



Linear Equation In One Variable

Ex-9.1

Linear Equation in one variable

Ex: 9.1

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

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

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

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

$$\Rightarrow \frac{37}{4} + \frac{4}{3} = y - \frac{4}{3} + \frac{4}{3} \quad \left(\text{Adding } \frac{4}{3} \text{ on both sides} \right)$$

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

$$y = \frac{37 \times 3 + 4 \times 4}{4 \times 3}$$

[Taking L.C.M.]

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

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

substitute 'y' in Equation.

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

$$= \frac{127 - 4 \times 4}{12}$$

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

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

L.H.S = R.H.S



$$(3) \quad \frac{5x}{3} + \frac{2}{5} = 1$$

$$\frac{5x}{3} + \frac{2}{5} - \frac{2}{5} = 1 - \frac{2}{5} \quad \left[\text{subtracting } \frac{2}{5} \text{ on b/s} \right]$$

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

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

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

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

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

Substitute 'x' in Eq.

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

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

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

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

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

Hence proved.



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

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

Multiply 12 on both sides

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

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

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

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

$$13x = 156$$

$$\boxed{x = 12}$$

Substitute x in Equation.

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

$$\frac{12 \times 6}{x} + \frac{4 \times 8}{x} + \frac{3 \times 3}{x} = 13$$

$$6 + 4 + 3 = 13$$

$$13 = 13$$

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

Hence verified



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

L.C.M of 2, 8 is 8.

Multiply with 8 on both sides.

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

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

$$4x + x = 1$$

$$5x = 1$$

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

[dividing eq. with 5]

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

Substitute value in eq.

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

$$\frac{1}{10} + \frac{1}{40} = \frac{16}{80} = \frac{1}{8}$$

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

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

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

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

$$\frac{1}{8} = \frac{1}{8}$$

Hence verified.



$$(5) \quad \frac{2x}{3} - \frac{3x}{8} = \frac{7}{12}$$

L.C.M of 3, 8 is 24

Multiply the eq with 24 on both sides

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

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

$$16x - 9x = 14$$

$$7x = 14$$

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

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

$$\boxed{x = 2}$$

Substitute x in eq.

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

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

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

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

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

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

$$\frac{7}{12} = \frac{7}{12}$$

L.H.S = R.H.S



$$\textcircled{c} (x+2)(x+3) + (x-3)(x-2) - 2x(x+1) = 0.$$

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

$\therefore$ eg. $\Rightarrow$

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

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

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

$$2x - 12 = 0$$

$$2x = 12$$

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

$$\boxed{x = 6}$$

Sub. $x = 6$ in eg.

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

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

$$72 + 12 - 84 = 0.$$

$$84 - 84 = 0.$$

$$0 = 0$$

L.H.S = R.H.S

Hence verified.



$$\textcircled{7} \quad \frac{x}{2} - \frac{4}{5} + \frac{x}{5} + \frac{3x}{10} = \frac{1}{5}$$

L.C.M of 2, 5, 10 is 10.

multiply the Eq. with 10 on both sides

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

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

$$5x - 8 + 2x + 3x = 2$$

$$10x - 8 = 2$$

$$10x - 8 + 8 = 2 + 8$$

$$10x = 10$$

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

$$x = 1$$

Sub value of x in Eq.

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

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

$$\frac{10}{20} - \frac{8}{20} + \frac{2}{20} + \frac{3}{10}$$

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

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

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



$$\textcircled{B} \quad \frac{7}{x} + 35 = \frac{1}{10}$$

multiply eq. with x on both sides

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

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

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

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

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

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

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

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

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

Substitute x in eq.

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

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

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

$$\left[\frac{1}{10} = \frac{1}{10} \right]$$

Hence verified.



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

$$\frac{(2x-1)5}{3 \times 5} - \frac{(6x-2)3}{5 \times 3} = \frac{1}{3}$$

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

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

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

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

$$-8x + 1 = 5$$

$$8x = -4$$

$$x = -4/8$$

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

Substitute 'x' in Eq.

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

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

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

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

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

$$\boxed{1=1}$$

Hence verified.

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

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

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

$$5y - 25 - 20 = 0$$

$$5y = 45$$

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

$$\boxed{y = 9}$$

Substitute 'y' in Eq.

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

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

$$65 + 0 - 65 = 0$$

$$0 = 0$$

$$\boxed{0=0}$$

Hence verified.



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

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

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

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

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

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

$$5x - 34 = 54$$

$$5x = 88$$

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

Substitute 'x' in eq.

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

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

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

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

$$\Rightarrow \left(\frac{9}{2} = \frac{9}{2}\right) \text{, hence verified}$$



Linear Equation In One Variable Ex 9.2

Ex: 9.2

$$\textcircled{1} \quad \frac{2x+5}{3} = 3x-10$$

$$\left(\frac{2x+5}{3}\right) \times 3 = (3x-10)3 \quad \left\{ \because \text{multiplying Eq. with } 3 \right\}$$

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

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

$$2x+5 = 9x - 30$$

$$7x = 35$$

$$7x = 7 \times 5$$

$$\cancel{7x} \quad \frac{7x}{7} = \frac{7 \times 5}{7} \quad \left\{ \because \text{dividing Eq. with } 7 \right\}$$

$$\boxed{x = 5}$$

Sub. x in Eq.

