 0.6(x-2.71)/0.42 = x + 6.1$$

By substituting the value of 'x' we get,

$$0.5(-2.8 - 0.4)/0.35 - 0.6(-2.8 - 2.71)/0.42 = -2.8 + 6.1$$

$$-1.6/0.35 + 3.306/0.42 = 3.3$$

$$-4.571 + 7.871 = 3.3$$

$$3.3 = 3.3$$

Hence, the given equation is verified

$$23. 6.5x + (19.5x - 32.5)/2 = 6.5x + 13 + (13x - 26)/2$$

Solution:

$$6.5x + (19.5x - 32.5)/2 = 6.5x + 13 + (13x - 26)/2$$

By rearranging

$$6.5x + (19.5x - 32.5)/2 - 6.5x - (13x - 26)/2 = 13$$

$$(19.5x - 32.5)/2 - (13x - 26)/2 = 13$$

$$(19.5x - 32.5 - 13x + 26)/2 = 13$$

$$(6.5x - 6.5)/2 = 13$$

$$6.5x - 6.5 = 13 \times 2$$

$$6.5x - 6.5 = 26$$

$$6.5x = 26 + 6.5$$

$$6.5x = 32.5$$

$$x = 32.5/6.5$$

$$= 5$$

Let us verify the given equation now,

$$6.5x + (19.5x - 32.5)/2 = 6.5x + 13 + (13x - 26)/2$$

By substituting the value of 'x' we get,

$$6.5(5) + (19.5(5) - 32.5)/2 = 6.5(5) + 13 + (13(5) - 26)/2$$

$$32.5 + (97.5 - 32.5)/2 = 32.5 + 13 + (65 - 26)/2$$

$$32.5 + 65/2 = 45.5 + 39/2$$

$$(65 + 65)/2 = (91 + 39)/2$$

$$130/2 = 130/2$$

$$65 = 65$$

Hence, the given equation is verified

$$24. (3x - 8)(3x + 2) - (4x - 11)(2x + 1) = (x - 3)(x + 7)$$

Solution:

$$(3x - 8)(3x + 2) - (4x - 11)(2x + 1) = (x - 3)(x + 7)$$

Let us simplify

$$9x^2 + 6x - 24x - 16 - 8x^2 - 4x + 22x + 11 = x^2 + 7x - 3x - 21$$

$$9x^2 + 6x - 24x - 16 - 8x^2 - 4x + 22x + 11 - x^2 - 7x + 3x + 21 = 0$$

$$9x^2 - 8x^2 - x^2 + 6x - 24x - 4x + 22x - 7x + 3x - 16 + 21 + 11 = 0$$

$$-4x + 16 = 0$$

$$-4x = -16$$

$$x = 4$$

Let us verify the given equation now,

$$(3x - 8)(3x + 2) - (4x - 11)(2x + 1) = (x - 3)(x + 7)$$

By substituting the value of 'x' we get,

$$(3(4) - 8)(3(4) + 2) - (4(4) - 11)(2(4) + 1) = (4 - 3)(4 + 7)$$

$$(12 - 8)(12 + 2) - (16 - 11)(8 + 1) = 1(11)$$

$$4(14) - 5(9) = 11$$

$$56 - 45 = 11$$

$$11 = 11$$

Hence, the given equation is verified

$$25. [(2x+3) + (x+5)]^2 + [(2x+3) - (x+5)]^2 = 10x^2 + 92$$

Solution:

$$[(2x+3) + (x+5)]^2 + [(2x+3) - (x+5)]^2 = 10x^2 + 92$$

Let us simplify the given equation

$$[3x + 8]^2 + [x - 2]^2 = 10x^2 + 92$$

By using the formula $(a+b)^2$

$$9x^2 + 48x + 64 + x^2 - 4x + 4 = 10x^2 + 92$$

By rearranging

$$9x^2 - 10x^2 + x^2 + 48x - 4x = 92 - 64 - 4$$

$$44x = 24$$

$$x = 24/44$$

$$= 6/11$$

Let us verify the given equation now,

$$[(2x+3) + (x+5)]^2 + [(2x+3) - (x+5)]^2 = 10x^2 + 92$$

By substituting the value of 'x' we get,

$$[2(6/11) + 3 + (6/11) + 5]^2 + [2(6/11) + 3 - (6/11) - 5]^2 = 10(6/11)^2 + 92$$

