Linear Equation in one variable

$Ex : 9.1$

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

$9\frac{1}{4} = \frac{36+1}{4} = \frac{37}{4}$

$1\frac{1}{3} = \frac{1\times3 + 1}{3} = \frac{4}{3}$

$\Rightarrow \quad \frac{37}{4} = y - \frac{4}{3}$

$\Rightarrow \quad \frac{37}{4} + \frac{4}{3} = y - \frac{4}{3} + \frac{4}{3}$ $\qquad$ [Adding $\frac{4}{3}$ on both sides]

$\Rightarrow \quad \frac{37}{4} + \frac{4}{3} = y$

$y = \frac{37\times3 + 4\times4}{4\times3}$ $\qquad$ [Taking L.C.M]

$y = \frac{127}{12}$

$\therefore \quad \boxed{y = \frac{127}{12}}$

substitute 'y' in Equation

$\therefore \quad \frac{37}{4} = \frac{127}{12} - \frac{4}{3}$

$\qquad = \frac{127 - 4\times4}{12}$

$\frac{37}{4} = \frac{111}{12}$

$\boxed{\frac{37}{4} = \frac{37}{4}}$

$L.H.S = R.H.S$

⑤ $\frac{5x}{3} + \frac{2}{5} = 1$

$\frac{5x}{3} + \frac{2}{5} - \frac{2}{5} = 1 - \frac{2}{5}$ 〔subtracting $\frac{2}{5}$ on b/s〕

$\frac{5x}{3} = \frac{5}{5} - \frac{2}{5}$

$\frac{5x}{3} = \frac{5-2}{5}$

$\frac{5x}{3} = \frac{3}{5}$

$x = \frac{3}{5} \cdot \frac{3}{5}$

$$\boxed{x = \frac{9}{25}}$$

Substitute x in Eq.

$\frac{5}{3}\left(\frac{9}{25}\right) + \frac{2}{5} = 1$

$\left(\frac{5}{3}\right)\left(\frac{3 \times 3}{5 \times 5}\right) + \frac{2}{5} = 1$

$\frac{3}{5} + \frac{2}{5} = 1$

$\frac{5}{5} = 1$

$L \cdot HS = R.HS$

Hence proved.

③ $\frac{x}{2} + \frac{x}{3} + \frac{x}{4} = 13$.

L.C.M of 2,3,4 is 12

Multiply 12 on both sides

$\left(\frac{x}{2} + \frac{x}{3} + \frac{x}{4} \right) 12 = 13 \times 12$

$12 \times \frac{x}{2} + 12 \times \frac{x}{3} + 12 \times \frac{x}{4} = 156$

$6 \times 2 \times \frac{x}{2} + 4 \times 3 \times \frac{x}{3} + 4 \times 3 \times \frac{x}{4} = 156$

$6x + 4x + 3x = 156$

$13x = 156$

$\boxed{x = 12}$

Substitute x in Equation.

$\frac{12}{2} + \frac{12}{3} + \frac{12}{4} = 13$

$\frac{2 \times 6}{2} + \frac{4 \times 3}{3} + \frac{4 \times 3}{4} = 13$

$6 + 4 + 3 = 13$

$13 = 13$

$\boxed{L.H.S = R.H.S}$

Hence verified

(4) $\quad \dfrac{x}{2} + \dfrac{x}{8} = \dfrac{1}{8}$

L·C·M of $\quad 2, 8 \quad$ is $\quad 8.$

Multiple with 8 on both sides.

$$\left(\dfrac{x}{2} + \dfrac{x}{8}\right) 8 = \dfrac{1}{8} \times 8$$

$$\dfrac{x}{2} \times 4 \times 2 + \dfrac{x}{8} \times 8 = \dfrac{1}{8} \times 8$$

$$4x + x = 1$$

$$5x = 1$$

$$\dfrac{5}{5}x = \dfrac{1}{5} \qquad [\text{dividing eq. with } 5]$$

$$\boxed{x = \dfrac{1}{5}}$$

Substitute value in eq.

$$\dfrac{\left(\dfrac{1}{5}\right)}{2} + \dfrac{\left(\dfrac{1}{5}\right)}{8} = \left(\dfrac{1}{8}\right)$$

$$\dfrac{1}{10} + \dfrac{1}{40} = \dfrac{1}{8}$$

$$\dfrac{4}{4 \times 10} + \dfrac{1}{40} = \dfrac{1}{8}$$

$$\dfrac{4}{40} + \dfrac{1}{40} = \dfrac{1}{8}$$

$$\dfrac{4+1}{40} = \dfrac{1}{8}$$

$$\dfrac{5}{40} = \dfrac{1}{8}$$

$$\dfrac{1}{8} = \dfrac{1}{8} \qquad \text{Hence verified.}$$

⑤ $\dfrac{2x}{3} - \dfrac{3x}{8} = \cdot \dfrac{7}{12}$

L.C.M of 3, 8 . is 24

Multiply the Eq with 24 on both sides

$$\left(\dfrac{2x}{3} - \dfrac{3x}{8}\right) 24 = \dfrac{7}{12} \times 24$$

$$\dfrac{2x}{3} \times 8 \times 3 - \dfrac{3x}{8} \times 8 \times 3 = \dfrac{7}{12} \times 12 \times 2$$

$$16x - 9x = 14$$

$$7x = 14$$

$$x = \dfrac{14}{7}$$

$$x = \dfrac{7 \times 2}{7}$$

$$\boxed{x = 2}$$

Substitute x in Eq.

$$\dfrac{2x}{3} - \dfrac{3x}{8} = \dfrac{7}{12}$$

$$\dfrac{2}{3}(2) - \dfrac{3}{8}(2) = \dfrac{7}{12}$$

$$\dfrac{4}{3} - \dfrac{3}{4 \times 2} \times 2 = \dfrac{7}{12}$$

$$\dfrac{4}{3} - \dfrac{3}{4} = \dfrac{7}{12}$$

$$\dfrac{4 \times 4}{3 \times 4} - \dfrac{3 \times 3}{4 \times 3} = \dfrac{7}{12}$$

$$\dfrac{16}{12} - \dfrac{9}{12} = \dfrac{7}{12}$$

$$\dfrac{7}{12} = \dfrac{7}{12} \qquad L.HS = R.H.S$$

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

we know that $(x+a)(x+b) = x^2 + ab + ax + bx$

$\therefore$ Eq. $\Rightarrow$

$\Rightarrow x^2 + 2x + 3x + 6 + x^2 - 3x - 2x + 6 - 2x^2 - 2x = 0.$

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

$\Rightarrow -2x + 12 = 0.$

$2x - 2x + 12 = 2x$

$2x = 12$

$x = \dfrac{12}{2}$

$\boxed{x = 6}$

Sub. $x = 6$ in Eq.

$(6+2)(6+3) + (6-3)(6-2) - 2(6)(6+1) = 0$

$(8)(9) + (3)(4) - 12(7) = 0.$

$72 + 12 - 84 = 0.$

$84 - 84 = 0.$

$0 = 0$

L.H.S = R.H.S

Hence verified.

⑦ $\dfrac{x}{2} - \dfrac{4}{5} + \dfrac{x}{5} + \dfrac{3x}{10} = \dfrac{1}{5}$

l.c.m of 2, 5, 10 is 10.

multiply the eq. with 10 on both sides

$10\left(\dfrac{x}{2} - \dfrac{4}{5} + \dfrac{x}{5} + \dfrac{3x}{10}\right) = \to 10 \times \dfrac{1}{5}$

$2 \times 5 \times \dfrac{x}{2} - 5 \times 2 \times \dfrac{4}{5} + 5 \times 2 \times \dfrac{x}{5} + 10 x \dfrac{3x}{10} = 5 \times 2 \times \dfrac{1}{5}$

$$5x - 8 + 2x + 3x = 2$$
$$10x - 8 = 2$$
$$10x - 8 + 8 = 2 + 8$$
$$10x = 10$$
$$x = \dfrac{10}{10}$$
$$x = 1$$

Sub value of x in eq.

$\dfrac{1}{2} - \dfrac{4}{5} + \dfrac{1}{5} + \dfrac{3(1)}{10} = \dfrac{1}{5}$

$\dfrac{5}{5} \quad \dfrac{10}{10 \times 2} - \dfrac{4 \times 2}{5 \times 2} + \dfrac{2}{5 \times 2} + \dfrac{3}{10} = \dfrac{1}{5}$

$\dfrac{10}{20} - \dfrac{8}{20} + \dfrac{2}{10}$

$\dfrac{5}{5 \times 2} - \dfrac{4 \times 2}{5 \times 2} + \dfrac{1 \times 2}{5 \times 2} + \dfrac{3}{10} = \dfrac{1}{5}$

$\dfrac{5}{10} - \dfrac{8}{10} + \dfrac{2}{10} + \dfrac{3}{10} = \dfrac{1}{5}$

$\dfrac{-3 + 3 + 2}{10} = \dfrac{1}{5} \quad \Rightarrow \boxed{\dfrac{1}{5} = \dfrac{1}{5}}$

(8) $\frac{7}{x} + 35 = \frac{1}{10}$

multiply eq. with x on bothsides

$$\frac{7}{x} \times x + 35 \times x = \frac{1}{10} \times x$$

$$7 + 35x = \frac{x}{10}$$

$$7 + 35x - 35x = \frac{x}{10} - 35x$$

$$7 = \frac{x}{10} - \frac{350}{10}x$$

$$7 = \frac{x - 350x}{10}$$

$$7 = \frac{-349x}{10}$$

$$7 \times 10 = \frac{-349}{10}x \times 10$$

$$x = \frac{-70}{349}$$

$$\boxed{x = \frac{-70}{349}}$$

Substitub x in eq.

$$\frac{7}{(-70/349)} + 35 = \frac{1}{10}$$

$$\Rightarrow \frac{-7 \times 349}{\frac{70}{10}} + 35 = \frac{1}{10}$$

$$\Rightarrow \frac{-349}{10} + \frac{350}{10} = \frac{1}{10}$$

$$\boxed{\frac{1}{10} = \frac{1}{10}} \quad \text{Hence verified.}$$

(9) $\left(\dfrac{2x-1}{3}\right) - \left(\dfrac{6x-2}{5}\right) = \dfrac{1}{3}$

$\dfrac{(2x-1)5}{3\times5} - \dfrac{(6x-2)3}{5\times3} = \dfrac{1}{3}$

$\dfrac{(2x-1)5}{15} - \dfrac{(6x-2)3}{15} = \dfrac{1}{3}$

$\dfrac{(2x-1)5 - (6x-2)3}{15} = \dfrac{1}{3}$

$(2x-1)5 - (6x-2)3 = \dfrac{15}{3}$

$10x - 5 - 18x + 6 = 5$

$-8x + 1 = 5$

$8x = -4$

$x = -4/8$

$\boxed{x = -1/2}$

Substitute x in Eq.

$\left[\dfrac{2\left(-1/2\right) - 1}{3}\right] - \left[\dfrac{6\left(-1/2\right) - 2}{5}\right] = \dfrac{1}{3}$

$\left[\dfrac{-1-1}{3}\right] - \left[\dfrac{-3-2}{5}\right] = \dfrac{1}{3}$

$\left[\dfrac{-2}{3}\right] - \left[\dfrac{-5}{5}\right] = \dfrac{1}{3}$

$-\dfrac{2}{3} + 1 = \dfrac{1}{3}$

$1 = \dfrac{1}{3} + \dfrac{2}{3}$

$\boxed{1 = 1}$ Hence verified.

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

$13y - 13\times4 - 3y + (3\times9) - 5y - 5\times4 = 0$

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

$5y - 25 - 20 = 0$

$5y = 45$

$y = \dfrac{45}{5}$

$\boxed{y = 9}$

Substitute 'y' in Eq.