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

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

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

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

$$5 = 5$$

hence verified.



$$\textcircled{1} \quad \frac{a-8}{3} = \frac{a-3}{2}$$

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

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

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

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

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

$$a = -16 + 9$$

$$a = -7$$

Substitute 'a' in eq.

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

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

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

$$-5 = -5$$

hence verified.

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

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

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



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

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

($\therefore$ multiplying both 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.

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

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

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

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

Hence verified.



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

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

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

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

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

multiplying eq. with 6 on b/l.

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

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

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

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

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

$$\Rightarrow 24 = 17x$$

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

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

Substitute 'x' in eq.

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



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

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

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

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

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

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

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

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

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

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

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

(Adding $-7x$ on both sides)

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

$$\frac{x}{2} - 6 + 6 = \frac{1}{4} + 6 \quad \text{(Adding +6 on both sides)}$$

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



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

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

$$\frac{x}{2} \times 2 = \frac{25}{4} \times 2 \quad (\text{Multiplying eq. with 2})$$

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

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

Substitute x in eq.

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

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

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

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

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

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

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

$$\boxed{1=1}$$

Hence verified.



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

Adding $-4x + 6$ on both sides

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

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

multiplying Eq. with 8.

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

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

adding $-6x - 7$ on both sides

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

$$41 = 10x$$

$$\left[x = \frac{41}{10} \right]$$

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.

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

$$1 \cancel{4} \cancel{4} 20 = 35 + 328$$

$$(363 = 363)$$

Hence verified.

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

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

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

$$x = \frac{20}{3}x + 10 \quad \left(\text{Adding } -\frac{20}{3}x \text{ on both sides} \right)$$

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

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

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

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



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

$$\frac{7}{x} + x \times \frac{-3}{17} = 10 \times \left(\frac{-3}{17}\right)$$

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

Substitute x in Eq.

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

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

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

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

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.



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

multiply eq. with 6.

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

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

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

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

$$4x = -6 - 6 - 3$$

$$4x = -15$$

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

Substitute 'x' in eq.

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

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

multiply with 6 on b/s

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

$$-\frac{135}{2} + 3 + 6 = \left(\frac{-108-3}{4}\right) \times 2$$

$$-\frac{135}{2} + 9 = -\frac{108}{2} - 6$$

$$-117 = -117 \text{ Hence verified}$$



$$\textcircled{9} \quad \frac{3a-2}{3} + \frac{2a+3}{2} = a + \frac{7}{6}$$

multiplying eq. with 6 on b/s.

$$\left(\frac{3a-2}{3}\right)(3 \times 2) + \left(\frac{2a+3}{2}\right)(2 \times 2) = a \times 6 + \frac{7}{6} \times 6$$

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

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

$$\Rightarrow 12a + 2 = 6a + 7$$

$$\Rightarrow 6a = 5$$

$$\Rightarrow a = \frac{5}{6}$$

$$\boxed{a = \frac{5}{6}}$$

Substitute 'a' in eq.

$$\left[\frac{3\left(\frac{5}{6}\right)-2}{3}\right] + \left[\frac{2\left(\frac{5}{6}\right)+3}{2}\right] = \left[\frac{5}{6} + \frac{7}{6}\right]$$

multiplying eq. with 6

$$\left[\frac{1-2}{3}\right]6 + \left[\frac{\frac{5}{3}+3}{2}\right]6 = \left[\frac{1}{3} + \frac{7}{6}\right]6$$

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

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

$$9 = 9$$

Hence verified.



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

multiplying Eq. with 6

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

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

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

$$5x = 7$$

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

Substitute x in Eq.

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

and multiply Eq. with 30.

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

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

$$36 = 36$$

Hence verified

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

multiplying Eq. with 12

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

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

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

$$\boxed{x = -14/7}$$

2.

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

multiplying Eq. with 6

$$\frac{3}{4} \times 7 \times 6 - \frac{13}{2} \times 3 \times 2 = \frac{12}{3} \times 3 \times 2$$

$$63 - 39 = 24$$

$$24 = 24$$

Hence verified

">



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

multiply eq. with 60

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

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

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

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

$$73x = -51$$

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

Verify sol.

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

$$\frac{-255}{219} + \frac{124}{292} = \frac{210}{365}$$

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

Hence verified.

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

multiplying the equation with 112.



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

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

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

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

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

$$x = \frac{-28}{-15}$$

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

$$15x = 75$$

$$x = 5$$

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.

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

multiply with 56 on b/s.

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

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

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



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

$$-90 = 9x$$

$$x = -10$$

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.

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

divide eq. with 14 on both sides.

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

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

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

$$51x = 459$$

$$x = 9$$

Verify

solution

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

$$44 - (8) = 36$$

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



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

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

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

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

$$8 - 18 = x$$

$$x = -10$$

Substituting x in eq.

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

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

$$\frac{-4}{60} + \frac{-4+9}{20} = \frac{1}{12}$$

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

Hence verified.

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

multiply the equation with 108.

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



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

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

$$13x = 114 - 36$$

$$= 78$$

$$\boxed{x = 6}$$

Substitute value of x in Eq

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

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

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

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

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

Hence verified.

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

multiply the eq. with 45

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

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

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



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

$$28x = 30$$

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

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 eqn. with 45.