$$[(12/11) + 3 + (6/11) + 5]^2 + [(12/11) + 3 - (6/11) - 5]^2 = 10(6/11)^2 + 92$$

$$[(12+33)/11 + (6+55)/11]^2 + [(12+33)/11 - (6+55)/11]^2 = 10(6/11)^2 + 92$$

$$[(45/11) + (61/11)]^2 + [(45/11) - (61/11)]^2 = 360/121 + 92$$

$$(106/11)^2 + (-16/11)^2 = (360 + 11132)/121$$

$$11236/121 + 256/121 = 11492/121$$

$$11492/121 = 11492/121$$

Hence, the given equation is verified

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,

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

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

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

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

$$(-13/6) \times (4/13) = -2/3$$

$$-4/6 = -2/3$$

$$-2/3 = -2/3$$

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,

$$(2 - (-11/8)) / ((-11/8) + 7) = 3/5$$

$$((16+11)/8) / ((-11+56)/8) = 3/5$$

$$(27/8) / (45/8) = 3/5$$

$$(27/8) \times (8/45) = 3/5$$

$$27/45 = 3/5$$

$$3/5 = 3/5$$

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,

$$3x + 5 = 4(2x+7)$$

$$3x + 5 = 8x + 28$$

$$\begin{aligned}3x - 8x &= 28 - 5 \\-5x &= 23 \\x &= -23/5\end{aligned}$$

Now let us verify the given equation,

$$(3x+5) / (2x + 7) = 4$$

By substituting the value of 'x' we get,

$$(3(-23/5) + 5) / (2(-23/5) + 7) = 4$$

$$(-69/5 + 5) / (-46/5 + 7) = 4$$

$$(-69+25)/5 / (-46+35)/5 = 4$$

$$-44/5 / -11/5 = 4$$

$$-44/5 \times 5/-11 = 4$$

$$44/11 = 4$$

$$4 = 4$$

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,

$$\begin{aligned}9(2x + 1) &= 5(3x - 2) \\18x + 9 &= 15x - 10 \\18x - 15x &= -10 - 9 \\3x &= -19 \\x &= -19/3\end{aligned}$$

Now let us verify the given equation,

$$(2x + 1) / (3x - 2) = 5/9$$

By substituting the value of 'x' we get,

$$(2(-19/3) + 1) / (3(-19/3) - 2) = 5/9$$

$$(-38/3 + 1) / (-57/3 - 2) = 5/9$$

$$(-38 + 3)/3 / (-57 - 6)/3 = 5/9$$

$$-35/3 / -63/3 = 5/9$$

$$-35/3 \times 3/-63 = 5/9$$

$$-35/-63 = 5/9$$

$$5/9 = 5/9$$

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,

$$(1 - 9(-29/19)) / (19 - 3(-29/19)) = 5/8$$

$$(19 + 261)/19 / (361 + 87)/19 = 5/8$$

$$280/19 \times 19/448 = 5/8$$

$$280/448 = 5/8$$

$$5/8 = 5/8$$

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,

$$15/17 - (7 - 8(15/17)) / 9(15/17) - (3 + 4(15/17)) = 2/3$$

$$15/17 - (7 - 120/17) / 135/17 - (3 + 60/17) = 2/3$$

$$15/17 - ((119 - 120)/17) / 135/17 - ((51 + 60)/17) = 2/3$$

$$\begin{aligned}15/17 - (-1/17) / 135/17 - (111/17) &= 2/23 \\ ((15 + 1)/17) / ((135-111)/17) &= 2/3 \\ 16/17 / 24/17 &= 2/3 \\ 16/24 &= 2/3 \\ 2/3 &= 2/3\end{aligned}$$

