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Selina ICSE Solutions for Class 9 Maths Chapter 6 Simultaneous (Linear) Equations (Including Problems)

Exercise 6(A)

Solution 1:

$8x + 5y = 9...(1)$
$3x + 2y = 4...(2)$

$(2) \Rightarrow y = \dfrac{9 - 8x}{5}$

Putting this value of y in (2)

$3x + 2\left(\dfrac{9 - 8x}{5}\right) = 4$

$15x + 18 - 16x = 20$
$x = -2$

From (1) $y = \left(\dfrac{9 - 8x}{5}\right) = \dfrac{9 - 8(-2)}{5} = \dfrac{25}{5} = 5$

$y = 5$

Solution 2:

$2x - 3y = 7...(1)$
$5x + y = 9...(2)$

$(2) \Rightarrow y = 9 - 5x$
Putting this value of y in (1)
$2x - 3(9 - 5x) = 7$
$2x - 27 + 15x = 7$
$17x = 34$
$x = 2$
From (2)
$y = 9 - 5(2)$
$y = -1$

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Solution 3:

$2x + 3y = 8...(1)$
$2x = 2 + 3y...(2)$

$(2) \Rightarrow 2x = 2 + 3y$
Putting this value of 2x in (1)
$2 + 3y + 3y = 8$
$6y = 6$
$y = 1$
From (2) $2x = 2 + 3(1)$
$x = \dfrac{5}{2}$
$x = 2.5$

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Solution 4:

The given pair of linear equations are

$0.2x + 0.1y = 25$ ....(i)

$2(x - 2) - 1.6y = 116$ ....(ii)

Consider equation (i)

$0.2x + 0.1y = 25$

$\Rightarrow 0.2x = 25 - 0.1y$

$\Rightarrow x = \dfrac{(25 - 0.1y)}{0.2}$ ....(iii)

Substitute the value of x from equation (iii) in equation (ii).

$2(x - 2) - 1.6y = 116$

$\Rightarrow 2\left(\dfrac{(25 - 0.1y)}{0.2} - 2\right) - 1.6y = 116$

$\Rightarrow 10(25 - 0.1y) - 4 - 1.6y = 116$

$\Rightarrow 250 - y - 4 - 1.6y = 116$

$\Rightarrow -2.6y = -130$

$\Rightarrow y = 50$ ....(iv)

Substitute the value of y from equation (iv) in equation (iii).

$x = \dfrac{(25 - 0.1y)}{0.2}$

$\Rightarrow x = \dfrac{(25 - 0.1(50))}{0.2}$

$\Rightarrow x = \dfrac{(25 - 5)}{0.2}$

$\Rightarrow x = 100$

∴ Solution is $x = 100$ and $y = 50$.

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Solution 5:

$6x = 7y + 7 \dots (1)$

$7y - x = 8 \dots (2)$

$(2) \Rightarrow x = 7y - 8$

Putting this value of x in (1)

$6(7y - 8) = 7y + 7$

$42y - 48 = 7y + 7$

$35y = 55$

$$y = \frac{11}{7}$$

From (2) $x = 7\left(\frac{11}{7}\right) - 8$

$x = 3$

Solution 6:

$y = 4x - 7 \dots (1)$

$16x - 5y = 25 \dots (2)$

$(1) \Rightarrow y = 4x - 7$

Putting this value of y in (2)

$16x - 5(4x - 7) = 25$

$16x - 20x + 35 = 25$

$-4x = -10$

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

From (1)

$$y = 4\left(\frac{5}{2}\right) - 7$$

$\Rightarrow y = 10 - 7$

$\Rightarrow y = 7$

$y = 10 - 7 = 3$

Solution is $x = \frac{5}{2}$ and $y = 3$.

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Solution 7:

$2x + 7y = 39...(1)$

$3x + 5y = 31...(2)$

$(1) \Rightarrow x = \dfrac{39 - 7y}{2}$

Putting this value of x in (2)

$$3\left(\dfrac{39 - 7y}{2}\right) + 5y = 31$$

$117 - 21y + 10y = 62$

$-11y = -55$

$y = 5$

From (1) $x = \dfrac{39 - 7(5)}{2}$

$x = \dfrac{4}{2}$

$x = 2$

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Solution 8:

The given pair of linear equations are

$1.5x + 0.1y = 6.2$...............(i)

$3x - 0.4y = 11.2$..............(ii)

Consider equation (i)

$1.5x + 0.1y = 6.2$

$\Rightarrow 1.5x = 6.2 - 0.1y$

$\Rightarrow x = \dfrac{(6.2 - 0.1y)}{1.5}$.........(iii)

Substitute the value of x from equation (iii) in equation (ii).

$3x - 0.4y = 11.2$

$\Rightarrow 3\left(\dfrac{(6.2 - 0.1y)}{1.5}\right) - 0.4y = 11.2$

$\Rightarrow 2(6.2 - 0.1y) - 0.4y = 11.2$

$\Rightarrow 12.4 - 0.2y - 0.4y = 11.2$

$\Rightarrow -0.6y = -1.2$

$\Rightarrow y = 2$.......(iv)

Substitute the value of y from equation (iv) in equation (iii).

$x = \dfrac{(6.2 - 0.1y)}{1.5}$

$\Rightarrow x = \dfrac{(6.2 - 0.1(2))}{1.5}$

$\Rightarrow x = \dfrac{(6.2 - 0.2)}{1.5}$

$\Rightarrow x = 4$

$\therefore$ Solution is $x = 4$ and $y = 2$.