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

$13(5) - 3(0) - 5(13) = 0$

$65 + 3 - 60 = 0$

$65 - 65 = 0$

$\boxed{0 = 0}$

Hence verified.

(11) $\frac{2}{3}(x-5) - \frac{1}{4}(x-2) = \frac{9}{2}$.

$\frac{2}{3}(x-5) \times \frac{4}{4} - \frac{1}{4}(x-2) \times \frac{3}{3} = \frac{9}{2}$

$\Rightarrow \frac{8}{12}(x-5) - \frac{3}{12}(x-2) = \frac{9}{2}$

$\Rightarrow \frac{8(x-5) - 3(x-2)}{12} = \frac{9}{2}$

$\Rightarrow \frac{8x - 40 - 3x + 6}{12} = \frac{9}{2}$

$\Rightarrow 5x - 34 = \frac{12^6 \times 9}{2}$

$5x - 34 = 54$

$5x = 88$

$\boxed{x = \frac{88}{5}}$

Substitute x in Eq.

$\frac{2}{3}\left(\frac{88}{5} - 5\right) - \frac{4}{4}\left(\frac{88}{5} - 2\right) = \frac{9}{2}$

$\Rightarrow \frac{2}{3}\left(\frac{88}{5} - \frac{25}{5}\right) - \frac{1}{4}\left(\frac{88}{5} - \frac{10}{5}\right) = \frac{9}{2}$

$\Rightarrow \frac{2}{3}\left(\frac{63^{21}}{5}\right) - \frac{1}{4}\left(\frac{78^{39}}{5}\right) = \frac{9}{2}$

$\Rightarrow \frac{42}{5} - \frac{39}{10} = \frac{9}{2}$

$\Rightarrow \boxed{\frac{9}{2} = \frac{9}{2}}$ Hence verified

Linear Equation In One Variable Ex 9.2

Ex: 9.2

(1) $\dfrac{2x+5}{3} = 3x - 10$

$\left(\dfrac{2x+5}{3}\right) \times 3 = (3x-10)3$ $\quad$ [∵ multiplying Eq. with 3]

$(2x+5) \times \dfrac{3}{3} = (3x-10)3$

$2x+5 = 3x \times 3 - 10 \times 3$

$2x+5 = 9x - 36$

$7x = 35$

$7x = 7 \times 5$

$\dfrac{7x}{7} = \dfrac{7 \times 5}{7}$ $\quad$ [∵ dividing Eq. with 7]

$\boxed{x = 5}$

Sub. x in Eq.

$\dfrac{2(5)+5}{3} = 3(5) - 10$

$\dfrac{10+5}{3} = 3(5) - 10$

$\dfrac{15}{3} = 15 - 10$

$\dfrac{5 \times 3}{3} = 5$

$5 = 5$

hence verified.

② $\dfrac{a-8}{3} = \dfrac{a-3}{2}$

$\left(\dfrac{a-8}{3}\right) \times \left(\dfrac{2}{2}\right) = \left(\dfrac{a-3}{2}\right) \times \left(\dfrac{3}{3}\right)$ $\left[\because 1 = \dfrac{3}{3} = \dfrac{2}{2}\right]$

$\dfrac{2(a-8)}{6} = \dfrac{3(a-3)}{6}$

$\dfrac{2(a-8)}{6} \times 6 = \dfrac{3(a-3)}{6} \times 6$ (multiplying eq. with 6)

$2a - 16 = 3a - 9$

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

$a = -16 + 9$

$a = -7$

Substitute 'a' in eq.

$\dfrac{-7-8}{3} = \dfrac{-7-3}{2}$

$-\dfrac{15}{3} = -\dfrac{10}{2}$

$-\dfrac{5 \times 3}{3} = -\dfrac{5 \times 2}{2}$

$-5 = -5$

hence verified.

③ $\dfrac{7y+2}{5} = \dfrac{6y-5}{11}$

$\left(\dfrac{7y+2}{5}\right) 1 = \left(\dfrac{6y-5}{11}\right) \times 1$

$\left(\dfrac{7y+2}{5}\right)\left(\dfrac{11}{11}\right) = \left(\dfrac{6y-5}{11}\right)\left(\dfrac{5}{5}\right)$

$$\frac{11(7y+2)}{55} = \frac{5(6y-5)}{55}$$

$$\frac{11(7y+2)}{55} \times 55 = \frac{5(6y-5)}{55} \times 55$$

| $\because$ multiplying the eq. with 55]

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

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

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

$$47y = -47.$$

$$y = \frac{-47}{47}$$

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

substitute y in eq.

$$\frac{7(-1)+2}{5} = \frac{6(-1)-5}{11}$$

$$\frac{-7+2}{5} = \frac{-6-5}{11}$$

$$\frac{-5}{5} = \frac{-11}{11}$$

$$\boxed{(-1 = -1)}$$

Hence verified.

4) $x - 2x + 2 - \frac{16}{3}x + 5 = 3 - \frac{7}{2}x$

$-x + 2 + 5 - \frac{16}{3}x = 3 - \frac{7}{2}x$

$-x + 7 - \frac{16}{3}x = 3 - \frac{7}{2}x$

$-x + 7 - 3 - \frac{16}{3}x = 3 - 3 - \frac{7}{2}x$

$-x + 4 - \frac{16}{3}x = -\frac{7}{2}x$

multiplying Eq. with 6 on b/s.

$\Rightarrow \left(-x + 4 - \frac{16}{3}x\right)6 = \left(-\frac{7}{2}x\right)6$

$\Rightarrow -6x + 24 - \frac{16}{3}x \times 3 \times 2 = -\frac{7}{2}x \times 3 \times 2$

$\Rightarrow -6x + 24 - 32x = -21x$

$\Rightarrow 24 - 38x = -21x$

$\Rightarrow 24 - 38x + 38x = +38x - 21x$

$\Rightarrow 24 = 17x$

$\Rightarrow \frac{24}{17} = \frac{17}{17}x$

$$\boxed{x = \frac{24}{17}}$$

Substitute x in Eq.

$\frac{24}{17} - 2\left(\frac{24}{17}\right) + 2 - \frac{16}{3}\left(\frac{24}{17}\right) + 5 = 3 - \frac{7}{2}\left(\frac{24}{17}\right)$

$$\frac{24}{17} - \frac{48}{17} + 2 - \frac{16}{8} \times \frac{8 \times 3}{7} + 5 = 3 - \frac{7}{2} \times \frac{2 \times 2}{17}$$

$$\frac{-24}{17} + 2 - \frac{128}{7} + 5 = 3 - \frac{84}{17}$$

$$-3 + \left(-\frac{24}{17}\right) + 7 - \frac{128}{7} = 3 - \frac{84}{17} - 3$$

$$4 - \frac{24}{17} + \frac{24}{17} - \frac{128}{7} = \frac{-84}{17} + \frac{24}{17}$$

$$4 - \frac{128}{7} = \frac{-60}{17}$$

$$\frac{4 \times 7}{7} - \frac{128}{7} = \frac{-60}{17}$$

$$\frac{28 - 128}{7} = \frac{-60}{17}$$

$$\frac{100}{7} = \frac{60}{17}$$

$$\frac{6}{17} = \frac{6}{17}$$

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

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

[Adding "−7x" on both sides]

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

$\frac{x}{2} - 6 + 6 = \frac{1}{4} + 6$ [Adding +6 on b/s]

$\frac{x}{2} = \frac{1}{4} + \frac{6 \times 4}{4}$ $\left[6(1) = 6 \times \frac{4}{4}\right]$

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

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

$$\frac{x}{2} \times 2 = \frac{25}{4} \times 2 \qquad \text{(Multiplying Eq with 2)}$$

$$x = \frac{25}{2 \times 2} \times 2$$

$$\boxed{x = \frac{25}{2}}$$

Substitute x in Eq.

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

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

$$\left[\text{Adding } -7\left(\frac{25}{2}\right) \text{ on bothsides} \right]$$

$$\left(\frac{25}{4}\right) - 6 = \frac{1}{4}$$

$$\frac{25}{4} - \frac{6 \times 4}{4} = \frac{1}{4} \qquad \left[6(1) = 6\left(\frac{4}{4}\right) \right]$$

$$\frac{25 - 24}{4} = \frac{1}{4}$$

$$\frac{1}{4} = \frac{1}{4}$$

$$\boxed{1 = 1} \qquad \text{Hence verified.}$$

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

Adding $-4x + 6$ on both sides

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

$\frac{3x}{4} + 6 = \frac{7}{8} + 2x$

multiplying Eq. with 8.

$\frac{3x}{4} \times 8^2 + 6 \times 8 = \frac{7}{8} \times 8 + 2x \times 8$

$6x + 48 = 7 + 16x$

adding $-6x - 7$ on both sides

$-6x - 7 + 6x + 48 = 7 + 16x - 6x - 7$

$41 = 10x$

$$\boxed{x = \frac{41}{10}}$$

Verify x in Eq.

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

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

Adding $+6 - \frac{164}{10}$ on both sides

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

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

$$\frac{123 + 240}{40} = \frac{7}{8} + \frac{82}{10}$$

multiplying Eq. with 40.

$$\frac{363}{40} \times 40 = \frac{7}{8} \times 40 + \frac{82}{10} \times 40$$

$$\cancel{19 \cancel{} \cancel{} } = 35 + 328$$

$$\boxed{363 = 363}$$

Hence verified.

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

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

$\Rightarrow \quad \frac{\cancel{2}x}{\cancel{2}} = \frac{20x}{3} + 10$

$x = \frac{20}{3}x + 10 \qquad \left[\text{Adding } -\frac{20}{3}x \text{ on bothsides}\right]$

$x - \frac{20}{3}x = \frac{20\cancel{x}}{\cancel{3}} - \frac{20x}{3} + 10$

$\frac{3x}{3} - \frac{20x}{3} = 10$

$\frac{3x - 20x}{3} = 10$

$\frac{-17x}{3} = 10$

multiplying eq. with $\left(\frac{-3}{17}\right)$

$$\frac{17}{3} x \times \frac{-3}{17} = 10 \times \left(\frac{-3}{17}\right)$$

$$\boxed{x = \frac{-30}{17}}$$

Substitute x in Eq.

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

$$\left(\frac{7}{2}\right)\left(\frac{-15 \times 2}{17}\right) + \frac{5}{2}\left(\frac{15 \times 2}{17}\right) = \frac{-20 \times 3 \times 10}{3 \times 17} + 10$$

$$-\frac{105}{17} + \frac{75}{17} = -\frac{200}{17} + 10.$$

$$\frac{75-105}{17} = -\frac{200}{17} + 10$$

Adding $+\frac{200}{17}$ on b/s.

$$-\frac{30}{17} + \frac{200}{17} = -\frac{200}{17} + \frac{200}{17} + 10$$

$$\frac{-30 + 200}{17} = 10$$

$$+\frac{170}{17} = 10$$

$$\frac{17 \times 10}{17} = 10$$

$$\boxed{10 = 10}$$

Hence verified.

⑧ $\dfrac{6x+1}{2} + 1 = \dfrac{7x-3}{3}$

multiply eq. with 6.

$\left(\dfrac{6x+1}{2}\right)(6) + 1(6) = \left(\dfrac{7x-3}{3}\right)(6)$

$(6x+1)\dfrac{(3\times\cancel{6})}{\cancel{2}} + 6 = \left(\dfrac{7x-3}{3}\right)(\cancel{3}\times 2)$

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

$18x + 3 + 6 = 14x - 6.$

$4x = -6 - 6 - 3$

$4x = -15$

$x = \dfrac{-15}{4}$

Substitute 'x' in eq.