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

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

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

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

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

$$45 = 45$$

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

Hence verified



$$\textcircled{20} \quad 5 \left(\frac{7x+5}{3} \right) - \frac{23}{3} = 13 - \left(\frac{4x-2}{3} \right)$$

multiply the equation with 3

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

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

$$39x + 2 = 41$$

$$39x = 39$$

$$\underline{x=1}$$

Substitute 'x' in Eq.

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

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

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

$$7 = 7.$$

Hence verified



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

multiply the eq. with 12 on both side,

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

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

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

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

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

$$21x - 10x - 1 = 40$$

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

$$x = \frac{41}{11}$$

substitute x in eq.

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

multiplying eq. with 12 on both side

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

$$3 \left[\frac{287}{11} - 1 \right] - 4 \left(2 \times \frac{41}{11} - \left(1 - \frac{41}{11} \right) \right) = \frac{40 \times 41}{11}$$
$$= \frac{170}{3}$$



$$\frac{187 \times 3}{11} - 3 - \frac{4 \times 2 \times 11}{11} + \frac{4 \times (1 - \frac{11}{11})}{2} = \frac{4 \times 11}{11} = \frac{120}{3}$$

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

$$\frac{861}{11} - \frac{33}{11} - \frac{328}{11} + \frac{4}{2} - \frac{164}{11 \times 2} = \frac{1640}{11} = 40$$

$$\frac{861 - 33 - 328}{11} + \frac{2 \times 11}{11} - \frac{82}{11} = \frac{1640}{11} = 40$$

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

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

$$40 = 40$$

Hence verified.

$$(2b) \quad \frac{0.5(x - 0.4)}{0.35} - \frac{0.6(x - 2.71)}{0.42} = x + 6.1$$

dividing the eq. with 100 on both sides.

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

multiplying the equation with 10 on both side.

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

$$(2) \quad \frac{5(x - 0.4)}{35} - \frac{6(x - 2.71)}{42} = \frac{10(x + 6.1)}{100}$$



$$\Rightarrow \frac{5(x-0.4)}{5+7} - \frac{9(x-2.71)}{7 \times 6} = \frac{x+6.1}{10}$$

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

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

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

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

• multiplying eq. with 100. on b/s

$$\Rightarrow \frac{2.31 \times 100}{7} = \frac{(x+6.1) \frac{10 \times 10}{10}}{10}$$

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

$$\Rightarrow \frac{231}{7} = 10x + 61$$

$$\Rightarrow 33 = 10x + 61$$

$$33 - 61 = 10x + 61 - 61 \quad (\text{Adding } -61 \text{ on b/s})$$

$$10x = -28$$

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

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



Substitute 'x' in eq.

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

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

multiply the equation with $\frac{100}{100}$ on both side

$$= \frac{(0.5)(-3.2)(10 \times 10)}{0.35 \times 100} + \frac{(0.6)(5.51)(100)}{0.42 \times 100} = (6.1 - 2.8) \left(\frac{100}{100} \right)$$

$$= \frac{(45)(-32)}{35} + \frac{0.6 \times 551}{42} = \frac{(6.1 - 2.8)(100)}{100}$$

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

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

multiply eq. with 10. on b/s.

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

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

$$= \frac{(-5)(320)}{7 \times 1} + \frac{6 \times 551}{7 \times 4} = \frac{33 \times 100}{100}$$



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

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

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

$$\Rightarrow \frac{7 \times 33}{1} = 33$$

$$\Rightarrow 33 = 33$$

Hence verified.

$$(23) \quad 6.5x + \frac{19.5x - 32.5}{2} = 6.5x + 13 + \left(\frac{13x - 26}{2}\right)$$

multiplying the eq. with $10x2$ on both sides

$$6.5x \times 10x2 + \frac{(19.5x - 32.5) 10x2}{2} =$$

$$6.5x \times 10x2 + 13 \times 10x2 + \left(\frac{13x - 26}{2}\right) \times 10x2$$

$$2 \times \frac{65}{10} \times 10x2 + \frac{195}{10} \times 10 - \frac{325}{10} \times 10$$

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

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

$$\Rightarrow 325x - 325 = 2 \times 130 + 130x$$



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

$$325x - 325 = 260x$$

adding $-260x + 325$ on both sides

$$325x - 325 - 260x + 325 = 260x - 260x + 325$$

$$= 65x = 325$$

$$= 65x = 65 \times 5$$

$$\Rightarrow \boxed{x = 5}$$

verify 'x' in Eq.

$$6.5(5) + \frac{19.5(5) - 325}{2} = 6.5 \times 5 + 13 + \left(\frac{13 \times 5 - 26}{2} \right)$$

multiplying with 10 on b/s.

$$6.5 \times 5 \times 10 + \frac{(19.5 \times 5 - 325)}{2} \times 10 = 6.5 \times 5 \times 10 + 13 \times 10 + \left(\frac{13 \times 5 - 26}{2} \right) \times 10$$

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



$$\cancel{5 \times 65} + \frac{1955 - 325}{2} = \cancel{65 \times 5} + 130 + \frac{39 \times 5 \times 2}{2}$$

$$\therefore \frac{975 - 325}{2} = 130 + 195$$

$$\therefore \frac{650}{2} = 325$$

$$\therefore \frac{2 \times 325}{2} = 325$$

$$325 = 325$$

Hence verified.

$$\begin{aligned} \textcircled{54} \quad (3x-8)(3x+2) - (4x-11)(2x+1) \\ = (x-3)(x+7) \end{aligned}$$