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Solution 9:

Given equations are

$2(x-3)+3(y-5)=0$ ....(1)

$5(x-1)+4(y-4)=0$ ....(2)

From (1), we get

$2x-6+3y-15=0$

$\Rightarrow 2x-21+3y=0$

$\Rightarrow 2x=21-3y$

$\Rightarrow x=\dfrac{21-3y}{2}$

From (2), we get

$5(x-1)+4(y-4)=0$

$\Rightarrow 5x-5+4y-16=0$

$\Rightarrow 5x+4y-21=0$ ....(3)

Substituting $x=\dfrac{21-3y}{2}$ in (3), we get

$5\left(\dfrac{21-3y}{2}\right)+4y-21=0$

$\Rightarrow \dfrac{105-15y}{2}+4y-21=0$

$\Rightarrow 105-15y+8y-42=0$

$\Rightarrow -7y+63=0$

$\Rightarrow 7y=63$

$\Rightarrow y=9$

Substituting $y=9$ in $x=\dfrac{21-3y}{2}$, we get

$x=\dfrac{21-3(9)}{2}=\dfrac{21-27}{2}=\dfrac{-6}{2}=-3$

∴ Solution is $x=-3$ and $y=9$

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Solution 10:

$$\frac{2x+1}{7} + \frac{5y-3}{3} = 12 \quad \text{(given)}$$

$$\Rightarrow \frac{3(2x+1)+7(5y-3)}{21} = 12$$

$$\Rightarrow 6x + 3 + 35y - 21 = 252$$

$$\Rightarrow 6x + 35y - 18 = 252$$

$$\Rightarrow 6x + 35y = 270$$

$$\Rightarrow 6x = 270 - 35y$$

$$\Rightarrow x = \frac{270 - 35y}{6}$$

$$\frac{3x+2}{2} - \frac{4y+3}{9} = 13 \quad \text{(given)}$$

$$\Rightarrow \frac{9(3x+2)-2(4y+3)}{18} = 13$$

$$\Rightarrow 27x + 18 - 8y - 6 = 234$$

$$\Rightarrow 27x - 8y + 12 = 234$$

$$\Rightarrow 27x - 8y = 222 \quad ....(1)$$

Substituting $x = \dfrac{270-35y}{6}$ in (1), we get

$$27\left(\frac{270-35y}{6}\right) - 8y = 222$$

$$\Rightarrow 7290 - 945y - 48y = 1332$$

$$\Rightarrow -993y = -5958$$

$$\Rightarrow y = 6$$

Substituting $y = 6$ in $x = \dfrac{270-35y}{6}$, we get

$$x = \frac{270 - 35 \times 6}{6} = \frac{270 - 210}{6} = \frac{60}{6} = 10$$

$\therefore$ Solution is $x = 10$ and $y = 6$

Exercise 6(B)

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Solution 1:

$13 + 2y = 9x …(1)$
$3y = 7x …(2)$

Multiplying equation no. (1) by 3 and (2) by 2, we get,

$$39 + 6y = 27x \quad …(1)$$
$$6y = 14x \quad …(2)$$
$$\underline{- \quad - \quad -}$$
$$39 = 13x$$
$$x = 3$$

From (2)
$3y = 7(3)$
$y = 7$

Solution 2:

$3x - y = 23 …(1)$

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

$4x + 3y = 48 …(2)$

Multiplying equation no. (1) by 3

$$9x - 3y = 69 \quad …(3)$$
$$4x + 3y = 48$$
$$\overline{13x = 117}$$
$$x = 9$$

From (1)
$3(9) - y = 23$
$y = 27 - 23$
$y = 4$

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Solution 3:

The given pair of linear equations are

$$\frac{5y}{2} - \frac{x}{3} = 8$$

$$\Rightarrow -\frac{x}{3} + \frac{5y}{2} = 8 \ldots\ldots\ldots\ldots(i) \ [\text{On simplifying}]$$

$$\frac{y}{2} + \frac{5x}{3} = 12$$

$$\Rightarrow \frac{5x}{3} + \frac{y}{2} = 12 \ldots\ldots\ldots\ldots(ii) \ [\text{On simplifying}]$$

Multiply equation (i) by 5, we get:

$$-\frac{5x}{3} + \frac{25y}{2} = 40$$

$$\frac{5x}{3} + \frac{y}{2} = 12 \qquad\qquad [\text{Equation } (ii)]$$

$$+ \qquad + \qquad + \qquad\qquad [\text{Adding}]$$

$$\overline{\qquad\qquad\qquad\qquad}$$

$$\frac{26y}{2} = 52$$

$$\Rightarrow 13y = 52$$

$$\Rightarrow y = 4$$

Substituting $y = 4$ in equation (i), we get

$$-\frac{x}{3} + \frac{5(4)}{2} = 8$$

$$\Rightarrow -\frac{x}{3} = 8 - 10$$

$$\Rightarrow x = 6$$

$\therefore$ Solution is $x = 6$ and $y = 4$.

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Solution 4:

$$\frac{1}{5}(x-2) = \frac{1}{4}(1-y) \Rightarrow 4x + 5y = 13 \quad \ldots(1)$$

$$26x + 3y = -4 \quad \ldots(2)$$

Multiplying equation no. (1) by 3 and (2) by 5.

$$12x + 15y = 39 \quad \ldots(3)$$

$$130x + 15y = -20$$

$$\underline{--+}$$

$$-115x = 59$$

$$x = -\frac{59}{118}$$

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

From (1)

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

$$5y = 13 + 2$$

$$y = 3$$

Solution 5:

$$y = 2x - 6$$

$$y = 0$$

$$\Rightarrow 2x - y = 6 \quad \ldots(1)$$

$$\underline{y = 2 \quad \ldots(2)}$$

$$2x = 6$$

$$x = 3 \quad y = 0$$

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Solution 6:

The given pair of linear equations are

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

$\Rightarrow 13x - y = 48 \ldots\ldots\ldots\ldots(i)$ [On simplifying]

$2x + y = 3(x - 4)$

$\Rightarrow x - y = 12 \ldots\ldots\ldots\ldots(ii)$ [On simplifying]

Multiply equation (ii) by 13, we get:

$\quad 13x - 13y = 156$

$\quad 13x - y = 48 \qquad\qquad$ [Equation (i)]

$\underline{-\qquad +\qquad -\qquad\quad}$ [Subtracting]

$\qquad\quad -12y = 108$

$\Rightarrow y = -9$

Substituting $y = -9$ in equation (i), we get

$13x - (-9) = 48$

$\Rightarrow 13x = 39$

$\Rightarrow x = 3$

$\therefore$ Solution is $x = 3$ and $y = -9$.