$\left[\dfrac{6\left(\dfrac{-15}{4}\right)+1}{2}\right] + 1 = \dfrac{7\left(\dfrac{-15}{4}\right)-3}{3}$

$\left[\dfrac{\left(\dfrac{-45}{2}\right)+1}{2}\right] + 1 = \dfrac{\dfrac{-105}{4}-3}{3}$

multiply with 6 on b/s

$\left[\dfrac{\left(-\dfrac{45}{2}\right)+1}{\cancel{2}}\right]\times\cancel{6}\times 3 + 1\times 6 = \left(\dfrac{\dfrac{-105}{4}-3}{\cancel{3}}\right)\cancel{6}$

$-\dfrac{135}{2} + 3 + 6 = \left(\dfrac{-105}{4}-3\right)2$

$\dfrac{-135}{2} + 9 = -\dfrac{105}{2} - 6$

$-15 = -15$ Hence verified

⑨ $\dfrac{3a-2}{3} + \dfrac{2a+3}{2} = a + \dfrac{7}{6}$

multiplying eq. with 6 on b/s.

$\left(\dfrac{3a-2}{\cancel{3}}\right)(3\times2) + \left(\dfrac{2a+3}{\cancel{2}}\right)(2\times3) = a\times6 + \dfrac{7}{\cancel{6}}\times6$

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

$\Rightarrow \quad 6a - 4 + 6a + 9 = 6a + 7$

$\Rightarrow \quad 12a + 5 = 6a + 7$

$\Rightarrow \quad 6a = 2$

$\Rightarrow \quad a = 2/6$

$\boxed{a = 1/3}$

Substitute 'a' in eq.

$\left[\dfrac{3\left(1/3\right)-2}{3}\right] + \left[\dfrac{2\left(1/3\right)+3}{2}\right] = \left[\dfrac{1}{3} + \dfrac{7}{6}\right]$

multiplying eq. with 6

$\left[\dfrac{1-2}{3}\right]6 + \left[\dfrac{\frac{2}{3}+3}{2}\right]6 = \left[\dfrac{1}{3} + \dfrac{7}{6}\right]6$

$(-1)(2) + 2 + 9 = 2 + 7$

$-2 + 2 + 9 = 2 + 7$

$9 = 9$

Hence verified.

(10) $x - \dfrac{(x-1)}{2} = 1 - \dfrac{(x-2)}{3}$

multiplying Eq. with 6

$x \times 6 - \left(\dfrac{x-1}{2}\right)(3 \times 2) = 6 - \left(\dfrac{x-2}{2}\right)(3 \times 2)$

$\Rightarrow 6x - 3x + 3 = 6 - 2x + 4$

$\Rightarrow 3x + 3 = -2x + 10$

$5x = 7$

$$\boxed{x = 7/5}$$

Substitute 'x' in Eq.

$\left(\dfrac{7}{5}\right) - \dfrac{\left(\dfrac{7}{5} - 1\right)}{2} = 1 - \dfrac{\left(\dfrac{7}{5} - 2\right)}{3}$

divid multiply Eq. with 30.

$\dfrac{7}{5} \times 6 \times 5 - \left(\dfrac{\frac{7}{5} - 1}{2}\right)(6 \times 5) = 30 - \dfrac{\frac{7}{5} - 2}{3} \times 30$

$42 - 21 + 15 = 30 - 14 + 20$

$36 = 36$

Hence verified

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

multiplying Eq. with 12

$\dfrac{3x}{4} \times 4 \times 3 - \dfrac{(x-1)}{2} \times 6 \times 2 = \left(\dfrac{x-2}{3}\right)(4 \times 3)$

$9x - 6(x-1) = 4(x-2)$

$9x - 6x + 6 = 4x - 8$

$$\boxed{x = +14}$$

$\left(\dfrac{3}{4}\right)(14) - \left(\dfrac{14-1}{2}\right) = \left(\dfrac{14-2}{3}\right)$

multiplying Eq. with 6.

$\dfrac{3}{2} \times 7 \times 6^3 - \dfrac{13}{2} \times 3 \times 2 = \dfrac{12}{3} \times 3 \times 2$

$63 - 39 = 24$

$24 = 24$

Hence verified

(12) $\dfrac{5x}{3} - \left(\dfrac{x-1}{4}\right) = \left(\dfrac{x-3}{5}\right)$

multiply eq. with 60

$\dfrac{5x}{3} \times 3 \times 20 \quad - \dfrac{(x-1)}{4} \times 15 \times 4 \quad = \left(\dfrac{x-3}{5}\right)(5 \times 12)$

$100x - 15(x-1) = 12(x-3)$

$100x - 15x + 15 = 12x - 36$

$100x - 27x = -36 - 15$

$73x = -51$

$x = \dfrac{-51}{73}$

Verify sol.

$\dfrac{5}{3}\left(\dfrac{-51}{73}\right) - \left(\dfrac{\frac{-51}{73}-1}{4}\right) = \dfrac{\left(\frac{-51}{73}\right)-3}{5}$

$\dfrac{-255}{219} + \dfrac{124}{292} = \dfrac{270}{365}$

$\dfrac{-54}{73} = \dfrac{-54}{73}$

Hence verified.

(13) $\dfrac{3x+1}{16} + \dfrac{2x-3}{7} = \dfrac{x+3}{8} + \dfrac{3x-1}{14}$

multiplying the equation with 112.

$$\frac{3x+1}{16} \times 112 + \frac{2x-3}{7} \times 112 = \frac{x+3}{8} \times 112 + \frac{3x-1}{14} \times 112$$

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

$$\Rightarrow 21x+7 + 32x - 48 = 14x + 42 + 24x - 8$$

$$\Rightarrow \cancel{-20} + 32x = 38x + 36$$

$$x \quad \cancel{55-6 = 6x}$$

$$x = -\frac{-28}{3}$$

$$\Rightarrow 53x - 41 = 38x + 34$$

$$\Rightarrow 75 = 15x$$

$$x = 5$$

verify solution

$$\frac{3(5)+1}{16} + \frac{2(5)-3}{7} = \frac{5+3}{8} + \frac{3(5)-1}{14}$$

$$1 + 1 = 1 + 1$$

Hence verified.

(14) $\left(\frac{1-2m}{7}\right) - \left(\frac{2x-3x}{8}\right) = \frac{3}{2} + \frac{x}{4}$

multiply with 56 on b/s.

$$\frac{(1-2m)}{7} \times 7 \times 8 - \frac{(2-3x)}{8} \times 8 \times 7 = \frac{3}{2} \times \overset{28}{56} + \frac{x}{4} \times 56$$

$$8(1-2x) - 7(2-3x) = 84 + 14x$$

$$8 - 16x - 14 + 21x = 84 + 14x$$

$$-6 + 5x = 84 + 14x$$

$$-90 = 9x$$

$$x = -10$$

Substitute $-x$ in equation.

$$\left[\frac{1 - 2(-10)}{7}\right] - \left[\frac{2 - 3(-10)}{8}\right] = \frac{3}{2} + \frac{(-10)}{4}$$

$$3 - 4 = \frac{3}{2} - \frac{5}{2}$$

$$-1 = -1$$

hence verified.

(15) $$\frac{9x + 7}{2} - \left(x - \frac{x-2}{7}\right) = 36.$$

divide eq. with 14 on both sides.

$$\left(\frac{9x+7}{2}\right)(14) - \left(14x - \left(\frac{x-2}{7} \times 14\right)\right) = 36 \times 14$$

$$63x + 49 \quad -14x + 2x - 4 = 504$$

$$49x + 2x + 45 = 504$$

$$51x = 459$$

$$x = 9$$

verify solution

$$\frac{9(9) + 7}{2} - \left(9 - \frac{(9-2)}{7}\right) = 36$$

$$44 - (8) = 36$$

$$36 = 36 \qquad \text{hence verified.}$$

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

multiplying eq. with 100 on b/s

$100 \times 0.18(5x-4) = 100 \times 0.5x + 100 \times 0.8$

$18(5x-4) = 50x + 80$

$90x - 72 = 50x + 80$

$40x = 152$

$x = \dfrac{152}{40}$

$\boxed{x = 3.8}$

Substitute x in eq.

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

multiplying eq. with 100

$0.18 \times 100 (5(3.8) - 4) = 0.5 \times 100 (3.8) + 0.8 \times 100$

$18(5(3.8) - 4) = 50(3.8) + 80$

$342 - 72 = 190 + 80.$

$270 = 270.$

Hence verified

(17) $\frac{2}{3x} - \frac{3}{2x} = \frac{1}{12}$

multiplying the equation with $12x$ on both side.

$\frac{2}{3x} \times 12x - \frac{3}{2x} \times 12x = \frac{1}{12} \times 12x$

$\frac{2}{3x} \times 4 \times 3x - \frac{3}{2x} \times 6 \times 2x = \frac{1}{12} \times 12 \times x$

$8 - 18 = x$

$x = -10$

Substituting x in eq.

$\frac{2}{3(-10)} - \frac{3}{2(-10)} = \frac{1}{12}$

$\frac{-2}{30} + \frac{3}{20} = \frac{1}{12}$

$\frac{}{} + \frac{-4+9}{60} = \frac{1}{12}$

$\frac{1}{12} = \frac{1}{12}$

Hence verified.

(18) $\frac{4x}{9} + \frac{1}{3} + \frac{13}{108}x = \frac{8x+19}{18}$

& multiply the equation with 108.

$\not{9} \times \frac{4x}{\not{9}} \times 12 + \frac{1}{3} \times 108 + \frac{13}{108} \times x \times 108 = \frac{8x+19}{18} \times 108$

$$48x + 36 + 13x = 6(8x+19)$$

$$61x + 36 = 48x + 114$$

$$13x = 114 - 36$$

$$= 78$$

$$\boxed{x = 6}$$

substitute value of x in $\mathcal{E}_q$

$$\frac{4}{9}(6) + \frac{1}{3} + \frac{13}{108}(6) = \frac{8(6)+19}{18}$$

$$\frac{8}{3} + \frac{1}{3} + \frac{13}{18} = \frac{67}{18}$$

$$\frac{6 \times 9}{6 \times 3} + \frac{13}{18} = \frac{67}{18}$$

$$\frac{54 + 13}{18} = \frac{67}{18}$$

$$\frac{67}{18} = \frac{67}{18}$$

Hence verified.

⑲ $$\left(\frac{45 - 2x}{15}\right) - \frac{(4x+10)}{5} = \frac{15-14x}{9}$$

multiply the $\mathcal{E}q$. with 45

$$\left(\frac{45 - 2x}{15}\right)(45 \div 3) - \left(\frac{4x+10}{5}\right)(45 \div 9) = \left(\frac{15-14x}{9}\right) \times 45$$

$$135 - 6x - 36x - 90 = 75 - 70x$$

$$45 - 42x = 75 - 70x$$

$$70x - 42x = 75 - 45$$

$$28x = 30$$

$$\boxed{x = \frac{15}{14}}$$

Substituting 'x' in Eq.

$$\left[\frac{45 - 2\left(\frac{15}{14}\right)}{15}\right] - \left[\frac{4 \times \frac{15}{14} + 10}{5}\right] = \left[\frac{15 - 14\left(\frac{15}{14}\right)}{9}\right]$$

multiply the equation with 45

$$\frac{\left(45 - \frac{15}{7}\right)}{15} \times 45 - \frac{\left(\frac{30}{7} + 10\right)}{5} \times 45 = \frac{(0)}{9} \times 45$$

$$3\left(45 - \frac{15}{7}\right) - 9\left(\frac{30}{7} + 10\right) = 0.$$

$$135 - \frac{45}{7} - \frac{270}{7} - 90 = 0.$$

$$45 - \frac{315}{7} = 0.$$

$$45 = \frac{315}{7}$$

$$45 = 45$$

L.HS = R.HS

Hence verified.