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

$$= ax^2 + xb + ay + ab$$

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

$$\begin{aligned} \therefore 3x(3x+2) - 8(3x+2) - 4x(2x+1) + 11(2x+1) \\ = x(x+7) - 3(x+7) \end{aligned}$$

$$\begin{aligned} \therefore 3 \times 3x \times x + 3x \times 2 - 8 \times 3x - 8 \times 2 - 4x(2x) \\ - 4x \times 1 + 11 \times 2x + 11 = x^2 + 7x - 3x - 21 \end{aligned}$$

$$\begin{aligned} \therefore 9x^2 + 6x - 24x - 16 - 8x^2 - 44x + 22x + 11 \\ = x^2 + 7x - 3x - 21 \end{aligned}$$



$$\cancel{5 \times 65} + \frac{1950 - 325}{2} = \cancel{65 \times 5} + 130 + \frac{39 \times 5 \times 2}{2}$$

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

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

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

$$325 = 325$$

Hence verified.

$$\begin{aligned} \textcircled{54} \quad (3x-8)(3x+2) - (4x-11)(2x+1) \\ = (x-3)(x+7) \end{aligned}$$

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

$$= ax^2 + xb + ay + ab$$

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

$$\begin{aligned} \Rightarrow 3x(3x+2) - 8(3x+2) - 4x(2x+1) + 11(2x+1) \\ = x(x+7) - 3(x+7) \end{aligned}$$

$$\begin{aligned} \Rightarrow 3 \times 3x \times x + 3x \times 2 - 8 \times 3x - 8 \times 2 - 4x(2x) \\ - 4x \times 1 + 11 \times 2x + 11 = x^2 + 7x - 3x - 21 \end{aligned}$$

$$\begin{aligned} \Rightarrow 9x^2 + 6x - 24x - 16 - 8x^2 - 44x + 22x + 11 \\ = x^2 + 7x - 3x - 21 \end{aligned}$$



$$\textcircled{25} \left[(2x+3) + (x+5) \right]^2 + \left[(2x+3) - (x+5) \right]^2$$

$$= 10x^2 + 92$$

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

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

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

$$= 10x^2 + 92$$

$$\Rightarrow 3x \times 3x + 3x \times 8 + 8 \times 3x + 8 \times 8 + x \times x - 2x$$

$$- 2x + 2x = 10x^2 + 92$$

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

$$= 10x^2 + 92$$

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

$$\Rightarrow 44x + 68 = 92$$

adding -68 on both sides

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

$$44x = 24$$

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

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

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

verify

in equation



$$= \left[\left(2\left(\frac{6}{11}\right) + 3 \right) + \left(\frac{6}{11} + 5 \right) \right]^2 + \left[\left(2\left(\frac{6}{11}\right) + 3 \right) - \left(\frac{6}{11} + 5 \right) \right]^2$$

$$= 10\left(\frac{6}{11}\right)^2 + 92$$

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

$$= \left[\frac{18}{11} + 8 \right]^2 + \left[\frac{6}{11} - 2 \right]^2 = \frac{10 \times 36}{121} + 92$$

$$= \left[\frac{18}{11} + 8 \right] \left[\frac{18}{11} + 8 \right] + \left[\frac{6}{11} - 2 \right] \left[\frac{6}{11} - 2 \right] = \frac{360}{121} + 92$$

$$= \frac{18}{11} \left(\frac{18}{11} + 8 \right) + 8 \left(\frac{18}{11} + 8 \right) + \frac{6}{11} \left(\frac{6}{11} - 2 \right) - 2 \left(\frac{6}{11} - 2 \right)$$

$$= \frac{360}{121} + 92$$

$$= \left(\frac{18}{11} \right)^2 + \frac{8 \times 18}{11} + \frac{8 \times 8}{11} + 64 + \left(\frac{6}{11} \right)^2 - \frac{2 \times 6}{11} - \frac{2 \times 2}{11}$$

$$+ 4 = \frac{360}{121} + 92$$

$$= \frac{324}{121} + \frac{36}{121} + \frac{144}{11} + \frac{144}{11} + 64 - \frac{12}{11} - \frac{12}{11}$$

$$+ 4 = \frac{360}{121} + 92$$

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

$$= \frac{264}{11} + 68 = 92$$

$$= \frac{11 \times 24}{11} + 68 = 92$$

$$= 24 + 68 = 92$$

hence verified.



Linear Equation In One Variable Ex 9.3

43

Exercise 9.3

$$\textcircled{1} \frac{2x-3}{3x+2} = -\frac{2}{3}$$

Cross multiply. $\therefore$

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

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

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

adding $6x + 9$ on both sides

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

$$12x = 5$$

$$x = 5/12$$

Substitute 'x' in Eq.

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

Cross multiplying.

$$3 \left[2 \left(\frac{5}{12} \right) - 3 \right] = -2 \left[\frac{3 \times 5}{4 \times 3} + 2 \right]$$

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

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

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

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

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

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

$$\boxed{5=5}$$

Hence verified



$$\textcircled{2} \quad \frac{2-y}{y+7} = \frac{3}{5}$$

cross multiply

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

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

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

adding $5y - 21$ on both sides

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

$$-11 = 8y$$

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

substitute $-y$ in eq.

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

cross multiplying.