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,

$$\begin{aligned}12(-5) &= 1(6x) \\ -60 &= 6x \\ x &= -60/6 \\ &= -10\end{aligned}$$

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

$$(x^2 + 2x + 1)(x + 4) - (x + 2)(x^2 + 4x + 4) = 0$$

$$\begin{aligned}x^3 + 2x^2 + x + 4x^2 + 8x + 4 - (x^3 + 4x^2 + 4x + 2x^2 + 8x + 8) &= 0 \\x^3 + 2x^2 + x + 4x^2 + 8x + 4 - x^3 - 4x^2 - 4x - 2x^2 - 8x - 8 &= 0 \\-3x - 4 &= 0 \\x &= -4/3\end{aligned}$$

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 $(x+5)(x+6)$
$$\frac{(x+2)(x+6) - x(x+5)}{(x+5)(x+6)} = 0$$
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,
$$\frac{(x+2)}{(x+5)} = \frac{x}{(x+6)}$$
By substituting the value of 'x' we get,
$$\frac{(-4 + 2)}{(-4 + 5)} = \frac{-4}{(-4 + 6)}$$
$$\frac{-2}{1} = \frac{-4}{2}$$
$$-2 = -2$$
Hence, the given equation is verified

18. $2x - (7-5x) / 9x - (3+4x) = 7/6$

Solution:

We have,
$$\frac{2x - (7-5x)}{9x - (3+4x)} = \frac{7}{6}$$
$$\frac{(2x - 7 + 5x)}{(9x - 3 - 4x)} = \frac{7}{6}$$
$$\frac{(7x - 7)}{(5x - 3)} = \frac{7}{6}$$
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,
$$\frac{2x - (7-5x)}{9x - (3+4x)} = \frac{7}{6}$$
$$\frac{(7x - 7)}{(5x - 3)} = \frac{7}{6}$$
By substituting the value of 'x' we get,
$$\frac{(7(3) - 7)}{(5(3) - 3)} = \frac{7}{6}$$
$$(21-7) / (15-3) = 7/6$$

$$14/12 = 7/6$$

$$7/6 = 7/6$$

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,

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

$$((12+15)/5)/((12-15)/5) + ((12+10)/5)/((12-10)/5) = 2$$

$$(27/5)/(-3/5) + (22/5)/(2/5) = 2$$

$$-27/3 + 22/2 = 2$$

$$((-27 \times 2) + (22 \times 3))/6 = 2$$

$$(-54 + 66)/6 = 2$$

$$12/6 = 2$$

$$2 = 2$$

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,

$$2(y^2 + 4) = 1(3y^2 + 7)$$

$$2y^2 + 8 = 3y^2 + 7$$

$$3y^2 - 2y^2 = 7 - 8$$

$$y^2 = -1$$

$$y = \sqrt{-1}$$

$$= 1$$

EXERCISE 9.4

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1. Four-fifth of a number is more than three-fourth of the number by 4. Find the number.

Solution:

Let us consider the number as 'x'

So, Three-fourth of the number is $3x/4$

Fourth-fifth of the number is $4x/5$

$$4x/5 - 3x/4 = 4$$

By taking LCM of 5 and 4 is 20

$$(16x - 15x)/20 = 4$$

By cross-multiplying we get,

$$16x - 15x = 4(20)$$

$$x = 80$$

∴ The number is 80.

2. The difference between the squares of two consecutive numbers is 31. Find the numbers.

Solution:

Let the two consecutive numbers be x and (x - 1)

So now,

$$x^2 - (x-1)^2 = 31$$

By using the formula $(a-b)^2 = a^2 + b^2 - 2ab$

$$x^2 - (x^2 - 2x + 1) = 31$$

$$x^2 - x^2 + 2x - 1 = 31$$

$$2x - 1 = 31$$

$$2x = 31 + 1$$

$$2x = 32$$

$$x = 32/2$$

$$= 16$$

Two consecutive numbers are, x and (x-1) : 16 and (16-1)=15

∴ The two consecutive numbers are 16 and 15.