(30) $5\left(\dfrac{7x+5}{3}\right) - \dfrac{23}{3} = 13 - \left(\dfrac{4x-2}{3}\right)$

multiply the equation with 3

$$5\dfrac{(7x+5)}{3} \times 3 - \dfrac{23}{3} \times 3 = 13 \times 3 - \left(\dfrac{4x-2}{3}\right) 3$$

$$35x + 25 - 23 = 39 - 4x + 2$$

$$39x + 2 = 41$$

$$39x = 39$$

$$\boxed{x = 1}$$

Substitute x in eq.

$$5\dfrac{(7(1)+5)}{3} - \dfrac{23}{3} = 13 - \left(\dfrac{4(1)-2}{3}\right)$$

$$5\left(\dfrac{12}{3}\right) - \dfrac{23}{3} = 13 - \left(\dfrac{2}{3}\right)$$

$$20 - \dfrac{23}{3} = 13 - \dfrac{2}{3}$$

$$7 = 7.$$

Hence verified

(21) $\dfrac{7x-1}{4} - \dfrac{1}{3}\left(2x - \dfrac{1-x}{2}\right) = \dfrac{10}{3}$

multiply the eq. with 12 on bothsides

$\dfrac{7x-1}{4} \times 4 \times 3 - \dfrac{1}{3}\left(2x - \dfrac{1-x}{2}\right) \times 4 \times 3 = \dfrac{10}{3} \times 4 \times 3$

$3(7x-1) - 4\left(2x - \dfrac{1-x}{2}\right) = 40$

$21x - 3 - 8x + 2 \times 4 \times \left(\dfrac{1-x}{4}\right) = 40$

$21x - 3 - 8x + 2(1-x) = 40$

$21x - 3 - 8x + 2 - 2x = 40$

$21x - 10x - 1 = 40$

$2 + 2x \quad 11x = 41$

$\boxed{x = \dfrac{41}{11}}$

substitute x in eq.

$\left[\dfrac{7\left(\frac{41}{11}\right) - 1}{4}\right] - \dfrac{1}{3}\left[2x - \dfrac{1-x}{2}\right] = \dfrac{10}{3} \times \dfrac{41}{11}$

multiplying eq. with 12 on bothsides

$4 \times 3\left[\dfrac{7\left(\frac{41}{11}\right) - 1}{4}\right] - \dfrac{1}{3}\left[2x - \dfrac{1-x}{2}\right] 4 \times 3$

$= \dfrac{10}{3} \times \dfrac{41}{11} \times 4 \times 3$

$3\left[\dfrac{287}{11} - 1\right] - 4\left[2\left(\dfrac{41}{11}\right) - \left(1 - \dfrac{41}{11}\right)\right]$

$= \dfrac{40 \times 41}{11}$

$= \dfrac{120}{3}$

$$\frac{87 \times 3}{11} - 3 - \frac{4 \times 2 \times 41}{11} + \frac{4x\left(1-\frac{4}{11}\right)}{2} = \frac{40 \times 11}{11} = \frac{120}{3}$$

$$\frac{861}{11} - 3 \times \frac{11}{11} - \frac{328}{11} + \frac{\left(4 - \frac{164}{11}\right)}{2} = \frac{164}{11} = \frac{40 \times 3}{3}$$

$$\frac{861}{11} - \frac{33}{11} - \frac{328}{11} + \frac{4}{2} - \frac{164}{11 \times 2} = \frac{1440}{11} = 40$$

$$\frac{861 - 33 - 328}{11} + \frac{2 \times 11}{11} - \frac{82}{11} = \frac{440}{11} = 40$$

$$\frac{440}{11} = 40$$

$$\frac{4 \times 10 \times 11}{11} = 40$$

$$40 = 40$$

Hence verified.

(22)
$$\frac{0.5 \ (x - 0.4)}{0.35} - \frac{0.6 \ (x - 2.71)}{0.42} = x + 6.1$$

dividing the eq. with 100 on both sides.

$$\frac{0.5 \ (x - 0.4)}{100 \times 0.35} - 0.6 \frac{(x - 2.71)}{0.42 \times 100} = \frac{x + 6.1}{100}$$

multiplying the equation with 10 on both sides.

$$\frac{0.5 \times 10 \ (x - 0.4)}{100 \times 0.35} - \frac{0.6 \times 10 \ (x - 2.71)}{0.42 \times 100} = \frac{10 \ (x + 6.1)}{100}$$

$$\frac{5 \ (x - 0.4)}{35} - \frac{6 \ (x - 2.71)}{42} = \frac{10 \ (x + 6.1)}{10 \times 10}$$

$\Rightarrow \dfrac{8(x-0.4)}{8+7} - \dfrac{9(x-2.71)}{.7\times6} = \dfrac{x+6.1}{10}$

$\Rightarrow \dfrac{x-0.4}{7} - \dfrac{(x-2.71)}{7} = \dfrac{x+6.1}{10}$

$\Rightarrow \dfrac{x-0.4-x-(-2.71)}{7} = \dfrac{x+6.1}{10}$

$\Rightarrow \dfrac{-0.4+2.71}{7} = \dfrac{x+6.1}{10}$

$\Rightarrow \dfrac{2.31}{7} = \dfrac{x+6.1}{10}$

of multiplying Eq. with 100. on b/s

$\Rightarrow \dfrac{2.31\times100}{7} = (x+6.1)\dfrac{10\times10}{10}$

$\Rightarrow \dfrac{231}{7} = 10x + 10(6.1)$

$\Rightarrow \dfrac{7\times33}{7} = 10x + 61$

$\Rightarrow 33 = 10x + 61$

$33-61 = 10x + 61 - 61$ (Adding -61 on b/s)

$10x = -28$

$\Rightarrow \dfrac{10x}{10} = \dfrac{-28}{10}$

$\Rightarrow \boxed{x = -2.8}$

Substitute 'x' in eq.

$$0.5 \left(\dfrac{-2.8 - 0.4}{0.35} \right) - 0.6 \dfrac{(-2.8 - 2.71)}{0.42} = \dfrac{-2.8}{+6.1}$$

$$0.5 \dfrac{(-3.2)}{0.35} - 0.6 \dfrac{(-5.51)}{0.42} = 6.1 - 2.8$$

multiply the equation with $\dfrac{100}{100}$ on both sides

$$\dfrac{(0.5)(-3.2)(10 \times 10)}{0.35 \times 100} + \dfrac{(0.6)(5.51)(100)}{0.42 \times 100}$$

$$= (6.1 - 2.8) \left(\dfrac{100}{100} \right)$$

$$\Rightarrow \dfrac{(5)(-32)}{35} + \dfrac{0.6 \times 551}{42} = \dfrac{(6.1 - 28)(100)}{100}$$

$$\Rightarrow \dfrac{-160}{35} + \dfrac{0.6 \times 551}{42} = \dfrac{610 - 280}{100}$$

$$\Rightarrow \dfrac{-160}{35} + \dfrac{0.6 \times 551}{42} = \dfrac{330}{100}$$

multiply eq. with 10. on b/s.

$$\Rightarrow \dfrac{-160 \times 10}{35} + \dfrac{0.6 \times 10 \times 551}{42} = \dfrac{330 \times 10}{100}$$

$$\Rightarrow \dfrac{-1600}{35} + \dfrac{6 \times 551}{42} = \dfrac{3300}{100}$$

$$\Rightarrow \dfrac{(-5)(320)}{5 \times 7} + \dfrac{6 \times 551}{7 \times 6} = \dfrac{33 \times 100}{100}$$

$$-\frac{320}{7} + \frac{551}{7} = 33$$

$$\Rightarrow \frac{551-320}{7} = 33$$

$$\Rightarrow \frac{231}{7} = 33$$

$$\Rightarrow \frac{7 \times 33}{7} = 33$$

$$\Rightarrow 33 = 33$$

Hence verified.

(23) $6.5x + \dfrac{19.5x - 325}{2} = 6.5x + 13 + \left(\dfrac{13x-26}{2}\right)$

multiplying the eq. with 10×2 on both sides

$$6.5x \times 10 \times 2 + \frac{(19.5x - 32.5)10 \times 2}{2} =$$

$$6.5x \times 10 \times 2 + 13 \times 10 \times 2 + \left(\frac{13x-26}{2}\right) \times 10 \times 2$$

$$2 \times \frac{65}{10} \times 10 \times x + \frac{195}{10} x \times 10 - \frac{325}{10} \times 10$$

$$= \frac{65}{10} \times 10 \times 2x + 13 \times 10 \times 2 + (130x - 260)$$

$$\Rightarrow 130x + 195x - 325 = 130x + 260 + 130x - 260$$

$$\Rightarrow 325x - 325 = x \times 130 + 130x$$

$$325x - 325 = 130x + 130x$$

$$325x - 325 = 260x$$

adding $-260x + 325$ on both sides

$$325x - 325 - 260x + 325 = 260x$$
$$ \quad -260x + 325$$

$$\Rightarrow \quad 65x = 325$$
$$\Rightarrow \quad 65x = 65 \times 5$$
$$\Rightarrow \boxed{x = 5}$$

verify 'x' in Eq.

$$6.5(5) + \frac{19.5(5) - 32.5}{2} = 6.5 \times 5 + 13 + \left(\frac{13 \times 5 - 26}{2}\right)$$

multiplying with 10 on b/s.

$$6.5 \times 5 \times 10 + \frac{(19.5 \times 5 - 32.5)}{2} \times 10 = 6.5 \times 5 \times 10 + 13 \times 10 + \left(\frac{13 \times 5 - 26}{2}\right) 10$$

$$\frac{65}{10} \times 5 \times 10 + \left[\frac{\frac{195 \times 5}{10} \times 10 - \frac{325}{10} \times 10}{2}\right] = \frac{65}{10} \times 5 \times 10 + 13 \times 10 + \frac{39}{2} \times 10$$

$5 \times 65 + \dfrac{195 \times 5 - 325}{2} = 65 \times 5 + 130 + \dfrac{39 \times 5 \times 5}{5}$

$\Rightarrow \quad \dfrac{975 - 325}{2} = 130 + 195$

$\Rightarrow \quad \dfrac{650}{2} = 325$

$\Rightarrow \quad \dfrac{2 \times 325}{2} = 325$

$\qquad 325 = 325$

Hence verified.

(54)

$(3x - 8)(3x + 2) \quad -(4x - 11)(2x + 1)$

$\qquad\qquad\qquad = (x - 3)(x + 7)$

$(x + a)(x + b) = x(x + b) + a(x + b)$

$\qquad\qquad\quad \Rightarrow x^2 + xb + ax + ab$

$\qquad\qquad\quad \Rightarrow x^2 + ax + bx + ab$

$\Rightarrow \quad 3x(3x + 2) - 8(3x + 2) - 4x(2x + 11) + 11(2x + 1)$

$\qquad\qquad\qquad = x(x + 7) - 3(x + 7)$

$\Rightarrow \quad 3 \times 3 \times x \times x + 3x \times 2 - 8 \times 3x - 8 \times 2 - 4x(2x)$

$\qquad -4 x \times 11 + 11 \times 2x + 11 = x^2 + 7x - 3x - 21$

$\Rightarrow \quad 9x^2 + 6x - 24x - 16 - 8x^2 - 44x + 22x + 11$

$\qquad\qquad\qquad . = x^2 + 7x - 3x - 21$

$5 \times 65 + \dfrac{195 \times 5 - 325}{2} = 65 \times 5 + 130 + \dfrac{39 \times 5 \times 5}{5}$

$\Rightarrow \dfrac{975 - 325}{2} = 130 + 195$

$\Rightarrow \dfrac{650}{2} = 325$

$\Rightarrow \dfrac{2 \times 325}{2} = 325$

$325 = 325$

Hence verified.