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

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

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

adding $\frac{33}{8} - 10$ on both sides

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

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

$$11 = 11$$

Hence verified



$$\textcircled{3} \quad \frac{5x-7}{3x} = \frac{2}{1}$$

cross multiplying

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

$$5x-7 = 6x$$

adding $-5x$ on both sides

$$5x-7 \xrightarrow{-5x} 5x-7-5x = 6x-5x$$

$$-7 = x$$

$$x = -7$$

substitute x in eq.

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

cross multiplying

$$\begin{aligned} -25 \cdot 1(-35-7) &= 2(-21) \\ -42 &= -42 \end{aligned}$$

Hence verified.

$$\textcircled{4} \quad \frac{3x+5}{2x+7} = 4$$

cross multiplying

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

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

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

adding $-3x-28$ on both sides

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

$$-23 = 5x$$

$$x = \frac{-23}{5}$$



Substitute 'x' in Eq.

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

Cross multiply as

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

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

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

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

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

$$\frac{115}{5} = 23$$

$$23 = 23$$

Hence verified.

$$\textcircled{5} \quad \frac{2y+5}{y+4} = 1$$

cross multiply ~

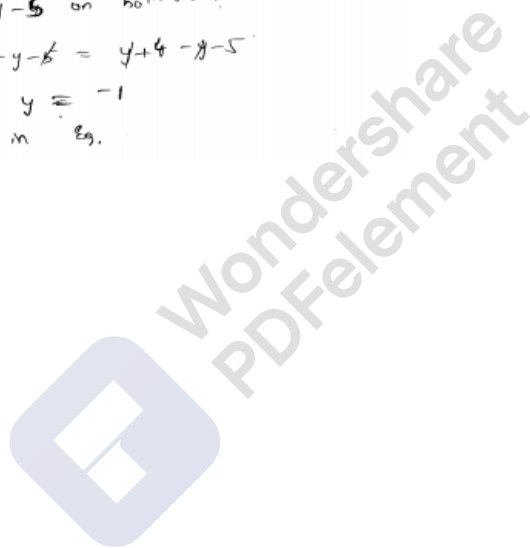
$$2y+5 = y+4$$

adding $-y-5$ on both sides

$$2y + \cancel{x} - y - \cancel{x} = y + 4 - \cancel{x} - 5$$

$$y = -1$$

Substitute 'y' in Eq.





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

cross multiply

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

$$3 = 3$$

hence verified.

$$(6) \quad \frac{2x+1}{3x-2} = \frac{5}{9}$$

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.

$$\frac{2(-19/3) + 1}{3(-19/3) - 2} = \frac{5}{9} \quad [\therefore \text{cross multiply}]$$

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

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

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

$$-105 = -105 \quad \text{hence verified.}$$



$$\textcircled{7} \frac{1-9y}{19-3y} = \frac{5}{8}$$

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

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

$$-57y = 87$$

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

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

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

Substitute y in Eq.

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

Cross multiplying

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

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

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



$$\begin{array}{r}
 -8 - \frac{15 \times 29}{19} + 8 + \frac{8 \times 9 \times 29}{19} = 579 + \frac{5 \times 3 \times 29}{19} \\
 - \frac{15 \times 29}{19} - 8
 \end{array}$$

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

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

$$87 = 87$$

hence verified

$$\textcircled{8} \quad \frac{2x}{3x+1} = -3$$

cross multiplying

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

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

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

adding $+9x$ on both sides

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

$$11x = -3$$

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

addn substitute 'x' in eq.

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

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

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

$$-\frac{6}{11} = -\frac{6}{11} \quad \text{Hence verified}$$



$$\textcircled{1} \frac{y - (7 - 8y)}{9y - (3 + 4y)} = \frac{2}{3}$$

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

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

$$\Rightarrow \frac{9y - 7}{5y - 3} = \frac{2}{3} \quad \text{cross multiplying}$$

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

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

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

$$\text{adding } -10y + 21 \text{ on both sides}$$

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

$$\Rightarrow 17y = 15$$

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

Substituting 'y' in Eq.

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

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

cross multiplying

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



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

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

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

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

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

$$\Rightarrow 15 - 15 = 0$$

$0 = 0$ hence verified

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

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

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.



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

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

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

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

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

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

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

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



12

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

cross multiplying

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

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

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

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

adding $-22x - 35$ on both sides

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

$$19x = -27$$

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

Substitute x in eq.

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

multiplying

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

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

$$\frac{19 \quad 95 - 81}{38 - 108} = \frac{76 - 81}{133 - 108}$$

$$\frac{14}{-70} = \frac{19 \quad -5}{25} \quad \text{or} \quad \frac{-1}{5} = \frac{-1}{5} \quad \text{hence verified}$$



⑬

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

cross multiplying

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

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

$$(7x)(5x) + (7x)(4) - 2(5x) - 2(4) = \cancel{(7x)(5x)} - 7x + 3(5x) - 3$$

$$35x - 10x - 8 = -7x + 15x - 3$$

$$18x - 8 = 8x - 3$$

adding $-8x + 8$ on both sides

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

$$10x = 5$$

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

substituting x in eq.

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

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

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

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

$$1 = 4 - 3$$

$$1 = 1$$

Hence verified.



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

cross multiplying.