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Solution 7:

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

$2(x + y) = 4 - 3y$

$\Rightarrow -x - y = -6$

$\Rightarrow x + y = 6 \ldots (1)$

$2x + 5y = 4 \ldots (2)$

Multiplying equation no. (1) by 2.

$$2x + 2y = 12$$
$$2x + 5y = 4$$
$$\underline{- \quad - \qquad -}$$
$$-3y = 8 \quad \Rightarrow y = \frac{-8}{3}$$

From (1)

$$x - \frac{8}{3} = 6 \qquad \Rightarrow x = \frac{26}{3}$$

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Solution 8:

$2x - 3y - 3 = 0$

$\dfrac{2x}{3} + 4y + \dfrac{1}{2} = 0$

$\Rightarrow 2x - 3y = 3 \ldots(1)$
$\Rightarrow 4x + 24y = -3 \ldots(2)$

Multiplying equation no. (1) by 8.

$16x - 24y = 24 \qquad \ldots(3)$

$\underline{4x + 24y = -3}$

$\qquad 20x = 21 \quad \Rightarrow x = \dfrac{21}{20}$

From (1)

$2\left(\dfrac{21}{20}\right) - 3y = 3$

$-3y = 3 - \dfrac{21}{10} \quad \Rightarrow y = \dfrac{-3}{10}$

Solution 9:

$13x + 11y = 70 \ldots(1)$
$11x + 13y = 74 \ldots(2)$
Adding(1) and (2)
$24x + 24y = 144$
$x + y = 6 \ldots(3)$

subtracting (2) from (1)
$2x - 2y = -4$
$x - y = -2 \ldots(4)$
$x + y = 6 \ldots(3)$
$\overline{\ 2x = 4\ } \qquad \Rightarrow x = 2$

From (3)
$2 + y = 6 \Rightarrow y = 4$

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Solution 10:

$41x + 53y = 135 \ldots(1)$
$53x + 41y = 147 \ldots(2)$
Adding (1) and (2)
$94x + 94y = 282$
$x + y = 3 \ldots(3)$

Subtracting (2) from (1)
$-12x + 12y = -12$
$\quad -x + \quad y = -1 \qquad \ldots(4)$
$\quad \underline{\quad x + \quad y = 3 \quad}$
$\qquad 2y = 2 \quad \Rightarrow y = 1$

From (3)
$x + 1 = 3 \Rightarrow x = 2$

Solution 11:

$2x + y = 23 \ldots(1)$

$4x - y = 19 \ldots(2)$

Adding equation (1) and (2) we get,
$2x + y = 23$
$\underline{4x - y = 19}$
$\quad 6x = 42 \quad \Rightarrow x = 7$

From (1)
$2(7) + y = 23$
$y = 23 - 14$
$\Rightarrow y = 9$
$\therefore x - 3y = 7 - 3(9) = -20$

And $5y - 2x = 5(9) - 2(7) = 45 - 14 = 31$

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Solution 12:

$10y = 7x - 4$
$-7x + 10y = -4 \ldots(1)$
$12x + 18y = 1 \ldots(2)$

Multiplying equation no. (1) by 12 and (2) by 7.

$$-84x + 120y = -48 \qquad \ldots(3)$$
$$\underline{84x + 126y = \quad 7}$$
$$246y = -41 \qquad \Rightarrow y = \frac{-1}{6}$$

From (1)

$$-7x + 10\left(\frac{-1}{6}\right) = -4$$

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

$$\therefore 4\left(\frac{1}{3}\right) + 6\left(\frac{-1}{6}\right) = \frac{1}{3} \text{ and } 8y - x = 8\left(\frac{-1}{6}\right) - \frac{1}{3} = \frac{-5}{3}$$

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Solution 13:

(i)

The given pair of linear equations are

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

$\Rightarrow 55x + 6y = 128............(i)$ [On simplifying]

$$\frac{7-5x}{2} + \frac{3-4y}{6} = 5y - 18$$

$\Rightarrow 15x + 34y = 132.............(ii)$ [On simplifying]

Multiply equation (i) by 3 and equation (ii) by 11, we get:

$165x + 18y = 384$

$165x + 374y = 1452$

$-\quad\quad-\quad\quad\quad-$ [Subtracting]

$\overline{\quad\quad\quad -356y = -1068\quad}$

$\Rightarrow y = 3$

Substituting $y = 3$ in equation (i), we get

$55x + 6(3) = 128$

$\Rightarrow 55x = 110$

$\Rightarrow x = 2$

∴ Solution is $x = 2$ and $y = 3$.

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(ii)

The given pair of linear equations are

$4x = 17 - \dfrac{x - y}{8}$

$\Rightarrow 33x - y = 136 \ldots\ldots\ldots\ldots(i)$ [On simplifying]

$2y + x = 2 + \dfrac{5y + 2}{3}$

$\Rightarrow 3x + y = 8 \ldots\ldots\ldots\ldots(ii)$ [On simplifying]

Multiply equation (ii) by 11, we get:

$33x + 11y = 88$

$33x - y = 136$ [Equation (i)]

$- \quad + \quad -$ [Subtracting]

$\overline{\qquad\qquad\qquad}$

$12y = -48$

$\Rightarrow y = -4$

Substituting $y = -4$ in equation (i), we get:

$33x - (-4) = 136$

$\Rightarrow 33x = 132$

$\Rightarrow x = 4$

∴ Solution is $x = 4$ and $y = -4$.

Solution 14:

Let $x = 2$ and $y = 1$ be a solution of the equation

$2x + 3y = m$.

$\Rightarrow 2(2) + 3(1) = m$

$\Rightarrow 4 + 3 = m$

$\Rightarrow m = 7$

∴ If $x = 2$ and $y = 1$ is the solution of the equation

$2x + 3y = m$ then the value of m is 7.