3. Find a number whose double is 45 greater than its half.

Solution:

Let us consider the number as 'x'

So,

$$2x - x/2 = 45$$

$$(4x-x)/2 = 45$$

By cross-multiplying we get,

$$3x = 90$$

$$x = 90/3$$

$$= 30$$

∴ The number is 30.

4. Find a number such that when 5 is subtracted from 5 times that number, the result is 4 more than twice the number.

Solution:

Let us consider the number as 'x'

Then, five times the number will be 5x

And, two times the number will be 2x

So,

$$5x - 5 = 2x + 4$$

$$5x - 2x = 5 + 4$$

$$3x = 9$$

$$x = 9/3$$

$$x = 3$$

∴ The number is 3.

5. A number whose fifth part increased by 5 is equal to its fourth part diminished by 5. Find the number.

Solution:

Let us consider the number as 'x'

So,

$$x/5 + 5 = x/4 - 5$$

$$x/5 - x/4 = -5 - 5$$

By taking LCM for 5 and 4 which is 20

$$(4x-5x)/20 = -10$$

By cross-multiplying we get,

$$4x - 5x = -10(20)$$

$$-x = -200$$

$$x = 200$$

∴ The number is 200.

6. A number consists of two digits whose sum is 9. If 27 is subtracted from the number the digits are reversed. Find the number.

Solution:

We know that one of the digit be 'x'

The other digit is $9-x$

So, the two digit number is $10(9-x) + x$

The number obtained after interchanging the digits is $10x + (9-x)$

$$10(9-x) + x - 27 = 10x + (9-x)$$

Upon simplification,

$$90 - 10x + x - 27 = 10x + 9 - x$$

$$-10x + x - 10x + x = 9 - 90 + 27$$

$$-18x = -54$$

$$x = 54/18$$

$$= 9/3$$

$$= 3$$

The two digit number is $10(9-x) + x$

Substituting the value of x we get,

$$10(9-x) + x$$

$$10(9 - 3) + 3$$

$$10(6) + 3$$

$$60 + 3$$

$$63$$

∴ The number is 63.

7. Divide 184 into two parts such that one-third of one part may exceed one-seventh of another part by 8.

Solution:

Let one of the number be ' x '

The other number as $184 - x$

So, One-third of one part may exceed one-seventh of another part by 8.

$$x/3 - (184-x)/7 = 8$$

LCM for 3 and 7 is 21

$$(7x - 552 + 3x)/21 = 8$$

By cross-multiplying we get,

$$(7x - 552 + 3x) = 8(21)$$

$$10x - 552 = 168$$

$$10x = 168 + 552$$

$$10x = 720$$

$$x = 720/10$$

$$= 72$$

∴ One of the number is 72 and other number is $184 - x \Rightarrow 184 - 72 = 112$.

8. The numerator of a fraction is 6 less than the denominator. If 3 is added to the numerator, the fraction is equal to $\frac{2}{3}$. What is the original fraction equal to?

Solution:

Let us consider the denominator as x and numerator as $(x-6)$

By using the formula,

Fraction = numerator/denominator = $(x-6)/x$

$$(x - 6 + 3)/x = 2/3$$

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

By cross-multiplying

$$3(x-3) = 2x$$

$$3x - 9 = 2x$$

$$3x - 2x = 9$$

$$x = 9$$

\therefore The denominator is $x = 9$, numerator is $(x-6) = (9-6) = 3$

And the fraction = numerator/denominator = $(x-6)/x = 3/9 = 1/3$

9. A sum of Rs 800 is in the form of denominations of Rs 10 and Rs 20. If the total number of notes be 50. Find the number of notes of each type.