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

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

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

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

$$= \cancel{x^3} - \cancel{2x^2} + \cancel{2x^2} - 4x + x - 2 = \cancel{x^3} + 16x - 8x^2 + 8x^2 + 16 \times 8 - 64x$$

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

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

adding $48x + 2$ on both sides

$$x - 3x - \cancel{2} + 48x + \cancel{2} = 128 - 48x + 48x + 2$$

$$= 48x - 3x = 130$$

$$= 45x = 130$$

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

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

Substitute

in Eq.



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

$$9 \left(\frac{\frac{35}{9}}{\frac{16-26}{9}} \right)^2 = \left(\frac{\frac{26+72}{9}}{\frac{26-18}{9}} \right)$$

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

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

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

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

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

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

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

add $-3x + 42$ on both sides

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

$$44x = 22$$

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

substitute x on b/s.

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



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

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

$$(17) \quad \frac{x+2}{x+5} = \frac{x}{x+6}$$

Cross multiplying

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

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

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

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

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

$$\Rightarrow 3x = -12$$

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

substitute -4 in eq.

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

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

$$-2 = -2$$

Hence verified.



$$(16) \quad \frac{2x - (7 - 5x)}{9x - (3 + 4x)} = \frac{7}{6}$$

$$\frac{2x - 7 + 5x}{9x - 3 - 4x} = \frac{7}{6}$$

$$\Rightarrow \frac{7x - 7}{5x - 3} = \frac{7}{6} \quad \text{cross multiplying}$$

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

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

$$\text{adding } -35x + 42 \text{ on both sides}$$

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

$$\Rightarrow 7x = 21$$

$$x = 3$$

Substitute x in $2x$

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

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

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

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

$$\frac{7}{6} = \frac{7}{6}$$



$$\textcircled{19} \quad \frac{15(2-x) - 5(x+6)}{1-3x} = 10$$
$$\frac{30 - 15x - 5x - 30}{1-3x} = 10$$

$$\frac{-20x}{1-3x} = 10 \quad \text{cross multiplying}$$

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

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

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

adding $+30x$ on both sides

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

$$10x = 10$$

$$x = 1$$

substitute x in eq.

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

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

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

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

$$10 = 10$$

Hence verified



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

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

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

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

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

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

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

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

adding -12 on both sides

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

$$-24 = -10x$$

$$x = \frac{24}{10}$$

Substitute 'x' in eq.

$$\left(\frac{\frac{24}{10} + 3}{\frac{24}{10} - 3} \right) + \left(\frac{\frac{24}{10} + 2}{\frac{24}{10} - 2} \right) = 2$$

$$\frac{\frac{12+30}{5}}{\frac{12-30}{5}} + \frac{\frac{12+20}{5}}{\frac{12-20}{5}} = 2$$

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

$$-9 + 11 = 2$$

$$2 = 2$$

Hence verified.



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

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

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

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

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

$\Rightarrow$ 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

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

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

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

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

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

Hence verified.



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

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

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

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

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

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

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

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

$$\text{adding } +3x-6 \text{ on both sides}$$

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

$$\Rightarrow -8 = 33x$$

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

substitute 'x' in eq.

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

$$5\left(-\frac{8}{33}\right) + 1$$

$$\frac{\frac{64}{1089} - \left(\frac{33-8}{33}\right)\left(\frac{66-8}{33}\right)}{1 - \frac{40}{33}} = 6$$



$$\frac{64}{1089} = \frac{25 \times 58}{1089} = 6$$

$$\frac{33-40}{33}$$

$$\frac{64-1450}{1089} = 6$$

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

$$\frac{1 \times 198 \times 33}{33 \times 33 \times 7} = +6$$

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

$$6 = 6$$

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





$$-9x + 3x + 48x - 30 = -48x - 88 + 48x - 30$$

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

$$\Rightarrow 39x = -118$$

$$\Rightarrow x = \frac{-118}{39}$$

substitute x in Eq.

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

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

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

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

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

$$\Rightarrow \frac{-8}{3} = \frac{-8}{3}$$

hence verified.



(24)

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

cross multiplying

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

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

adding $5x^2 + 81$ on both sides

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

$$\Rightarrow 14x^2 = 56$$

$$x^2 = 4$$

$$x = \pm 2$$

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

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

substitute $+2$

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

$$\therefore x = \pm 2$$

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

$$3y^2+7$$

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 $x = 1$

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



Linear Equation In One Variable Ex 9.4

Ex: 9.4

(1) Given let 'x' be the given number

Given that

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

$\Rightarrow$ multiply Eq. with 20 on both sides

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

$$\Rightarrow 16x = 15x + 80$$

$$\boxed{x = 80}$$

(2) let the numbers be x, x+1

$$\text{Given } (x+1)^2 - x^2 = 31$$

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

$$\Rightarrow (x+1+x)(x+1-x) = 31$$

$$\Rightarrow (2x+1)(1) = 31$$

$$2x+1 = 31$$

$$2x = 30$$

$$x = 15$$

$\therefore$ The numbers are 15, 15+1
15, 16



③ Let the number be 'x'.

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

multiply 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'.

$$\text{Given } 5x - 5 = 2x + 4$$

$$3x = 9$$

$$x = 3$$

∴ The number is 3.

⑤ Let the number be 'x'.

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

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

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 ~~100~~ 200



⑥ Let the number be xy .