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Solution 15:

10% of x + 20% of y = 24

$\Rightarrow 0.1x + 0.2y = 24$..............(i)   [On simplyfying]

$3x - y = 20$.............(ii)

Multiply equation (ii) by 0.2, we get:

$\quad 0.6x - 0.2y = 4$

$\quad 0.1x + 0.2y = 24$ [Equation (i)]

$\underline{+ \quad\quad + \quad\quad\quad +}$ [Adding]

$\quad\quad 0.7x = 28$

$\Rightarrow x = 40$

Substituting $x = 40$ in equation (i), we get

$0.1(40) + 0.2y = 24$

$\Rightarrow 0.2y = 20$

$\Rightarrow y = 100$

$\therefore$ Solution is $x = 40$ and $y = 100$.

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Solution 16:

The value of expression mx - ny is 3 when x = 5 and y = 6.

$$\Rightarrow 5m - 6n = 3 \ldots\ldots\ldots\ldots(i)$$

The value of expression mx - ny is 8 when x = 6 and y = 5.

$$\Rightarrow 6m - 5n = 8 \ldots\ldots\ldots\ldots(ii)$$

Multiply equation (i) by 6 and equation (ii) by 5, we get:

$$30m - 36n = 18 \qquad \text{[Equation (i)]}$$
$$30m - 25n = 40 \qquad \text{[Equation (ii)]}$$
$$\underline{\quad -\quad\quad +\quad\quad -\quad\quad} \qquad \text{[Subtracting]}$$
$$-11n = -22$$
$$\Rightarrow n = 2$$

Substituting $n = 2$ in equation (i), we get

$$5m - 6(2) = 3$$
$$\Rightarrow 5m = 15$$
$$\Rightarrow m = 3$$

$\therefore$ Solution is $m = 3$ and $n = 2$.

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Solution 17:

$11(x - 5) + 10(y - 2) + 54 = 0$ (given)

$\Rightarrow 11x - 55 + 10y - 20 + 54 = 0$

$\Rightarrow 11x + 10y - 21 = 0$

$\Rightarrow 11x + 10y = 21$ ....(1)

$7(2x - 1) + 9(3y - 1) = 25$ (given)

$\Rightarrow 14x - 7 + 27y - 9 = 25$

$\Rightarrow 14x + 27y - 16 = 25$

$\Rightarrow 14x + 27y = 41$ ....(2)

Multiplying equation (1) by 27 and equation (2) by 10, we get

$297x + 270y = 567$ ....(3)

$140x + 270y = 410$ ....(4)

Subtracting equation (4) from equation (3), we get

$157x = 157$

$\Rightarrow x = 1$

Substituting $x = 1$ in equation (1), we get

$11 \times 1 + 10y = 21$

$\Rightarrow 10y = 10$

$\Rightarrow y = 1$

$\therefore$ Solution set is $x = 1$ and $y = 1$.

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Solution 18:

$$\frac{7+x}{5} - \frac{2x-y}{4} = 3y - 5 \quad \text{(given)}$$

$$\Rightarrow 4(7+x) - 5(2x-y) = 20(3y-5)$$

$$\Rightarrow 28 + 4x - 10x + 5y = 60y - 100$$

$$\Rightarrow -6x - 55y = -128 \quad \ldots(1)$$

$$\frac{5y-7}{2} + \frac{4x-3}{6} = 18 - 5x \quad \text{(given)}$$

$$\Rightarrow 3(5y-7) + 4x - 3 = 6(18-5x)$$

$$\Rightarrow 15y - 21 + 4x - 3 = 108 - 30x$$

$$\Rightarrow 34x + 15y = 132 \quad \ldots(2)$$

Multiplying equation (1) by 34 and equation (2) by 6, we get

$$-204x - 1870y = -4352 \quad \ldots(3)$$

$$204x + 90y = 792 \quad \ldots(4)$$

Adding equations (3) and (4), we get

$$-1780y = -3560$$

$$\Rightarrow y = 2$$

Substituting y = 2 in equation (1), we get

$$-6x - 55 \times 2 = -128$$

$$\Rightarrow -6x - 110 = -128$$

$$\Rightarrow -6x = -18$$

$$\Rightarrow x = 3$$

$$\therefore \text{ Solution is } x = 3 \text{ and } y = 2$$

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Solution 19:

$$4x + \frac{x - y}{8} = 17 \quad \text{(given)}$$

$$\Rightarrow 32x + x - y = 136$$

$$\Rightarrow 33x - y = 136 \quad ....(1)$$

$$2y + x - \frac{5y + 2}{3} = 2 \quad \text{(given)}$$

$$\Rightarrow 6y + 3x - 5y - 2 = 6$$

$$\Rightarrow 3x + y = 8 \quad ....(2)$$

Adding equations (1) and (2), we get

$$36x = 144$$

$$\Rightarrow x = 4$$

Substituting $x = 4$ in equation (2), we get

$$3 \times 4 + y = 8$$

$$\Rightarrow 12 + y = 8$$

$$\Rightarrow y = -4$$

$\therefore$ Solution is $x = 4$ and $y = -4$

Exercise 6(C)

Solution 1:

Given equations are $4x + 3y = 17$ and $3x - 4y + 6 = 0$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$a_1 = 4, b_1 = 3, c_1 = -17$ and $a_2 = 3, b_2 = -4, c_2 = 6$

Now, $x = \dfrac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1}$ and $y = \dfrac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$

$\Rightarrow x = \dfrac{3 \times 6 - (-4) \times (-17)}{4 \times (-4) - 3 \times 3}$ and $y = \dfrac{-17 \times 3 - 6 \times 4}{4 \times (-4) - 3 \times 3}$

$\Rightarrow x = \dfrac{18 - 68}{-16 - 9}$ and $y = \dfrac{-51 - 24}{-16 - 9}$

$\Rightarrow x = \dfrac{-50}{-25}$ and $y = \dfrac{-75}{-25}$

$\Rightarrow x = 2$ and $y = 3$

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Solution 2:

Given equations are $3x + 4y = 11$ and $2x + 3y = 8$

Comparing with $a_1 x + b_1 y + c_1 = 0$ and $a_2 x + b_2 y + c_2 = 0$, we have

$a_1 = 3, b_1 = 4, c_1 = -11$ and $a_2 = 2, b_2 = 3, c_2 = -8$

Now, $x = \dfrac{b_1 c_2 - b_2 c_1}{a_1 b_2 - a_2 b_1}$ and $y = \dfrac{c_1 a_2 - c_2 a_1}{a_1 b_2 - a_2 b_1}$