Solution:

Let the number of 10Rs notes be x

Number of 20Rs notes be $50 - x$

Amount due to 10Rs notes = $10 \times x = 10x$

Amount due to 20Rs notes = $20 \times (50 - x) = 1000 - 20x$

So the total amount is Rs 800

$$10x + 1000 - 20x = 800$$

$$-10x = 800 - 1000$$

$$-10x = -200$$

$$x = -200/-10$$

$$= 20$$

\therefore The number of 10Rs notes is 20

Number of 20Rs notes are $50 - 20 = 30$

10. Seeta Devi has Rs 9 in fifty-paise and twenty five-paise coins. She has twice as many twenty-five paise coins as she has fifty-paise coins. How many coins of each kind does she have?

Solution:

Let the number of fifty paise coins be x

Number of twenty five paise coins be $2x$

Amount due to fifty paise coins = $(50 \times x)/100 = 0.50x$

Amount due to twenty five paise coins = $(25 \times 2x)/100 = 0.50x$

So the total amount is Rs 9

$$0.50x + 0.50x = 9$$

$$1x = 9$$

$$x = 9$$

∴ The number of fifty paise coins is $x = 9$

Number of twenty five paise coins, $2x = 2 \times 9 = 18$

11. Sunita is twice as old as Ashima. If six years is subtracted from Ashima's age and four years added to Sunita's age, then Sunita will be four times Ashima's age. How old were they two years ago?

Solution:

Let the present age of Ashima be 'x' years

The present age of Sunita is $2x$ years

Ashima's new age = $(x - 6)$ years

Sunita's new age = $(2x + 4)$ years

$$\text{So, } (2x + 4) = 4(x - 6)$$

$$2x + 4 = 4x - 24$$

$$2x - 4x = -24 - 4$$

$$-2x = -28$$

$$x = -28/-2$$

$$= 14$$

∴ Age of Ashima is x years = 14 years

Age of Sunita is $2x$ years = $2(14) = 28$ years

Two years ago, age of Ashima is $14 - 2 = 12$ years, age of Sunita = $28 - 2 = 26$ years

12. The ages of Sonu and Monu are in the ratio 7:5 Ten years hence, the ratio of their ages will be 9:7 find their present ages.

Solution:

Let the present age of Sonu be $7x$ years

Present age of Monu be $5x$ years

Sonu's age after 10 years = $(7x + 10)$ years

Monu's age after 10 years = $(5x + 10)$ years

So,

$$(7x + 10) / (5x + 10) = 9/7$$

by using cross-multiplication we get,

$$7(7x + 10) = 9(5x + 10)$$

$$49x + 70 = 45x + 90$$

$$49x - 45x = 90 - 70$$

$$4x = 20$$

$$x = 20/4$$

$$= 5$$

∴ Present age of Sonu is $7x = 7(5) = 35$ years

Present age of Monu is $5x = 5(5) = 25$ years

13. Five years ago a man was seven times as old as his son. Five years hence, the father will be three times as old as his son. Find their present ages.

Solution:

Let the age of son five years ago be x years

The age of man five years ago be $7x$ years

After five years, son's age is $x + 5$ years

After five years father's age is $7x + 5$ years

So, since five years, the relation in their ages are

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

$$7x + 10 = 3x + 15 + 15$$

$$7x + 10 = 3x + 30$$

$$7x - 3x = 30 - 10$$

$$4x = 20$$

$$x = 5$$

∴ Present father's age is $7x + 5 = 7(5) + 5 = 35 + 5 = 40$ years

Present son's age is $x + 5 = 5 + 5 = 10$ years

14. I am currently 5 times as old as my son. In 6 years time I will be three times as old as he will be then. What are our ages now?

Solution:

Let the present son's age be x years

Present father's age be $5x$ years

Son's age after 6 years = $(x + 6)$ years

Fathers' age after 6 years = $(5x + 6)$ years

So,

$$5x + 6 = 3(x + 6)$$

$$5x + 6 = 3x + 18$$

$$5x - 3x = 18 - 6$$

$$2x = 12$$

$$x = 12/2$$

$$= 6$$

∴ present son's age is $x = 6$ years

Present father's age is $5x = 5(6) = 30$ years

15. I have Rs 1000 in ten and five rupee notes. If the number of ten rupee notes that I have is ten more than the number of five rupee notes, how many notes do I have in each denomination?