Given $x+y=9$,

$$xy - 27 = yx.$$

⑦ Let $184 = x+y$

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

$$x = y + 184 - y$$

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

and multiply eq. with 21

$$7(184-y) = y(21) + 8(21)$$

$$\begin{array}{r} 1288 \\ - 7y \\ \hline 168 \end{array}$$

$$1288 - 7y = 21y + 168$$

$$10y = 1120$$

$$y = 112$$

$$x = 184 - y$$

$$x = 184 - 112$$

$$x = 72$$

∴ The numbers are 72, 112.

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

Given $x = y - 6$

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

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

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

$$3y - 9 = 2y, \quad y = 9, \quad x = 9 - 6 = 3$$



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

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

Given $10x + 20y = 800$

$$x + y = 50 \quad \text{--- (1)}$$

$$x + 2y = 80 \quad \text{--- (2)}$$

$$(2) - (1) \Rightarrow y = 30$$

$$x = 50 - y$$

$$x = 20$$

$\therefore$ 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 $900 = 50x + 25y$

$$2y = 2x$$

$$y = 2x$$

$$900 = 50x + 25(2x)$$

$$900 = 50x + 50x$$

$$100x = 900$$

$$x = 9$$

$$y = 2x$$

$$= 2 \times 9$$

$$y = 18$$

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



- (11) Let age of Sunitha be x years
age of Ashuma 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, Ashuma age 14 years.

(12)

ages of Sonu be S year

age of Mannu 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 $7\left(\frac{7}{5} + \frac{10}{M}\right) = 9\left(1 + \frac{10}{M}\right)$



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

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

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

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

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

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

$$S = 35 \text{ y}$$

age of son = 35 years

(13) let present age of man be x years
" " " " son be y years

Given five years ago:

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

$$(x+5) = 7(y+5) \quad \text{--- (1)}$$

$$(x-5) = 7(y-5) \quad \text{--- (2)}$$

$$(1) - (2)$$



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

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

$$10 = -4y + 50$$

$$4y = 40$$

$$y = 10$$

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

$$= 7(10-5)$$

$$= 35$$

$$x = 40$$

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

(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 6 years

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



- ⑮ let no. of Rs. 10 notes be x
let no. of Rs. 5 notes be y

$$\text{Given } 10x + 5y = 1000$$

$$\text{Given that } x = 10 + y$$

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

$$100 + 10y + 5y = 1000$$

$$15y = 900$$

$$y = 60$$

$$x = 10 + y = 70$$

$$\text{no. of ten rupee notes} = 70$$

$$\text{no. of 5 rupee notes} = 60$$

- ⑯ let total no. of guests be x .
 $\frac{x}{4}$ drank cola, $\frac{x}{3}$ drank squash, $\frac{2x}{5}$ drank
fruit juice & 3 did not drink anything

no. of person who drank is

$$x \left[\frac{x}{4} + \frac{x}{3} + \frac{2x}{5} \right]$$

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

$$\therefore x - 3 = x \left[\frac{x}{4} + \frac{x}{3} + \frac{2x}{5} \right]$$

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

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

$$60x - 180 = 59x$$

$$x = 180$$



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

(17)

Given

total no. of question = 180

marks scored = 480

Let the correct answers be x

marks scored by marking correct answer is

$$\Rightarrow 4x$$

remaining questions unattempted or wrong is
 $x(180 - x)$

marks reduced due to this is

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

∴ Total marks scored

$$= 4x - 1(180 - x)$$

$$= 4x + x - 180$$

$$= 5x - 180$$

But marks scored = 480

$$\therefore 5x - 180 = 480$$

$$5x = 660$$

$$x = 132$$

Correct answers marked are 132



(18)

Total no. of days to be engaged is 20

amount received 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 = $x \times 60$

amount fined for absence = $(20-x) \times 5$

Total amount received = $60x - 5(20-x)$
= 745

$$60x - 100 + 5x = 745$$

$$65x = 845$$

$$x = \frac{845}{65} = 13$$

$$\boxed{x = 13}$$

no. of days he worked is 13.



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

multiply 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.

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

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

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

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

Hence verified.

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

multiply the equation with 108

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



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

Given $x = y - 3$

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

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

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

$$2x+4 = x+3+5 \quad \left\{ \begin{array}{l} y = x+3 \end{array} \right.$$

$$x = 4$$

$$y = 4+3$$

$$y = 7$$

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

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

Given $2x = 2 + y$

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

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

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

$$3x+9 = 2(2x-2)+6 \quad \left\{ \begin{array}{l} y = 2x-2 \end{array} \right.$$

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

$$x = 9+4-6$$

$$x = 7$$

$$y = 2x - 2$$

$$y = 2(7) - 2$$

$$y = 12$$

$\therefore$ The rational number is $\frac{x}{y} = \left(\frac{7}{12}\right)$



~~Gruen~~ heb die

Given distance between station $d = 340 \text{ km}$.