(54)

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

$\qquad = (x - 3)(x + 7)$

$(x + a)(x + b) = x(x + b) + a(x + b)$

$\qquad = x^2 + xb + ax + ab$

$\qquad = x^2 + ax + bx + ab$

$\Rightarrow 3x(3x + 2) - 8(3x + 2) - 4x(2x + 11) + 11(2x + 1)$

$\qquad = x(x + 7) - 3(x + 7)$

$\Rightarrow 3 \times 3 \times x \times x + 3x \times 2 - 8 \times 3x - 8 \times 2 - 4x(2x)$

$\quad - 4x \times 11 + 11 \times 2x + 11 = x^2 + 7x - 3x - 21$

$\Rightarrow 9x^2 + 6x - 24x - 16 - 8x^2 - 44x + 22x + 11$

$\qquad = x^2 + 7x - 3x - 21$

㉗ $\left[(2x+3)+(x+5)\right]^2 + \left[(2x+3)-(x+5)\right]^2$
$$= 10x^2 + 92$$

$\Rightarrow \left[3x+8\right]^2 + \left[x-2\right]^2 = 10x^2 + 92$

$\Rightarrow (3x+8)(3x+8) + (x-2)(x-2) = 10x^2 + 92$

$\Rightarrow 3x(3x+8) + 8(3x+8) + x(x-2) - 2(x-2)$
$$= 10x^2 + 92$$

$\Rightarrow 3x \times 3x + 3x \times 8 + 8 \times 3x + 8 \times 8 + x \times x - 2 \times x$
$$- 2x + 2 \times 2 = 10x^2 + 92$$

$\Rightarrow 9x^2 + 24x + 24x + 64 + x^2 - 2x - 2x + 4$
$$= 10x^2 + 92$$

$\Rightarrow 10x^2 + 44x + 68 = 10x^2 + 92$

$\Rightarrow 44x + 68 = 92$

adding -68 on both sides

$44x + 68 - 68 = 92 - 68$

$44x = 24$

$x = \dfrac{24}{44}$

$x = \dfrac{12}{22}$

$\boxed{x = \dfrac{6}{11}}$

verify $-x'$ in equation

$$\Rightarrow \left[\left(2\left(\tfrac{6}{11}\right)+3\right)+\left(\tfrac{6}{11}+5\right)\right]^2 + \left[\left(2\left(\tfrac{6}{11}\right)+3\right)-\left(\tfrac{6}{11}+5\right)\right]^2$$
$$= 10\left(\tfrac{6}{11}\right)^2 + 92$$

$$\Rightarrow \left[3\left(\tfrac{6}{11}\right)+8\right]^2 + \left[\left(\tfrac{6}{11}\right)-2\right]^2 = 10\left(\tfrac{6}{11}\right)^2 + 92$$

$$\Rightarrow \left[\tfrac{18}{11}+8\right]^2 + \left[\tfrac{6}{11}-2\right]^2 = \tfrac{10\times36}{121} + 92$$

$$\Rightarrow \left(\tfrac{18}{11}+8\right)\left(\tfrac{18}{11}+8\right) + \left(\tfrac{6}{11}-2\right)\left(\tfrac{6}{11}-2\right) = \tfrac{360}{121}+92$$

$$\Rightarrow \tfrac{18}{11}\left(\tfrac{18}{11}+8\right) + 8\left(\tfrac{18}{11}+8\right) + \tfrac{6}{11}\left(\tfrac{6}{11}-2\right) - 2\left(\tfrac{6}{11}-2\right)$$
$$= \tfrac{360}{121}+92$$

$$\Rightarrow \left(\tfrac{18}{11}\right)^2 + \tfrac{8\times18}{11} + \tfrac{8\times8}{11} + 64 + \left(\tfrac{6}{11}\right)^2 - \tfrac{2\times6}{11} - \tfrac{2\times6}{11}$$
$$+4 = \tfrac{360}{121}+92$$

$$\Rightarrow \tfrac{324}{121} + \tfrac{36}{121} + \tfrac{144}{11} + \tfrac{144}{11} + 64 - \tfrac{12}{11} - \tfrac{12}{11}$$
$$+4 = \tfrac{360}{121}+92$$

$$\Rightarrow \left(\tfrac{360}{121}\right) + \tfrac{288-24}{11} + 64 + 4 = \tfrac{360}{121} + 92$$

$$\Rightarrow \tfrac{264}{11} + 68 = 92$$

$$= \tfrac{11\times24}{11} + 68 = 92$$

$$= 24 + 68 = 92$$

hence verified.

Exercise 9:3.

① $\dfrac{2x-3}{3x+2} = \dfrac{-2}{3}$

cross multiplying

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

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

$6x - 9 = -6x - 4$

adding $6x + 9$ on both sides

$6x - 9 + 6x + 9 = -6x - 4 + 6x + 9$

$12x = 5$

$x = 5/12$

substitute "x" in eq.

$\dfrac{2\left(5/12\right) - 3}{3\left(\frac{5}{12}\right) + 2} = -\dfrac{2}{3}$

cross multiplying.

$3\left[2\left(\frac{5}{6\times2}\right) - 3\right] = -2\left[\dfrac{2\times5}{4\times3} + 2\right]$

$3\left(\frac{5}{6}\right) - 3(3) = -2\left(\frac{5}{4}\right) + 2(2)$

$3\left(\frac{5}{2\times3}\right) - 9 = -2\left(\frac{5}{2\times2}\right) - 4$

$\dfrac{5}{2} - 9 = \dfrac{-5}{2} - 4$

adding $\dfrac{5}{2} + 9$ on both side

$\dfrac{5}{2} - 9 + \dfrac{5}{2} + 9 = \dfrac{-5}{2} - 4 + \dfrac{5}{2} + 9$

$\dfrac{10}{2} = 5$

$\boxed{5 = 5}$ hence verified

② $\dfrac{2-y}{y+7} = \dfrac{3}{5}$

cross multiplies

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

$5(y) - 5y = 3(y) + 7 \times 3$

$10 - 5y = 3y + 21$

adding $5y - 21$ on both sides

$10 - 5y + 5y - 21 = 3y + 21 + 5y - 21$

$-11 = 8y$

$\boxed{y = \dfrac{-11}{8}}$

substitute "y" in eq.

$\dfrac{2 - \left(\dfrac{-11}{8}\right)}{\dfrac{-11}{8} + 7} = \dfrac{3}{5}$

cross multiplying.

$5\left(2 + \dfrac{11}{8}\right) = 3\left(7 - \dfrac{11}{8}\right)$

$5(2) + \dfrac{5(11)}{8} = 3(7) - \dfrac{11(3)}{8}$

$10 + \dfrac{55}{8} = 21 - \dfrac{33}{8}$

adding $\dfrac{33}{8} - 10 = 0$ on both sides

$10 + \dfrac{55}{8} + \dfrac{33}{8} - 10 = 21 - \dfrac{33}{8} + \dfrac{33}{8} - 10$

$\dfrac{88}{8} = 21 - 10$

$11 = 11$ Hence verified

③ $\dfrac{5x-7}{3x} = \dfrac{2}{1}$

cross multiplying

$(5x-7) \ 1 = 2(3x)$.

$5x - 7 = 6x$

adding $-5x$ on both sides

$5x - 7 - 5x = 6x - 5x$

$-7 = x$

$x = -7$

substitute x in eq.

$\dfrac{5(-7) - 7}{3(-7)} = \dfrac{2}{1}$

cross multiplying

$-35 \quad 1(-35 - 7) = 2(-21)$

$-42 = -42$

Hence verified.

④ $\dfrac{3x+5}{2x+7} = 4$

cross multiplying

$(3x+5)(1) = 4(x+7)$

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

$3x + 5 = 8x + 28$

adding $-3x - 28$ on both sides

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

$-23 = 5x$

$x = \dfrac{-23}{1}$

substitute 'x' in Eq.

$$\frac{3\left(-\frac{23}{5}\right)+5}{2\left(-\frac{23}{5}\right)+7} = \frac{4}{1}$$

Cross multiplying

$$1\cdot\left(3\left(-\frac{23}{5}\right)+5\right) = 4\left[2\left(-\frac{23}{5}\right)+7\right]$$

$$-\frac{69}{5}+5 = 8\left(-\frac{23}{5}\right)+28.$$

$$-\frac{69}{5}+5 = -\frac{184}{5}+28.$$

adding $\frac{184}{5}-5$ on both sides

$$\frac{184}{5}-5-\frac{69}{5}+5 = -\frac{184}{5}+28+\frac{184}{5}-5$$

$$\frac{175}{5} = 23$$

$$23 = 23$$

Hence verified.

⑤ $$\frac{2y+5}{y+4} = 1$$

cross multiply.n

$$2y+5 = y+4$$

adding $-y-5$ on both sides.

$$2y+5-y-5 = y+4-y-5$$

$$y = -1$$

substitute 'y' in Eq.

$$\frac{2(-1)+5}{(-1)+4} = 1$$

cross multiplying

$2(-1) -2 +5 = -1+4$

$$3 = 3$$

hence verified,

⑥ $\dfrac{2x+1}{3x-2} = \dfrac{5}{9}$

Cross multiplying,

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

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

$18x + 9 = 15x - 10$

adding $-15x - 9$ on both sides,

$18x +9 -15x -9 = 15x -10 -15x -9$

$$3x = -19$$
$$x = -19/3$$

Substitute 'x' in eq.

$$\frac{2\left(\frac{-19}{3}\right) +1}{3\left(\frac{-19}{3}\right) -2} = \frac{5}{9}$$ [∴ cross multiplying]

$9\left[2\left(\frac{-19}{3}\right) + 1\right] = 5\left[3\left(\frac{-19}{3}\right) -2\right]$

$\overset{3}{9}(2)\left(\frac{-19}{3}\right) +9 = 5(-19-2)$

$-19(6) +9 = 5(-21)$

$-105 = -105$ hence verified.

⑨ $\dfrac{1-9y}{19-3y} = \dfrac{5}{8}$

Cross multiplying

$8(1-9y) = 5(19-3y)$

$8(1) - 8(9y) = 5(19) - 5(3y)$

$8 - 72y = 95 - 15y$

adding $15y - 8$ on both sides

$15y - 8 + 8 - 72y = 95 - 15y + 15y - 8$

$-57y = 87$

$y = \dfrac{-87}{57}$

$y = \dfrac{-3 \times 29}{3 \times 19}$

$\boxed{y = \dfrac{-29}{19}}$

substitute y in Eq.

$\dfrac{1 - 9\left(-\dfrac{29}{19}\right)}{19 - 3\left(-\dfrac{29}{19}\right)} = \dfrac{5}{8}$

cross multiplying

$8\left(1 + 9\left(\dfrac{29}{19}\right)\right) = 5\left(19 + 3\left(\dfrac{29}{19}\right)\right)$

$8 + \dfrac{8 \times 9 \times 29}{19} = 5 \times 19 + \dfrac{5 \times 3 \times 29}{19}$

adding $-\dfrac{5 \times 3 \times 29}{19} - 8$ on both sides

$$-8 - \frac{15 \times 29}{19} + 8 + \frac{8 \times 9 \times 29}{19} = 5 \times 9 + \frac{5 \times 3 \times 29}{19} - \frac{15 \times 29}{19} - 8$$

$$\frac{72(29) - 29(15)}{19} = 95 - 8$$

$$\frac{29(57)}{19} = 87$$

$$87 = 87$$

hence verified

⑧ $\dfrac{2x}{3x+1} = -3$

cross multiplying

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

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

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

adding $+9x$ on both sides

$$9x + 2x = -9x - 3 + 9x$$

$$11x = -3$$

$$\boxed{x = \frac{-3}{11}}$$

~~adds~~ substitute 'x' in eq.

$$\frac{2\left(\frac{-3}{11}\right)}{3\left(\frac{-3}{11}\right) + 1} = -3$$

$$-\frac{6}{11} = -3\left(\frac{-9}{11} + 1\right)$$

$$-\frac{6}{11} = +\frac{27}{11} - \frac{3 \times 11}{11}$$

$$-\frac{6}{7} = -\frac{6}{7} \qquad \text{Hence verified}$$

④ $\dfrac{y - (7 - 8y)}{9y - (3 + 4y)} = \dfrac{2}{3}$

$\Rightarrow \dfrac{y - 7 - (-8y)}{9y - 3 - 4y} = \dfrac{2}{3}$

$\Rightarrow \dfrac{y - 7 + 8y}{5y - 3} = \dfrac{2}{3}$

$\Rightarrow \dfrac{9y - 7}{5y - 3} = \dfrac{2}{3}$ cross multiplying

$\Rightarrow 3(9y - 7) = 2(5y - 3)$

$\Rightarrow 3(9y) - 3(7) = 2(5y) - 2(3)$

$\Rightarrow 27y - 21 = 10y - 6$

adding $-10y + 21$ on both sides

$\Rightarrow 27y - 21 - 10y + 21 = 10y - 6 - 10y + 21$

$\Rightarrow 17y = 15$

$y = \dfrac{15}{17}$

substituting 'y' in Eq.