Solution:

Let the number of five rupee notes be x

Number of ten rupee notes be $(x + 10)$

Amount due to five rupee notes = $5 \times x = 5x$

Amount due to ten rupee notes = $10(x + 10) = 10x + 100$

The total amount = Rs 1000

$$5x + 10x + 100 = 1000$$

$$15x = 900$$

$$x = 900/15$$

$$= 60$$

\therefore the number of five rupee notes are $x = 60$

Number of ten rupee notes are $x + 10 = 60 + 10 = 70$

16. At a party, colas, squash and fruit juice were offered to guests. A fourth of the guests drank colas, a third drank squash, two fifths drank fruit juice and just three did not drink anything. How many guests were in all?

Solution:

Let the number of guests be x

The given details are Number of guests who drank colas are $x/4$

Number of guests who drank squash are $x/3$

Number of guests who drank fruit juice are $2x/5$

Number of guests who did not drink anything are 3

$$x/4 + x/3 + 2x/5 + 3 = x$$

By taking LCM for 4, 3 and 5 is 60

$$(15x + 20x + 24x - 60x)/60 = -3$$

By cross-multiplying we get,

$$(15x + 20x + 24x - 60x) = -3(60)$$

$$-x = -180$$

$$x = 180$$

\therefore The total number of guests in all were 180

17. There are 180 multiple choice questions in a test. If a candidate gets 4 marks for every correct answer and for every unattempted or wrongly answered question one mark is deducted from the total score of correct answers. If a candidate scored 450 marks in the test, how many questions did he answer correctly?

Solution:

Let the number of correct answers be x

Number of questions answered wrong are $(180 - x)$

Total score when answered right = $4x$

Marks deducted when answered wrong = $1(180 - x) = 180 - x$

So,

$$4x - (180 - x) = 450$$

$$4x - 180 + x = 450$$

$$5x = 450 + 180$$

$$5x = 630$$

$$x = 630/5$$

$$= 126$$

∴ 126 questions he answered correctly.

18. A labourer is engaged for 20 days on the condition that he will receive Rs 60 for each day, he works and he will be fined Rs 5 for each day, he is absent. If he receives Rs 745 in all for how many days he remained absent?

Solution:

Let us consider the number of absent days as x

So, number of present days is $(20 - x)$

Wage for one day work = Rs 60

Fine for absent day = Rs 5

So,

$$60(20 - x) - 5x = 745$$

$$1200 - 60x - 5x = 744$$

$$-65x = 744 - 1200$$

$$-65x = -456$$

$$x = -456/-65$$

$$= 7$$

∴ For 7 days the labourer was absent.

19. Ravish has three boxes whose total weight is $60\frac{1}{2}$ Kg. Box B weighs $3\frac{1}{2}$ kg more than box A and box C weighs $5\frac{1}{3}$ kg more than box B. Find the weight of box A.

Solution:

The given details are total weight of three boxes is $60\frac{1}{2}$ kg = $121/2$ kg

Let the weight of box A be x kg

Weight of box B be $x + 7/2$ kg

Weight of box C be $x + 7/2 + 16/3$ kg

So,

$$x + x + 7/2 + x + 7/2 + 16/3 = 121/2$$

$$3x = 121/2 - 7/2 - 7/2 - 16/3$$

By taking LCM for 2 and 3 is 6

$$3x = (363 - 21 - 21 - 32)/6$$

$$3x = 289/6$$

$$x = 289/18$$

∴ The weight of box A is 289/18 kg

20. The numerator of a rational number is 3 less than the denominator. If the denominator is increased by 5 and the numerator by 2, we get the rational number $1/2$. Find the rational number.