Let speed of train A = x km/hr

$$1 \quad 4 \quad 4 \quad 4 \quad 3 = 9 \text{ km/hr}$$

Given, $x - y = 5 \text{ km/hr}$

after 1200 hours

per 100 hours distance travelled by train A is 2x km
distance travelled by train B is 2u km

1. Baner travelled by Train A → 24 km.
 4 4 1 Train B → 24 km.

distance between trains = $d - (v_1 t + v_2 t)$

$$= d - 2(x+y)$$

$$= 340 - 2(x + y)$$

distance between is given as $\Rightarrow 30 \text{ km}$

$$\therefore 340 - 2(x+y) = 30$$

$$2(x+y) = 310$$

$$x + y = 155$$

$$m - y = 5$$

$$2x = 160$$

$n = 80$

$$y = 75$$

speed of train A is 80 km/hr
B is 75 km/hr

3

25 km/hr



(23)

Let the speed of boat be x km/hr
down speed of stream is 1 km/hr

ups downstream net speed = $(x+1)$ km/hr

Let distance travelled be d km

$$\text{time taken downstream} = \frac{\text{distance}}{\text{speed}} \\ = \left(\frac{d}{x+1} \right) \text{ hr}$$

Let upstream net speed = $(x-1)$ km/hr

$$\text{time taken upstream} = \frac{\text{distance}}{\text{speed}} \\ = \left(\frac{d}{x-1} \right) \text{ km/hr}$$

$$\text{Given } \frac{d}{x+1} = 9, \quad \frac{d}{x-1} = 10.$$

$$d = 9(x+1), \quad d = 10(x-1)$$

$$\therefore 9(x+1) = 10(x-1)$$

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

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

speed of streamer in still water is 19 km/hr

$$\therefore d = 9(x+1)$$

$$= 9(20)$$

$$d = 180 \text{ km}$$

distance is 180 km



(24)

Total amount = Rs. 12,000

Let amount invested on 10% interest be Rs. x . $\therefore$ 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

$$= \frac{10x}{100} + \frac{12(12,000 - x)}{100}$$

but gives that amount earned is 1280 Rs.

$$\therefore \frac{10x}{100} + \frac{12(12,000 - x)}{100} = 1280$$

$$10x + 144,000 - 12x = 128,000$$

$$-2x + 144,000 = 128,000$$

$$2x = 144,000 - 128,000$$

$$2x = 16,000$$

$$x = 8,000$$

 $\therefore$ amount invested on 10% interest is Rs. 8,000

& amount invested on 12% interest is

Rs. 4,000.



(25)

Q Let length of rectangle be l cm
breadth b cm.

Given $l = b + 9$

~~Let~~ Area $= l \times b$

When l, b are increased by 3 cm

$$l+3, b+3$$

new Area $A_1 = (l+3)(b+3)$

Given that $A_1 = A + 84$.

$$(l+3)(b+3) = lb + 84$$

$$lb + 3b + 9 + 3l = lb + 84$$

$$3(l+b) + 9 = 84$$

$$3(l+b) = 75$$

$$l+b = 25 \quad \text{--- (1)}$$

Given $l - b = 9 \quad \text{--- (2)}$

$$\text{(1) + (2)}$$

$$\therefore 2l = 34$$

$$l = 17 \text{ cm}$$

$$b = 17 - 9$$

$$b = 8 \text{ cm}$$

$$\therefore \text{length} = 17 \text{ cm}$$

$$\text{breadth} = 8 \text{ cm}$$



(26) Let Anup's age be x years.

$$\text{His father's age} = 100 - x$$

$$\text{Anup's present age} = \left(\frac{100 - x}{5} \right) \text{ years.}$$

Anup becomes as old as his father is now
after $(100 - 2x)$ years

$$\begin{aligned} \text{Anup's age} &= \left[\frac{100 - x}{5} + 100 - 2x \right] \text{ years} \\ &= \frac{600 - 11x}{5} \text{ years} \end{aligned}$$

$$\begin{aligned} \text{Given } \frac{600 - 11x}{5} &= x + 8 \\ 600 - 11x &= 5x + 40 \end{aligned}$$

$$x = 35 \Rightarrow \text{Anup's age}$$

$$\text{father's age} = 65 \text{ years}$$

$$\text{Anup's age} = 35 \text{ years}$$

(27) Let total amount be Rs. x

$$\text{amount spent on hankies} = \text{Rs. } \frac{x}{2}$$

$$\text{amount given to beggar} = \text{Rs. } 1$$

$$\begin{aligned} \text{amount left} &= x - \frac{x}{2} - 1 \\ &= \frac{x - 2}{2} \end{aligned}$$

$$= \left(\frac{x - 2}{2} \right) \text{ Rs.}$$

$$\text{amount spent on food} = \text{Rs. } \left(\frac{x - 2}{4} \right)$$



$$\text{amount given as tip} = \text{Rs. } 2$$

$$\begin{aligned}\text{amount left} &= \left(\frac{x-2}{2}\right) - \left[\left(\frac{x-2}{4}\right) + 2\right] \\ &= \left(\frac{x-2}{4}\right) - 2 \\ &= \frac{x-2-8}{4}\end{aligned}$$

$$\text{amount left} = \left(\frac{x-10}{4}\right)$$

$$\text{amount spent on book} = \left(\frac{x-10}{8}\right) \text{ Rs.}$$

$$\text{amount spent on bus} = \text{Rs. } 3$$

$$\text{amount left} = \frac{x-10}{4} - 3 - \frac{(x-10)}{8}$$

$$= \frac{2x-20-24+10}{8} - 3$$

$$= \frac{x-10}{8} - 3$$

$$= \text{Rs. } \left(\frac{x-34}{8}\right)$$

$$\text{but amount left} = \text{Rs. } 1$$

$$\therefore \frac{x-34}{8} = 1$$

$$x = 8 + 34$$

$$x = 42$$

$\therefore$ The amount ~~spent~~ on she started with is

Rs. 42.