$y - \dfrac{\left(\frac{15}{17}\right) - \left(7 - 8\left(\frac{15}{17}\right)\right)}{9\left(\frac{15}{17}\right) - \left(3 + 4\left(\frac{15}{17}\right)\right)} = \dfrac{2}{3}$

$\dfrac{\left(\frac{15}{17}\right) - 7 + 8\left(\frac{15}{17}\right)}{9\left(\frac{15}{17}\right) - 3 - 4\left(\frac{15}{17}\right)} = \dfrac{2}{3}$

cross multiplying

$3\left(\dfrac{15}{17} \times 9\right) - 3(7) = 2\left(5 \times \dfrac{15}{17}\right) - 3(2)$

$$\frac{27 \times 15}{17} - 21 = \frac{150}{17} - 6$$

adding $-\frac{150}{17} + 6$ on both sides

$$\frac{27 \times 15}{17} - \frac{150}{17} + 6 - 21 = -6 + \frac{150}{17} - \frac{150}{17} + 6$$

$$\Rightarrow \frac{15(17)}{17} + 6 - 21 = 0$$

$$= 15 + 6 - 21 = 0$$

$$\Rightarrow 15 - 15 = 0$$

$$0 = 0 \quad \text{hence verified}$$

(10)
$$\frac{6}{2x - (3 - 4x)} = \frac{2}{3}$$

$$\frac{6}{2x - 3 + 4x} = \frac{2}{3}$$

Cross multiplying

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

$$18 = 2(6x) - 2(3)$$

$$18 = 12x - 6$$

adding +6

$$18 + 6 = 12x + 6 - 6$$

$$12x = 24$$

$$\boxed{x = 2}$$

substitute 'x' in Eq.

$$\frac{6}{2(2) - \cancel{2}(3 - 4(y))} = \frac{2}{3}$$

$$\frac{6}{4 - 3 + 8} = \frac{2}{3}$$

$$\frac{6}{9} = \frac{2}{3} \Rightarrow \frac{2 \times 3}{3 \times 3} = \frac{2}{3}$$

$$\frac{2}{3} = \frac{2}{3} \quad \text{Hence verified.}$$

(11) $$\frac{2}{3x} - \frac{3}{2x} = \frac{1}{12}$$

multiplying the eq. with 12x

$$\frac{2}{3x}(12x) - \frac{3}{2x}(12x) = \frac{1}{12} \times 12x$$

$$\frac{2}{3x}(3x \times 4) - \frac{3}{2x}(2x \times 6) = x$$

$$8 - 18 = x$$

$$x = -10.$$

substitute x in Eq

$$\frac{2}{3(-10)} - \frac{3}{2(-10)} = \frac{1}{12}$$

$$\frac{2}{-30} + \frac{3}{20} = \frac{1}{12}$$

multiply with 120 on both sides

$$\frac{2}{-30} \times (120) + \frac{3}{20}(120) = \frac{1}{12}(120)$$

$$(-2)(4) + 3(6) = 10$$

$$-8 + 18 = 10 \quad \boxed{10 = 10} \quad \text{hence verified.}$$

(12) $\dfrac{3x+5}{4x+2} = \dfrac{3x+4}{4x+7}$

cross multiplying a

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

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

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

$21x + 20x + 35 = 6x + 16x + 8$

adding $-22x - 35$ on both sides

$41x + 35 - 35 - 22x = 22x + 8 - 22x - 35$

$19x = -27$

$x = \dfrac{-27}{19}$

Substitute x in Eq.

$\dfrac{3\left(\frac{-27}{19}\right) + 5}{4\left(\frac{-27}{19}\right) + 2} = \dfrac{3\left(\frac{-27}{19}\right) + 4}{4\left(\frac{-27}{19}\right) + 7}$

multiplying

$\dfrac{\left[3\left(\frac{-27}{19}\right) + 5\right] \times 19}{\left[4\left(\frac{-27}{19}\right) + 2\right] \times 19} = \dfrac{\left[3\left(\frac{-27}{19}\right) + 4\right] \times 19}{\left[4\left(\frac{-27}{19}\right) + 7\right] \times 19}$

$\dfrac{-81 + 5(19)}{-4(27) + 38} = \dfrac{-81 + 19(4)}{-27(4) + 7(19)}$

$\dfrac{95 - 81}{38 - 108} = \dfrac{76 - 81}{133 - 108}$

$\dfrac{14}{-70} = \dfrac{-5}{25}$ or $\dfrac{-1}{5} = \dfrac{-1}{5}$

hence verified

(13) $\dfrac{7x-2}{5x-1} = \dfrac{7x+3}{5x+4}$

cross multiplying.

$(7x-2)(5x+4) = (7x+3)(5x-1)$

$7x(5x+4) - 2(5x+4) = 7x(5x-1) + 3(5x-1)$

$(7x)(5x) + (7x)(4) - 2(5x) - 2(4) = (7x)(5x)$
$\qquad\qquad\qquad\qquad\qquad\qquad -7x + 3(5x)$
$\qquad\qquad\qquad\qquad\qquad\qquad\qquad -3$

$\qquad 28x - 10x - 8 = -7x + 15x - 3$

$\qquad 18x - 8 = 8x - 3$

adding $-8x + 8$ on both sides

$\qquad 18x - 8 - 8x + 8 = 8x - 3 - 8x + 8$

$\qquad\qquad 10x = 5$

$\qquad\qquad x = 1/2$

substituting x in eq.

$\dfrac{7(1/2) - 2}{5(1/2) - 1} = \dfrac{7(1/2) + 3}{5(1/2) + 4}$

$\left(\dfrac{7}{2} - 2\right)\left(\dfrac{5}{2} + 4\right) = \left(\dfrac{7}{2} + 3\right)\left(\dfrac{5}{2} - 1\right)$

$\dfrac{35}{4} - 5 + 14 - 8 = \dfrac{35}{4} + \dfrac{15}{2} - \dfrac{7}{2} - 3$

$14 - 13 = \dfrac{8}{2} - 3$

$1 = 4 - 3$

$1 = 1$

Hence verified.

(15) $\left(\dfrac{x+1}{x-4}\right)^2 = \left(\dfrac{x+8}{x-2}\right)$

cross multiplying.

$(x+1)^2(x-2) = (x+8.)(x-4)^2$

$(x^2+2x+1)(x-2) = (x+8)(x^2+16-8x)$

$\left[\because (a+b)^2 = a^2 + 2ab + b^2\right]$

$\Rightarrow x^2(x-2) + 2x(x-2) + 1(x-2) = x(x^2+16-8x) + 8(x^2+16-8x)$

$\Rightarrow x^3 - 2x^2 + 2x^2 - 4x + x - 2 = x^3 + 16x - 8x^2 + 8x^2 + 16\times8 - 64x$

$\Rightarrow -4x + x - 2 = 16x + 128 - 64x$

$\Rightarrow -3x - 2 = 128 - 48x$

adding $48x + 2$ on both sides

$\Rightarrow -3x - 2 + 48x + 2 = 128 - 48x + 48x + 2$

$\Rightarrow 48x - 3x = 130$

$\Rightarrow 45x = 130$

$x = \dfrac{130}{45}$

$x = \dfrac{26}{9}$

Substitute x in eq.

$$\left(\frac{\frac{26}{9}+1}{\frac{26}{9}-4}\right)^2 = \frac{\frac{26}{9}+8}{\frac{26}{9}-2}$$

$$\Rightarrow \left(\frac{\frac{35}{9}}{\frac{26-36}{9}}\right)^2 = \left(\frac{\frac{26+72}{9}}{\frac{26-18}{9}}\right)$$

$$\Rightarrow \left(\frac{35}{-10}\right)^2 = \left(\frac{98}{8}\right)$$

$$\Rightarrow \frac{49}{4} = \frac{49}{4} \qquad \text{Hence verified}$$

⑯ $\quad \dfrac{9x-7}{3x+5} = \dfrac{3x-4}{x+6}$

$(9x-7)(x+6) = (3x-4)(3x+5)$

$9x(x+6) -7(x+6) = 3x(3x+5) -4(3x+5)$

$9x^2+54x -7x -42 = 9x^2 +15x -12x -20$

$\Rightarrow 47x -42 = 3x -20$

adding $-3x+42$ on both sides

$47x -42 -3x +42 = 3x-20 -3x +42$

$$44x = 22$$

$$x = \frac{1}{2}$$

substitute x on b/s.

$$\frac{9\left(\frac{1}{2}\right) -7}{3\left(\frac{1}{2}\right) +5} = \frac{3\left(\frac{1}{2}\right) -4}{\frac{1}{2} +6}$$

$$\frac{\left(\frac{9-14}{y}\right)}{\left(\frac{3+10}{y}\right)} = \frac{\left(\frac{3-8}{y}\right)}{\left(\frac{1+12}{x}\right)}$$

$$\Rightarrow \quad \frac{-5}{13} = \frac{-5}{13} \quad \text{hence verified.}$$

(17) $\dfrac{x+2}{m+5} = \dfrac{x}{n+6}$

cross multiplying

$(n+2)(n+6) = x(n+5)$

$x(n+6) + 2(n+6) = x^2 + 5x$

$\Rightarrow x^2 + 6x + 2x + 12 = x^2 + 5x$

$\Rightarrow$ adding $-5x - 12$ on both sides

$\Rightarrow 8x + 12 - 5x - 12 = 5x - 5x - 12$

$\Rightarrow 3x = -12$

$$\boxed{x = -4}$$

substitute 'x' in eq.

$$\frac{-4+2}{-4+5} = \frac{-4}{-4+6}$$

$$\frac{-2}{1} = \frac{-4}{2}$$

$$-2 = -2$$

Hence verified.

(16) $\dfrac{3x-(7-5x)}{9x-(3+4x)} = \dfrac{7}{6}$

$\dfrac{3x-7+5x}{9x-3-4x} = \dfrac{7}{6}$

$\Rightarrow \dfrac{7x-7}{5x-3} = \dfrac{7}{6}$ cross multiplying

$\Rightarrow 6(7x-7) = 7(5x-3)$

$\Rightarrow 42x - 42 = 35x - 21$

adding $-35x + 42$ on bothsides

$\Rightarrow 42x - 42 - 35x + 42 = 35x - 21 - 35x + 42$

$\Rightarrow 7x = 21$

$x = 3$

Substitute x in ℓ_2

$\dfrac{2(3) - (7-5(3))}{9(3) - (3+4(3))} = \dfrac{7}{6}$

$\dfrac{6 - (7-15)}{27 - (15)} = \dfrac{7}{6}$

$\dfrac{6 - (-8)}{12} = \dfrac{7}{6}$

$\dfrac{14}{12} = \dfrac{7}{6}$

$\dfrac{7}{6} = \dfrac{7}{6}$

(19) $\dfrac{15(2-x) - 5(x+6)}{1-3x} = 10$

$\dfrac{30 - 15x - 5x - 30}{1-3x} = 10$

$\dfrac{-20x}{1-3x} = 10$ cross multiplying

$-20x = 10(1-3x)$

$-20x = 10 - 3x(10)$

$-20x = 10 - 30x$

adding $+30x$ on both side

$30x - 20x = 10 - 30x + 30x$

$10x = 10$

$x = 1$

substitute 'x' in Eq.