Solution:

Let the denominator be x and the numerator be $(x - 3)$

By using the formula

$$\begin{aligned} \text{Fraction} &= \text{numerator/denominator} \\ &= (x - 3)/x \end{aligned}$$

So, when numerator is increased by 2 and Denominator is increased by 5, then fraction is $1/2$

$$(x - 3 + 2)/(x + 5) = 1/2$$

$$(x - 1)/(x + 5) = 1/2$$

By using cross-multiplication, we get

$$2(x - 1) = x + 5$$

$$2x - 2 = x + 5$$

$$2x - x = 2 + 5$$

$$x = 7$$

∴ Denominator is $x = 7$, numerator is $(x - 3) = 7 - 3 = 4$

And the fraction = numerator/denominator = $4/7$

21. In a rational number, twice the numerator is 2 more than the denominator. If 3 is added to each, the numerator and the denominator. The new fraction is $2/3$. Find the original number.

Solution:

Let the numerator be x and the denominator be $(2x - 2)$

By using the formula

$$\begin{aligned} \text{Fraction} &= \text{numerator/denominator} \\ &= x / (2x - 2) \end{aligned}$$

So, the numerator and denominator are increased by 3, then fraction is $2/3$

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

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

By cross-multiplying we get,

$$3(x + 3) = 2(2x + 1)$$

$$3x + 9 = 4x + 2$$

$$3x - 4x = 2 - 9$$

$$-x = -7$$

$$x = 7$$

∴ The numerator is $x = 7$, denominator is $(2x - 2) = (2(7) - 2) = 14 - 2 = 12$

And the fraction is numerator/denominator = $7/12$

22. The distance between two stations is 340 km. Two trains start simultaneously from these stations on parallel tracks to cross each other. The speed of one of them is greater than that of the other by 5 km/hr. If the distance between the two trains after 2 hours of their start is 30 km, find the speed of each train.

Solution:

Let the speed of one train be x km/hr.

Speed of other train be $(x + 5)$ km/hr.

Total distance between two stations = 340 km

By using the formula

Distance = speed \times time

So, Distance covered by one train in 2 hrs. Will be $x \times 2 = 2x$ km

Distance covered by other train in 2 hrs. Will be $2(x + 5) = (2x + 10)$ km

Distance between the trains is 30 km

$$2x + 2x + 10 + 30 = 340$$

$$4x + 40 = 340$$

$$4x = 340 - 40$$

$$4x = 300$$

$$x = 300/4$$

$$= 75$$

∴ The speed of one train is $x = 75$ km/hr.

Speed of other train is $(x + 5) = 75 + 5 = 80$ km/hr.

23. A steamer goes downstream from one point another in 9 hours. It covers the same distance upstream in 10 hours. If the speed of the stream be 1 km/hr., find the speed of the steamer in still water and the distance between the ports.

Solution:

Let the speed of steamer be x km/hr.

Speed of stream = 1 km/hr.

Downstream speed = $(x + 1)$ km/hr.

Upstream speed = $(x - 1)$ km/hr.

By using the formula

$$\begin{aligned}\text{Distance} &= \text{speed} \times \text{time} \\ &= (x + 1) \times 9 \text{ and} \\ &= (x - 1) \times 10\end{aligned}$$

$$9x + 9 = 10x - 10$$

$$9x - 10x = -10 - 9$$

$$-x = -19$$

$$x = 19 \text{ km/hr.}$$

∴ The speed of the steamer in still water is 19 km/hr.

Distance between the ports is $9(x + 1) = 9(19+1) = 9(20) = 180 \text{ km.}$

24. Bhagwanti inherited Rs 12000.00. She invested part of it as 10% and the rest at 12%. Her annual income from these investments is Rs 1280.00 How much did she invest at each rate?