$\Rightarrow x = \dfrac{4 \times (-8) - 3 \times (-11)}{3 \times 3 - 2 \times 4}$ and $y = \dfrac{-11 \times 2 - (-8) \times 3}{3 \times 3 - 2 \times 4}$

$\Rightarrow x = \dfrac{-32 + 33}{9 - 8}$ and $y = \dfrac{-22 + 24}{9 - 8}$

$\Rightarrow x = 1$ and $y = 2$

Solution 3:

Given equations are $6x + 7y - 11 = 0$ and $5x + 2y = 13$

Comparing with $a_1 x + b_1 y + c_1 = 0$ and $a_2 x + b_2 y + c_2 = 0$, we have

$a_1 = 6, b_1 = 7, c_1 = -11$ and $a_2 = 5, b_2 = 2, c_2 = -13$

Now, $x = \dfrac{b_1 c_2 - b_2 c_1}{a_1 b_2 - a_2 b_1}$ and $y = \dfrac{c_1 a_2 - c_2 a_1}{a_1 b_2 - a_2 b_1}$

$\Rightarrow x = \dfrac{7 \times (-13) - 2 \times (-11)}{6 \times 2 - 5 \times 7}$ and $y = \dfrac{-11 \times 5 - (-13) \times 6}{6 \times 2 - 5 \times 7}$

$\Rightarrow x = \dfrac{-91 + 22}{12 - 35}$ and $y = \dfrac{-55 + 78}{12 - 35}$

$\Rightarrow x = \dfrac{-69}{-23}$ and $y = \dfrac{23}{-23}$

$\Rightarrow x = 3$ and $y = -1$

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Solution 4:

Given equations are $5x + 4y + 14 = 0$ and $3x = -10 - 4y$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$a_1 = 5, b_1 = 4, c_1 = 14$ and $a_2 = 3, b_2 = 4, c_2 = 10$

Now, $x = \dfrac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1}$ and $y = \dfrac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$

$\Rightarrow x = \dfrac{4 \times 10 - 4 \times 14}{5 \times 4 - 3 \times 4}$ and $y = \dfrac{14 \times 3 - 10 \times 5}{5 \times 4 - 3 \times 4}$

$\Rightarrow x = \dfrac{40 - 56}{20 - 12}$ and $y = \dfrac{42 - 50}{20 - 12}$

$\Rightarrow x = \dfrac{-16}{8}$ and $y = \dfrac{-8}{8}$

$\Rightarrow x = -2$ and $y = -1$

Solution 5:

Given equations are $x - y + 2 = 0$ and $7x + 9y = 130$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$a_1 = 1, b_1 = -1, c_1 = 2$ and $a_2 = 7, b_2 = 9, c_2 = -130$

Now, $x = \dfrac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1}$ and $y = \dfrac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$

$\Rightarrow x = \dfrac{-1 \times (-130) - 9 \times 2}{1 \times 9 - 7 \times (-1)}$ and $y = \dfrac{2 \times 7 - (-130) \times 1}{1 \times 9 - 7 \times (-1)}$

$\Rightarrow x = \dfrac{130 - 18}{9 + 7}$ and $y = \dfrac{14 + 130}{9 + 7}$

$\Rightarrow x = \dfrac{112}{16}$ and $y = \dfrac{144}{16}$

$\Rightarrow x = 7$ and $y = 9$

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Solution 6:

Given equations are $4x - y = 5$ and $5y - 4x = 7$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$a_1 = 4, b_1 = -1, c_1 = -5$ and $a_2 = -4, b_2 = 5, c_2 = -7$

Now, $x = \dfrac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1}$ and $y = \dfrac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$

$\Rightarrow x = \dfrac{-1 \times (-7) - 5 \times (-5)}{4 \times 5 - (-4) \times (-1)}$ and $y = \dfrac{(-5) \times (-4) - (-7) \times 4}{4 \times 5 - (-4) \times (-1)}$

$\Rightarrow x = \dfrac{7 + 25}{20 - 4}$ and $y = \dfrac{20 + 28}{20 - 4}$

$\Rightarrow x = \dfrac{32}{16}$ and $y = \dfrac{48}{16}$

$\Rightarrow x = 2$ and $y = 3$

Solution 7:

Given equations are $4x - 3y = 0$ and $2x + 3y = 18$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$a_1 = 4, b_1 = -3, c_1 = 0$ and $a_2 = 2, b_2 = 3, c_2 = -18$

Now, $x = \dfrac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1}$ and $y = \dfrac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$

$\Rightarrow x = \dfrac{-3 \times (-18) - 3 \times 0}{4 \times 3 - 2 \times (-3)}$ and $y = \dfrac{0 \times 2 - (-18) \times 4}{4 \times 3 - 2 \times (-3)}$

$\Rightarrow x = \dfrac{54 - 0}{12 + 6}$ and $y = \dfrac{0 + 72}{12 + 6}$

$\Rightarrow x = \dfrac{54}{18}$ and $y = \dfrac{72}{18}$

$\Rightarrow x = 3$ and $y = 4$

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Solution 8:

Given equations are $8x + 5y = 9$ and $3x + 2y = 4$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$a_1 = 8$, $b_1 = 5$, $c_1 = -9$ and $a_2 = 3$, $b_2 = 2$, $c_2 = -4$

Now, $x = \dfrac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1}$ and $y = \dfrac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$

$\Rightarrow x = \dfrac{5 \times (-4) - 2 \times (-9)}{8 \times 2 - 3 \times 5}$ and $y = \dfrac{-9 \times 3 - (-4) \times 8}{8 \times 2 - 3 \times 5}$

$\Rightarrow x = \dfrac{-20 + 18}{16 - 15}$ and $y = \dfrac{-27 + 32}{16 - 15}$

$\Rightarrow x = \dfrac{-2}{1}$ and $y = \dfrac{5}{1}$

$\Rightarrow x = -2$ and $y = 5$

Solution 9:

Given equations are $4x - 3y - 11 = 0$ and $6x + 7y - 5 = 0$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$a_1 = 4$, $b_1 = -3$, $c_1 = -11$ and $a_2 = 6$, $b_2 = 7$, $c_2 = -5$

Now, $x = \dfrac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1}$ and $y = \dfrac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$

$\Rightarrow x = \dfrac{-3 \times (-5) - 7 \times (-11)}{4 \times 7 - 6 \times (-3)}$ and $y = \dfrac{-11 \times 6 - (-5) \times 4}{4 \times 7 - 6 \times (-3)}$

$\Rightarrow x = \dfrac{15 + 77}{28 + 18}$ and $y = \dfrac{-66 + 20}{28 + 18}$

$\Rightarrow x = \dfrac{92}{46}$ and $y = \dfrac{-46}{46}$

$\Rightarrow x = 2$ and $y = -1$

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Solution 10:

Given equations are $4x + 6y = 15$ and $3x - 4y = 7$

Comparing with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we have

$a_1 = 4, b_1 = 6, c_1 = -15$ and $a_2 = 3, b_2 = -4, c_2 = -7$

Now, $x = \dfrac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1}$ and $y = \dfrac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$

$\Rightarrow x = \dfrac{6 \times (-7) - (-4) \times (-15)}{4 \times (-4) - 3 \times 6}$ and $y = \dfrac{-15 \times 3 - (-7) \times 4}{4 \times (-4) - 3 \times 6}$

$\Rightarrow x = \dfrac{-42 - 60}{-16 - 18}$ and $y = \dfrac{-45 + 28}{-16 - 18}$

$\Rightarrow x = \dfrac{-102}{-34}$ and $y = \dfrac{-17}{-34}$

$\Rightarrow x = 3$ and $y = \dfrac{1}{2}$

Exercise 6(D)

Solution 1:

$\dfrac{9}{x} - \dfrac{4}{y} = 8$ ...(1)

$\dfrac{13}{x} + \dfrac{7}{y} = 101$ ...(2)

Multiplying equation no. (1) by 7 and (2) by 4.

$\dfrac{63}{x} - \dfrac{28}{y} = 56$ ...(3)

$\dfrac{52}{x} + \dfrac{28}{y} = 404$ ...(4)

$\overline{\dfrac{115}{x} = 460}$

$x = \dfrac{115}{460} \Rightarrow x = \dfrac{1}{4}$

From (1)

$9 \times \left(\dfrac{4}{1}\right) - \dfrac{4}{y} = 8$

$-\dfrac{4}{y} = -28 \Rightarrow y = \dfrac{1}{7}$

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Solution 2:

$$\frac{3}{x} + \frac{2}{y} = 10 \qquad ....(i)$$

$$\frac{9}{x} - \frac{7}{y} = 10.5 \qquad ....(ii)$$

Multiplying equation (i) by 3, we get

$$\frac{9}{x} + \frac{6}{y} = 30 \qquad ....(iii)$$

Subtracting (ii) from (iii), we get

$$\frac{13}{y} = 19.5$$

$$\Rightarrow y = \frac{13}{19.5} = \frac{2}{3}$$

From (i),

$$\frac{3}{x} + \frac{2 \times 3}{2} = 10$$

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

$$\Rightarrow \frac{3}{x} = 7$$

$$\Rightarrow x = \frac{3}{7}$$

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Solution 3:

$$5x + \frac{8}{y} = 19 \qquad ....(i)$$

$$3x - \frac{4}{y} = 7 \qquad ....(ii)$$

Multiplying equation (ii) by 2, we get

$$6x - \frac{8}{y} = 14 \qquad ....(iii)$$

Adding (i) and (iii), we get

$$11x = 33$$

$$\Rightarrow x = 3$$

Substituting x = 3 in equation 91), we get

$$5(3) + \frac{8}{y} = 19$$

$$\Rightarrow \frac{8}{y} = 19 - 15$$

$$\Rightarrow y = \frac{8}{4} = 2$$

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Solution 4:

$$4x + \frac{6}{y} = 15 \quad ....(i)$$

$$3x - \frac{4}{y} = 7 \quad ....(ii)$$

Multiplying (i) by 4 and (ii) by 6

$$16x + \frac{24}{y} = 60 \quad ....(iii)$$

$$18x - \frac{24}{y} = 42 \quad ....(iv)$$

Adding (iii) and (iv), we get

$$34x = 102$$

$$\Rightarrow x = 3$$

Substituting $x = 3$ in (i), we get

$$4(3) + \frac{6}{y} = 15$$

$$\Rightarrow \frac{6}{y} = 15 - 12$$

$$\Rightarrow y = \frac{6}{3} = 2$$

Now, $y = ax - 2$

$$\Rightarrow 2 = a(3) - 2$$

$$\Rightarrow 2 = 3a - 2$$

$$\Rightarrow 3a = 4$$

$$\Rightarrow a = \frac{4}{3} = 1\frac{1}{3}$$

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Solution 5:

$$\frac{3}{x} - \frac{2}{y} = 0 \qquad \ldots(1)$$

$$\frac{2}{x} + \frac{5}{y} = 19 \qquad \ldots(2)$$

Multiplying equation no. (1) by 5 and (2) by 2.

$$\frac{15}{x} - \frac{10}{y} = 0 \qquad \ldots(3)$$

$$\frac{4}{x} + \frac{10}{y} = 38 \qquad \ldots(4)$$

$$\frac{19}{x} = 38 \qquad \Rightarrow x = \frac{1}{2}$$

From (1) $3\left(\dfrac{1}{2}\right) - \dfrac{2}{y} = 0 \quad \Rightarrow y = \dfrac{1}{3}$

$\therefore y = ax + 3$

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

$$\frac{a}{2} = \frac{-8}{3} \Rightarrow a = \frac{-16}{3}$$

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Solution 6:

(i)

$$\frac{20}{x+y} + \frac{3}{x-y} = 7 \quad ...(1)$$

$$\frac{8}{x+y} - \frac{15}{x+y} = 5 \quad ...(2)$$

Multiplying equation no. (1) by 8 and (2) by 3.