$\dfrac{15(2-1) - 5(1+6)}{1-3(1)} = 10$

$\dfrac{15(1) - 5(7)}{1-3} = 10$

$\dfrac{15 - 35}{-2} = 10$

$\dfrac{-20}{-2} = 10$

$10 = 10$

Hence verified

(20) $\frac{x+3}{x-3} + \frac{x+2}{x-2} = 2$

multiplying $(x-3)(x-2)$ on both sides

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

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

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

$2x^2 - 12 = 2(x^2 - 5x + 6)$

$2x^2 - 12 = 2x^2 - 10x + 12$

$-12 = -10x + 12$

adding -12 on both sides

$-12 - 12 = -10x + 12 - 12$

$10x = 24$

$x = \frac{12}{5}$

Substitute 'x' in eq.

$\frac{\left(\frac{12}{5} + 3\right)}{\left(\frac{12}{5} - 3\right)} + \frac{\left(\frac{12}{5} + 2\right)}{\left(\frac{12}{5} - 2\right)} = 2$

$\frac{\frac{12+15}{5}}{\frac{12-15}{5}} + \frac{\frac{12+10}{5}}{\frac{12-10}{5}} = 2$

$\frac{27}{-3} + \frac{22}{2} = 2$

$-9 + 11 = 2$

$2 = 2$

Hence verified.

(21) $\dfrac{(x+2)(2x-3) - 2x^2 + 6}{x-5} = 2$

$\Rightarrow \dfrac{x(2x-3) + 2(2x-3) - 2x^2 + 6}{x-5} = 2$

$\Rightarrow \dfrac{2x^2 - 3x + 4x - 6 - 2x^2 + 6}{x-5} = 2$

$\Rightarrow \dfrac{4x - 3x}{x-5} = 2$

$\Rightarrow \dfrac{x}{x-5} = 2$

$\Rightarrow$ Cross multiplying.

$\Rightarrow x = 2(x-5)$

$\Rightarrow x = 2x - 10$

adding $+10 - x$ on both sides

$\Rightarrow x + 10 - x = 2x - 10 + 10 - x$

$\Rightarrow 10 = x$

$\therefore \boxed{x = 10}$

Substitute 'x' in Eq

$\dfrac{(10+2)(2(10)-3) - 2(10)^2 + 6}{10-5} = 2$

$\dfrac{12(20-3) - 200 + 6}{5} = 2$

$\dfrac{12(17) - 200 + 6}{5} = 2$

$\dfrac{204 - 200 + 6}{5} = 2$

$\dfrac{10}{5} = 2$

Hence verified.

(22) $\dfrac{x^2-(x+1)(x+2)}{5x+1}=6$

$\dfrac{x^2-(x(x+2)+1(x+2))}{5x+1}=6$

$\dfrac{x^2-(x^2+2x+x+2)}{5x+1}=6$

$\dfrac{x^2-x^2-2x-x-2}{5x+1}=6$

$\Rightarrow \dfrac{-3x-2}{5x+1}=6$ cross multiplying.

$\Rightarrow -3x-2=6(5x+1)$

$\Rightarrow -3x-2=6(5x)+6(1)$

$\Rightarrow -3x-2=30x+6$

adding $+3x-6$ on both sides

$-3x-2+3x-6=30x+6+3x-6$

$\Rightarrow -8=33x$

$$\boxed{x=-8/33}$$

subsibitate 'x' in eq.

$\dfrac{\left(\frac{-8}{33}\right)^2-\left(\frac{-8}{33}+1\right)\left(\frac{-8}{33}+2\right)}{5\left(\frac{-8}{33}\right)+1}=6$

$\dfrac{\frac{64}{1089}-\left(\frac{33-8}{33}\right)\left(\frac{66-8}{33}\right)}{1-\frac{60}{33}}=6$

$$\frac{\dfrac{64}{1089} - \dfrac{25 \times 58}{1089}}{\dfrac{33-40}{33}} = 6.$$

$$= \frac{\dfrac{64 - 1450}{1089}}{\dfrac{-7}{33}} = 6$$

$$\Rightarrow \frac{-1386 \times 33}{1089 \times (-7)} = 6$$

$$\Rightarrow \frac{7 \times 198 \times 33}{33 \times 33 \times 7} = +6$$

$$\therefore \frac{6 \times 33}{33} = 6.$$

$$\Rightarrow 6 = 6$$

hence verified.

(23) $$\frac{(2x+3) - (5x-7)}{6x+11} = \frac{-8}{3}$$

$$\frac{2x+3-5x+7}{6x+11} = \frac{-8}{3}$$

$$\frac{-3x+10}{6x+11} = \frac{-8}{3}$$

Cross multiplying.

$$+3(-3x+10) = -8(6x+11)$$

$$-9x+30 = -48x-88.$$

adding $+48x -30$ on both sides.

$-9x + 30 + 48x - 36 = -48x - 88 + 48x - 30$

$\Rightarrow \quad 39x = -88 - 30.$

$\Rightarrow \quad 39x = -118$

$\Rightarrow \quad x = \dfrac{-118}{39}$

substitute 'x' in Eq.

$$\dfrac{\left(2\left(\dfrac{-118}{39}\right) + 3\right) - \left(5\left(\dfrac{-118}{39}\right) - 7\right)}{6\left(\dfrac{-118}{39}\right) + 11} = \dfrac{-8}{3}$$

$$\dfrac{-\dfrac{236}{39} + 3 + \dfrac{118(5)}{39} + 7}{\dfrac{-6(118) + 11(39)}{39}} = \dfrac{-8}{3}$$

$$\Rightarrow \dfrac{\dfrac{118(5) - 236}{39} + \dfrac{10 \times 39}{39}}{\dfrac{(-118)(6) + 11(39)}{39}} = \dfrac{-8}{3}$$

$$\Rightarrow \dfrac{\dfrac{590 - 236 + 390}{39}}{\dfrac{-708 + 429}{39}} = \dfrac{-8}{3}$$

$$\Rightarrow \dfrac{744}{-279} = \dfrac{-8}{3}$$

$$\Rightarrow \dfrac{-8}{3} = \dfrac{-8}{3} \qquad \text{hence verified.}$$

(24)

(i) $\dfrac{x^2-9}{5+x^2} = \dfrac{-5}{9}$

cross multiplying

$9(x^2-9) = -5(x^2+5)$

$\Rightarrow 9x^2-81 = -5x^2-25$

adding $5x^2+81$ on bothsides

$\Rightarrow 9x^2-81+5x^2+81 = -5x^2-25+5x^2+81$

$\Rightarrow 14x^2 = 56$

$x^2 = 4$

$x = \pm 2$

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

$\therefore x = +2 \text{ (or) } (-2)$

substitute $+2$

$\dfrac{4-9}{5+4} = \dfrac{-5}{9} \Rightarrow \dfrac{-5}{9} = \dfrac{-5}{9}$ hence verified.

$\therefore \boxed{x = 2}$

(ii) $\dfrac{y^2+4}{3y^2+7} = \dfrac{1}{2}$

cross multiplying.

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

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

$y^2 = 1$

$y = \pm 1 \Rightarrow 1$

substitute $x = 1$

$\dfrac{1^2+4}{3(1)^2+7} = 1/2 \Rightarrow \dfrac{5}{10} = \dfrac{1}{2}$ hence verified.

Linear Equation In One Variable Ex 9.4

Ex : 9.4

① Given, let 'x' be the given number

Given that

$$\frac{4}{5}x = \frac{3}{4}x + 4$$

⟹ multiply Eq. with 20 on both sides

⟹ $\frac{4}{5} \times x \times 20 = \frac{3}{4}x \times 20 + 4(20)$

⟹ $16x = 15x + 80$

$$\boxed{x = 80}$$

② let the numbers be $x, x+1$

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

$a^2 - b^2 = (a+b)(a-b)$

⟹ $(x+1 + x)(x+1 - x) = 31$

⟹ $(2x+1)(1) = 31$

$2x + 1 = 31$

$2x = 30$

$x = 15$

∴ The numbers are $15, 15+1$

$15, 16$

③ let the number be 'x'.

Given $2x = \frac{x}{2} + 45$

multiplying the eq. with 2 on b/s

$2x \times 2 = \frac{x}{2} \times 2 + 45 \times 2$

$4x = x + 90$

$3x = 90$

$\boxed{x = 30}$

④ Let the number be 'x'.

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

$3x = 9$

$x = 3$

∴ The number is 3.

⑤ Let the number be 'x'.

Given $\frac{x}{5} + 5 = \frac{x}{4} - 5$

$\frac{x}{4} - \frac{x}{5} = 10$

multiply Eq. with 20 with on b/s

$20 \times \frac{x}{4} - 20\left(\frac{x}{5}\right) = 10 \times 20$

$5x - 4x = 200$

$\boxed{x = 200}$

The number is 200

⑥ let the number be xy

Given $x+y = 9$,

$xy - 27 = yx$.

⑦ let $184 = x+y$

Given $\dfrac{x}{3} = \dfrac{y}{7} + 8$.

$x = y + 8 \cdot 184 - y$

$\dfrac{184-y}{3} = \dfrac{y}{7} + 8$.

and multiply Eq. with 21

$7(184-y) = \dfrac{y}{7}(21) + 8(21)$

$1288 - 7y = 3y + 168$

$10y = 1120$

$y = 112$

$x = 180 - y$

$x = 184 - 112$

$x = 72$

$\therefore$ The numbers are $72, 112$.

⑧ Let the fraction be $\left(\dfrac{x}{y}\right)$

Given $x = y - 6$

$\dfrac{x+3}{y} = \dfrac{2}{3}$

$\Rightarrow \dfrac{y-6+3}{y} = \dfrac{2}{3}$

$\Rightarrow \dfrac{y-3}{y} = \dfrac{2}{3}$

$\Rightarrow 3y - 9 = 2y$

$y = 9$, $\Rightarrow x = 9-6 = 3$

The fraction $\frac{x}{y} = \frac{3}{9} = \left(\frac{1}{3}\right)$

⑨ let
no. of Rs 10 notes be x
no. of Rs. 20 notes be y

Given $10x + 20y = 800$.
$$x + y = 50 \quad —①$$
$$x + 2y = 80 \quad —②$$

②－①
$$y = 30$$
$$x = 50 - y$$
$$x = 20$$

∴ no. of Rs 10 notes is 20 & no. of Rs 20 notes is 30.

⑩ let x be no. of 50 paise coins, y be 25 paise coins

Given $900 = 50x + 25y$.

$$y = 2x$$
$$y = 2x$$
$$900 = 50x + 25(2x)$$
$$900 = 50x + 50x$$
$$100x = 900$$
$$x = 9.$$
$$y = 2x$$
$$= 2 \times 9$$
$$y = 18$$

no. of 50 paise coins $= 9$
" 25 " $= 18$

(11) let age of Sunitha be x years
age of Ashma be y years

Given

$$4(y-6) = (x+4)$$

$$x = 2y$$

$$4(y-6) = 2y+4$$

$$4y - 24 = 2y+4$$

$$2y = 28$$

$$y = 14$$

$$x = 2y = 28$$

Sunitha age $= 28y$ Ashma age 14 years.