Solution:

At rate of 10% Let the investment be Rs x

At the rate of 12% the investment will be Rs $(12000 - x)$

At 10% of rate the annual income will be $x \times (10/100) = 10x/100$

At 12% of rate the annual income will be $(12000 - x) \times 12/100 = (144000 - 12x)/100$

Total investment = 1280

So, $10x/100 + (144000 - 12x)/100 = 1280$

$$(10x + 144000 - 12x)/100 = 1280$$

$$(144000 - 2x)/100 = 1280$$

By cross-multiplying we get,

$$144000 - 2x = 1280(100)$$

$$-2x = 128000 - 144000$$

$$-2x = -16000$$

$$x = -16000/-2$$

$$= 8000$$

∴ At 10% of rate she invested Rs 8000 and at 12% of rate she invested Rs $(12000 - x) =$
Rs $(12000 - 8000) =$ Rs 4000

25. The length of a rectangle exceeds its breadth by 9 cm. If length and breadth are each increased by 3 cm, the area of the new rectangle will be 84 cm² more than that of the given rectangle. Find the length and breadth of the given rectangle.

Solution:

Let the breadth of the rectangle be x meter

Length of the rectangle be $(x + 9)$ meter

Area of the rectangle length \times breadth = $x(x + 9) \text{ m}^2$

When length and breadth increased by 3cm then,

$$\text{New length} = x + 9 + 3 = x + 12$$

$$\text{New breadth} = x + 3$$

So, Area is

$$(x + 12)(x + 3) = x(x + 9) + 84$$

$$x^2 + 15x + 36 = x^2 + 9x + 84$$

$$15x - 9x = 84 - 36$$

$$6x = 48$$

$$x = 48/6$$

$$= 8$$

∴ Length of the rectangle $(x + 9) = (8 + 9) = 17\text{cm}$ and breadth of the rectangle is 8cm.

26. The sum of the ages of Anup and his father is 100. When Anup is as old as his father now, he will be five times as old as his son Anuj is now. Anuj will be eight years older than Anup is now, when Anup is as old as his father. What are their ages now?

Solution:

Let the age of Anup be x years

So age of Anup's father will be $(100 - x)$ years

The age of Anuj is $(100-x)/5$ years

So, When Anup is as old as his father after $(100 - 2x)$ years,

Then Anuj's age = present age of his father (Anup) + 8

Present age of Anuj + $100 - 2x =$ Present age of Anup + 8

$$(100 - x)/5 + (100 - 2x) = x + 8$$

$$(100-x)/5 - 3x = 8 - 100$$

$$(100 - x - 15x)/5 = -92$$

By cross-multiplying we get,

$$100 - 16x = -460$$

$$-16x = -460 - 100$$

$$-16x = -560$$

$$x = -560/-16$$

$$= 35$$

∴ Present age of Anup is 35 years then, Age of Anup's father will be $(100-x) = 100-35 = 65$ years

The age of Anuj is $(100-x)/5 = (100 - 35)/5 = 65/5 = 13$ years

27. A lady went shopping and spent half of what she had on buying hankies and gave a rupee to a begger waiting outside the shop. She spent half of what was left of what was left on a lunch and followed that up with a two rupee tip. She spent half of

the remaining amount on a book and three rupees on bus fare. When she reached home, she found that she had exactly one rupee left. How much money did she start with?

Solution:

Let the amount lady had be Rs x

Amount spent for hankies and given to beggar is $x/2 + 1$

Remaining amount is $x - (x/2 + 1) = x/2 - 1 = (x-2)/2$

Amount spent for lunch $(x-2)/2 \times 1/2 = (x-2)/4$

Amount given as tip is Rs 2

Remaining amount after lunch $= (x-2)/2 - (x-2)/4 - 2 = (2x - 4 - x + 2 - 8)/4 = (x - 10)/4$

Amounts spent for books $= 1/2 \times (x-10)/4 = (x-10)/8$

Bus fare is Rs 3

Amount left $= (x-10)/4 - (x-10)/8 - 3 = (2x - 20 - x + 10 - 24)/8 = (x-34)/8$

So from the question we know that the amount left = Rs 1

$(x-34)/8 = 1$

By cross-multiplying we get,

$$x - 34 = 8$$

$$x = 8 + 34$$

$$= 42$$

\therefore the lady started with Rs. 42