(12)

ages of Sonu be S year
age of mom be M year

given $S : M = 7:5$

after ten years

$$\frac{S+10}{M+10} = \frac{9}{7}$$

$$\frac{\left(\frac{S}{M}\right) + \left(\frac{10}{M}\right)}{\left(\frac{M}{M}\right) + \left(\frac{10}{M}\right)} = \frac{9}{7}$$

$$\frac{\frac{7}{5} + \frac{10}{M}}{1 + \frac{10}{M}} = \frac{9}{7}$$

cross multiplying $7\left(\frac{7}{5} + \frac{10}{M}\right) = 9\left(1 + \frac{10}{M}\right)$

$$\frac{49}{5} + \frac{70}{M} = 9 + \frac{90}{M}$$

$$\frac{49}{5} - 9 = \frac{90}{M} - \frac{70}{M}$$

$$\frac{49-45}{5} = \frac{20}{M}$$

$$\frac{4}{5} = \frac{20}{M}$$

$$M = 25$$

age of monu = 25 y , $\frac{S}{M} = \frac{7}{5}$

$$\frac{S}{25} = \frac{7}{5}$$

$$S = 35 y$$

age of sonu = 35 years.

⑬ let present age of man be x years

" " " son be y years

Given five years ago.

$$x - 5 = 7(y-5)$$

$$(x+5) = 3(y+5) \quad — ①$$

$$(x-5) = 7(y-5) \quad — ②$$

① — ②

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

$10 = 3y + 15 - 7y + 35$

$10 = -4y + 50$

$4y = 40$

$y = 10$

$x - 5 = 7(y-5)$

$= 7(10-5)$

$= 35$

$x = 40$

age of man is 40years & age of son is 10years

(14) let age of man be x years

" " son " y years

given $x = 5y$

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

$5y + 6 = 3y + 18$

$2y = 12$

$y = 6$

age of son is 6years

age of man is $5y$ i.e. 30years.

(15) (a) let no. of Rs.10 notes be x

let no. of Rs.5 notes be y

Given $10x + 5y = 1000$

Given that $x = 10 + y$

$10(10 + y) + 5y = 1000$

$100 + 10y + 5y = 1000$

$15y = 900$

$y = 60$

$x = 10 + y = 70$

no. of ten rupee notes $= 70$
no. of 5 rupee notes $= 60$

(16) let total no. of guests be x.

$\frac{x}{4}$ drank colas, $\frac{x}{3}$ drank squash, $\frac{2}{5}x$ drank
fruit juice   &   3 did not drink anything

no of person who drank is

$= \frac{x}{4} + \frac{x}{3} + \frac{2x}{5}$

but no. of person who drank is $(x - 3)$

$\therefore$ $x - 3 = \frac{x}{4} + \frac{x}{3} + \frac{2x}{5}$

$(x - 3) = x\left[\frac{15 + 20 + 24}{60}\right]$

$60(x - 3) = x(59)$

$60x - 180 = 59x$

$x = 180$

∴ Total no. of person who attend party is 180.

(17)

Given

    total no. of question = 180

      marks scored = 450

  let the correct answers be x

marks scored by marking correct answer is

     $\Rightarrow 4x$

remaining questions unattempted or wrong is

     $\Rightarrow (180 - x)$

marks reduced due to this is

     $\Rightarrow (180 - x)(-1)$

∴ Total marks scored

    $\Rightarrow 4x - 1(180 - x)$

    $= 4x + x - 180$

    $\Rightarrow 5x - 180$

But mark scored $= 450$

∴ $5x - 180 = 450$

    $5x = 630$

    $x = 126$

correct answers marked are 126

(18)

Total no. of days to be engaged is 20

amount recieves if he works for one day = Rs. 60

amount fined if he is absent for one day = Rs. 5

amount received by worker = Rs. 745.

let 'x' be no. of days he worked

then (20-x) is no. of days he left working

amount received for doing work = x × 60

amount fined for absence = (20-x) 5

Total amount received = $60x - 5(20-x)$

= 745

$60x - 100 + 5x = 745$

$65x = 845$

$x = \dfrac{845}{65} \quad \dfrac{169}{13}$

$\boxed{x = 13}$

no. of days he worked is 13.

(17) $\dfrac{2}{3x} - \dfrac{3}{2x} = \dfrac{1}{12}$

multiplying the equation with $12x$ on both sides.

$\dfrac{2}{3x} \times 12x - \dfrac{3}{2x} \times 12x = \dfrac{1}{12} \times 12 x$

$\dfrac{2}{3x} \times 4 \times 3x - \dfrac{3}{2x} \times 6 \times 2x = \dfrac{1}{12} \times 12 \times x$

$\qquad 8 - 18 = x$

$\qquad x = -10$

Substituting x in Eq.

$\dfrac{2}{3(-10)} - \dfrac{3}{2(-10)} = \dfrac{1}{12}$

$\dfrac{-2}{30} + \dfrac{3}{20} = \dfrac{1}{12}$

$\dfrac{-1}{15} + \dfrac{-4 + 9}{60} = \dfrac{1}{12}$

$\qquad \dfrac{1}{12} = \dfrac{1}{12}$

Hence verified.

(18) $\dfrac{4x}{9} + \dfrac{1}{3} + \dfrac{13}{108} x = \dfrac{8x + 19}{18}$

& multiply the equation with 108.

$9 \times \dfrac{4x}{9} \times 12 + \dfrac{1}{3} \times 108 + \dfrac{13}{108} \times x \times 108 = \dfrac{8x + 19}{18} \times 108$

20   let the number be $\left(\frac{x}{y}\right)$

Given $x = y - 3$

$$\frac{x+2}{y+5} = \frac{1}{2}$$

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

$$2x + 4 = y + 5$$

$$2x + 4 = x + 3 + 5 \qquad \left(\because y = x+3\right)$$

$$x = 4$$
$$y = 4+3$$
$$y = 7$$

$\therefore$ The rational no. is $\left(\frac{4}{7}\right)$

21   let the number be $\left(\frac{x}{y}\right)$

Given $2x = 2 + y$

$$\frac{x+3}{y+3} = \frac{2}{3}$$

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

$$3x + 9 = 2y + 6$$

$$3x + 9 = 2(2x - 2) + 6 \qquad \left(\because y = 2x - 2\right)$$

$$3x + 9 = 4x - 4 + 6$$

$$x = 9 + 4 - 6$$

$$x = 7$$

$$y = 2x - 2$$
$$y = 2(7) - 2$$
$$y = 12$$

$\therefore$ The rational number is $\frac{x}{y} \Rightarrow \left(\frac{7}{12}\right)$

(27)

~~Given let dis~~

Given distance between stations $d = 340$ km.

let speed of train A $= x$ km/hr

,, ,, ,, ,, B $= y$ km/hr

Given $x - y = 5$ km/hr

after 2.00 hours

distance travelled by train A → $2x$ km

,, ,, ,, Train B → $2y$ km.

distance between trains $= d - (2x + 2y)$

$= d - 2(x + y)$

$= 340 - 2(x + y)$

distance between is given as → 30 km

$\therefore 340 - 2(x + y) = 30$

$2(x + y) = 310$

$x + y = 155$

$x - y = 5$

$2x = 160$

$x = 80$

$y = 75$

speed of train A is 80 km/hr

,, ,, ,, B is 75 km/hr

(23)

let the speed of boat be x km/hr

∴ speed of stream is 1 km/hr

ups downstream
net speed = $(x+1)$ km/hr

let distance travelled be 'd' km

time taken downstream $= \dfrac{distance}{speed}$

$= \left(\dfrac{d}{x+1}\right)$ hr

from & upstream net speed $= \left(\dfrac{x+1}{x-1}\right)$ km/hr

time taken upstream $= \dfrac{distance}{speed}$

$= \left(\dfrac{d}{x-1}\right)$ km/hr

Given $\dfrac{d}{x+1} = 9$, $\dfrac{d}{x-1} = 10$.

$d = 9(x+1)$, $d = 10(x-1)$

∴ $9(x+1) = 10(x-1)$

$9x+9 = 10x-10$

$x = 19$ km/hr

speed of streamer in still water is 19 km/hr

∴ $d = 9(x+1)$

$= 9(20)$

$d = 180$ km

distance is 180 km

(24)

Total amount = Rs. 12,000

let amount invested on 10% interest be Rs. x.

∴ amount invested on 12% interest is Rs. (12,000 − x)

amount earned by 10% interest is

$$= \frac{10 \times x}{100}$$

amount earned by 12% interest is

$$= \frac{12 \times (12,000 - x)}{100}$$

total amount earned is

$$= \frac{10 \times x}{100} + \frac{12(12000 - x)}{100}$$

but given that amount earned is 1280 Rs.

$$\therefore \frac{10x}{100} + \frac{12(12000 - x)}{100} = 1280$$

$$10x + 144000 - 12x = 128000$$

$$-2x + 1,44,000 = 1,28,000$$

$$2x = 1,44,000 - 1,28,000$$

$$2x = 16,000$$

$$x = Rs. 8000$$

∴ amount invested on 10% interest is Rs. 8000
& amount invested on 12% interest is

Rs. 4,000.

(25)

G let length of rectangle be l cm
breadth " " b cm.

Given $\quad l = b + 9$

$\quad\quad b=3 \quad$ Area $= l \times b$

When l, b are increased by 3cm

$\quad\quad l+3, b+3$

new Area $\quad A_1 = (l+3)(b+3)$

Given that $\quad A_1 = A + 84$.

$\quad\quad (l+3)(b+3) = lb + 84.$

$\quad\quad lb + 3b + 9 + 3l = lb + 84$

$\quad\quad\quad 3(l+b) + 9 = 84$

$\quad\quad\quad 3(l+b) = 75 \quad\quad - ①$

$\quad\quad\quad l + b = 25 \quad\quad - ①$

Given $\quad l - b = 9 \quad\quad - ②$

$\quad ① + ②$

$\quad\quad \Rightarrow 2l = 34$

$\quad\quad\quad l = 17$ cm

$\quad\quad\quad b = 17 - 9$

$\quad\quad\quad b = 8$ cm

$\quad\therefore$ length $= 17$cm

$\quad\quad$ breadth $= 8$cm.

㉖ Let anup's age be 'x' years.

His fathers age = $100 - x$

anup's present age = $\left(\dfrac{100-x}{5}\right)$ years.

Anup becomes as old as his father is now after $(100 - 2x)$ years

Anup's age = $\left[\dfrac{100-x}{5} + 100 - 2x\right]$ years

$= \dfrac{600 - 11x}{5}$ years

Given $\dfrac{600 - 11x}{5} = x + 8$

$600 - 11x = 5x + 40$

$\Rightarrow x = 35$ $\Rightarrow$ anup's age.

fathers age = 65 years

Anup's anup age = 13 years.

㉗ let total amount be Rs. x

amount spent on hankies $= Rs. \dfrac{x}{2}$

amount given to beggar $= Rs. 1$

amount left $= x - \dfrac{x}{2} - 1$

$\Rightarrow \dfrac{x - x - 2}{2} \Rightarrow$

$\Rightarrow \left(\dfrac{x-2}{2}\right) Rs.$

amount spent on food $= Rs \left(\dfrac{x-2}{4}\right)$

amount given as tip $= Rs.2$

amount left $= \left(\dfrac{x-2}{2}\right) - \left[\left(\dfrac{x-2}{4}\right) + 2\right]$

$= \left(\dfrac{x-2}{4}\right) - 2$

$= \dfrac{x-2-8}{4}$

amount left $= \left(\dfrac{x-10}{4}\right)$

amount spent on book $= \left(\dfrac{x-10}{8}\right)$ Rs.

amount spent on bus $= Rs.\ 3$

amount left $= \dfrac{x-10}{4} - 3 - \dfrac{(x-10)}{8}$

$= \dfrac{2x-20-x+10}{8} - 3$

$= \dfrac{x-10}{8} - 3$

$= Rs.\left(\dfrac{x-34}{8}\right)$

but amount left $= A.1.$

$\therefore \dfrac{x-34}{8} = 1$

$x = 8 + 34$

$x = 42$

$\therefore$ The amount spent she started with is

$Rs.\ 42.$