$$\frac{160}{x+y} + \frac{24}{x-y} = 56 \quad ...(3)$$

$$\frac{-45}{x+y} + \frac{24}{x-y} = 15 \quad ...(4)$$

$$\overline{}$$

$$\frac{205}{x+y} = 41$$

$$x + y = 5 \quad ...(5)$$

From (1)

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

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

$$x - y = 1 \quad ...(6)$$

$$x + y = 5 \quad ...(5)$$
$$\underline{x - y = 1 \quad ...(6)}$$
$$2x = 6$$
$$x = 3$$

from (5)

$$3 + y = 5 \Rightarrow y = 2$$

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(ii)

Let $a = 3x + 4y$ and $b = 3x - 2y$

$$\therefore \frac{34}{3x + 4y} + \frac{15}{3x - 2y} = 5$$

$$\Rightarrow \frac{34}{a} + \frac{15}{b} = 5 \ldots\ldots\ldots(i)$$

$$\frac{25}{3x - 2y} - \frac{8.50}{3x + 4y} = 4.5$$

$$\Rightarrow -\frac{8.50}{a} + \frac{25}{b} = 4.5 \ldots\ldots\ldots(ii)$$

Multiply equation (ii) by 4, we get :

$$-\frac{34}{a} + \frac{100}{b} = 18$$

$$\frac{34}{a} + \frac{15}{b} = 5 \qquad \text{[Equation (i)]}$$

$$\underline{+ \qquad + \qquad +} \qquad \text{[Adding]}$$

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

$$\Rightarrow b = 5$$

$$\Rightarrow 3x - 2y = 5 \ldots\ldots\ldots(iii)$$

Substituting $b = 5$ in equation (i), we get

$$\frac{34}{a} + \frac{15}{5} = 5$$

$$\Rightarrow 2a = 34$$

$$\Rightarrow a = 17$$

$$\Rightarrow 3x + 4y = 17 \ldots\ldots\ldots(iv)$$

Subtracting equation (iv) from equation (iii), we get::

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$$3x - 2y = 5$$
$$3x + 4y = 17$$
$$\underline{\quad - \quad - \qquad - \qquad}$$
$$-6y = -12$$
$$\Rightarrow y = 2$$

SubStituting $y = 2$ in equation (iii), we get

$$3x - 2(2) = 5$$
$$\Rightarrow 3x = 9$$
$$\Rightarrow x = 3$$

$\therefore$ Solution is $x = 3$ and $y = 2$.

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Solution 7:

(i)

$$x + y = 2xy \qquad \ldots(1)$$
$$x - y = 6xy \qquad \ldots(2)$$
$$\overline{}$$
$$2x = 8xy$$
$$2 = 8y$$
$$y = \frac{1}{4}$$

From (1)

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

(ii)

$$x + y = 7xy \ldots(1)$$
$$2x - 3 = -xy \ldots(2)$$

Multiplying equation no. (1) by 3.

$$3x + 3y = 21xy \qquad \ldots(3)$$
$$2x - 3y = -xy \qquad \ldots(4)$$
$$\overline{}$$
$$5x = 20xy$$
$$y = \frac{1}{4}$$

From (1)

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

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Solution 8:

Given equations are $\dfrac{a}{x} - \dfrac{b}{y} = 0$ and $\dfrac{ab^2}{x} + \dfrac{a^2b}{y} = a^2 + b^2$

Taking $\dfrac{1}{x} = u$ and $\dfrac{1}{y} = v$, the above system of equations become

$au - bv + 0 = 0$

$ab^2u + a^2bv - (a^2 + b^2) = 0$

By cross-multiplication, we have

$$\frac{u}{-b \times [-(a^2 + b^2)] - a^2b \times 0} = \frac{-v}{a \times [-(a^2 + b^2)] - ab^2 \times 0} = \frac{1}{a \times a^2b - ab^2 \times (-b)}$$

$$\Rightarrow \frac{u}{b(a^2 + b^2)} = \frac{-v}{-a(a^2 + b^2)} = \frac{1}{a^3b + ab^3}$$

$$\Rightarrow \frac{u}{b(a^2 + b^2)} = \frac{v}{a(a^2 + b^2)} = \frac{1}{ab(a^2 + b^2)}$$

$$\Rightarrow u = \frac{b(a^2 + b^2)}{ab(a^2 + b^2)} \quad \text{and} \quad v = \frac{a(a^2 + b^2)}{ab(a^2 + b^2)}$$

$$\Rightarrow u = \frac{1}{a} \quad \text{and} \quad v = \frac{1}{b}$$

$$\Rightarrow \frac{1}{x} = \frac{1}{a} \quad \text{and} \quad \frac{1}{y} = \frac{1}{b}$$

$$\Rightarrow x = a \quad \text{and} \quad y = b$$

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Solution 9:

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

$$\Rightarrow \frac{x+y}{xy} = \frac{4}{3}$$

$$\Rightarrow \frac{1}{x} + \frac{1}{y} = \frac{4}{3} \quad ....(1)$$

$$\frac{xy}{2x-y} = -\frac{3}{10}$$

$$\Rightarrow \frac{2x-y}{xy} = -\frac{10}{3}$$

$$\Rightarrow -\frac{1}{x} + \frac{2}{y} = -\frac{10}{3} \quad ....(2)$$

Let $\frac{1}{x} = u$ and $\frac{1}{y} = v$

Then, equations (1) and (2) become

$$u + v = \frac{4}{3} \quad \text{and} \quad -u + 2v = -\frac{10}{3}$$

$$\Rightarrow 3u + 3v = 4 \text{ and } -3u + 6v = -10$$

Adding, we have

$$9v = -6$$

$$\Rightarrow v = -\frac{6}{9} = -\frac{2}{3}$$

$$\Rightarrow \frac{1}{y} = -\frac{2}{3} \Rightarrow y = -\frac{3}{2}$$

Substituting $y = -\frac{3}{2}$ in (1), we have

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

$$\Rightarrow \frac{1}{x} = \frac{6}{3} = 2$$

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

Hence, $x = \frac{1}{2}$ and $y = -\frac{3}{2}$

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Solution 10:

Given equations are $\dfrac{3}{2x} + \dfrac{2}{3y} = -\dfrac{1}{3}$ and $\dfrac{3}{4x} + \dfrac{1}{2y} = -\dfrac{1}{8}$

Let $\dfrac{1}{x} = u$ and $\dfrac{1}{y} = v$

Then, the system of equations become

$\dfrac{3}{2}u + \dfrac{2}{3}v = -\dfrac{1}{3}$ and $\dfrac{3}{4}u + \dfrac{1}{2}v = -\dfrac{1}{8}$

$\Rightarrow \dfrac{9u + 4v}{6} = -\dfrac{1}{3}$ and $\dfrac{3u + 2v}{4} = -\dfrac{1}{8}$

$\Rightarrow 27u + 12v = -6$ and $24u + 16v = -4$

$\Rightarrow 27u + 12v + 6 = 0$ and $24u + 16v + 4 = 0$

$\Rightarrow \dfrac{u}{12 \times 4 - 16 \times 6} = \dfrac{-v}{27 \times 4 - 24 \times 6} = \dfrac{1}{27 \times 16 - 24 \times 12}$

$\Rightarrow \dfrac{u}{48 - 96} = \dfrac{-v}{108 - 144} = \dfrac{1}{432 - 288}$

$\Rightarrow \dfrac{u}{-48} = \dfrac{-v}{-36} = \dfrac{1}{144}$

$\Rightarrow \dfrac{u}{-48} = \dfrac{v}{36} = \dfrac{1}{144}$

$\Rightarrow u = \dfrac{-48}{144} = -\dfrac{1}{3}$ and $v = \dfrac{36}{144} = \dfrac{1}{4}$

$\Rightarrow \dfrac{1}{x} = -\dfrac{1}{3}$ and $\dfrac{1}{y} = \dfrac{1}{4}$

$\Rightarrow x = -3$ and $y = 4$

Exercise 6(E)

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Solution 1:

Let the two numbers be x and y
According to the question,

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

3x - 2y = 0 ...(1)

Also, $\frac{x-2}{y-8} = \frac{3}{2}$

2x - 3y = -20 ...(2)

Multiplying equation no. (1) by 2 and (2) by 3and substracting

$$6x - 4y = 0$$
$$6x - 9y = -60$$
$$\underline{- \quad + \quad +}$$
$$5y = 60$$

y = 12

From (1), we get

3x - 2(12) = 0

$$x = \frac{24}{3}$$

x = 8

Thus, the numbers are 8 and 12.

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Solution 2:

Let the smaller number be x
and the larger number be y.
According to the question,

$$\frac{x}{y} = \frac{4}{7}$$

$7x -; 4y = 0...(1)$

and, $3y + 2x = 59...(2)$

Multiplying equation no. (1) by 3 and (2) by 4. and adding them

$$21x - 12y = 0 \qquad ...(3)$$

$$\underline{8x + 12y = 236} \qquad ...(4)$$

$$29x = 236$$

$$x = \frac{236}{29}$$

From (1)

$$7\left(\frac{236}{29}\right) = 4y$$

$$y = 7\left(\frac{59}{29}\right)$$

$$y = \frac{413}{29}$$

Hence, the number are $\frac{236}{29}$ and $\frac{413}{29}$.

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Solution 3:

Let x be the greater number and y be the smaller number.

When the greater of the two numbers increased by 1 divides the sum of the numbers, the result is $\dfrac{3}{2}$.

$$\Rightarrow \frac{x + y}{(x + 1)} = \frac{3}{2}$$

$$\Rightarrow 2x + 2y = 3(x + 1)$$

$$\Rightarrow x - 2y = -3\ldots\ldots\ldots\ldots(i)$$

When the difference of these number is divided by the smaller, the result is $\dfrac{1}{2}$.

$$\Rightarrow \frac{x - y}{y} = \frac{1}{2}$$

$$\Rightarrow 2x - 2y = y$$

$$\Rightarrow 2x - 3y = 0\ldots\ldots\ldots\ldots(ii)$$

Multiply equation (i) by 2, we get:

$$\begin{array}{ll}
2x - 4y = -6 & \\
2x - 3y = 0 & \text{[Equation } (ii)\text{]} \\
-\quad +\quad - & \text{[Subtracting]} \\
\hline
\quad -y = -6 &
\end{array}$$

$$\Rightarrow y = 6$$

Substituting $y = 6$ in equation (i), we get

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

$$\Rightarrow x = 9$$

∴ 9 is the greater number and 6 is the smaller number.

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Solution 4:

Let the common multiple between the numbers be x.

So, the numbers are $4x$ and $5x$.

According to the question,

$$\frac{4x - 30}{5x - 30} = \frac{1}{2}$$

$\Rightarrow 8x - 60 = 5x - 30$

$\Rightarrow 3x = 30$

$\Rightarrow x = 10$

So, $4x = 4(10) = 40$ and $5x = 5(10) = 50$

Thus, the numbers are 40 and 50.

Solution 5:

Let the numerator and denominator a fraction be x and y respectively.
According to the question,

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

$3x - 2y = -8 \ldots(1)$

And,

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

$3x - y = -1 \qquad \ldots(2)$

Now subtracting,

$3x - y = -1 \qquad \ldots(2)$

$3x - 2y = -8 \qquad \ldots(1)$

$\underline{- \quad + \qquad +}$

$\qquad y = 7$

From (1),

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

$3x = -8 + 14$

$x = 2$

Required fraction $= \dfrac{2}{7}$

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Solution 6:

Let the numerator and denominator of a fraction be x and y respectively. Then the fraction will be $\frac{x}{y}$

According to the question,
$x + y = 7$...(1)
$5y - 4x = 8$...(2)
Multiplying equation no. (1) by 4 and add with (2),

$$4x + 4y = 28 \quad ..(3)$$
$$\underline{-4x + 5y = 8}$$
$$9y = 36$$

$y = 4$

From (1)
$x + 4 = 7$
$x = 3$
Required fraction = $\frac{3}{4}$

Solution 7:

Let the numerator of the fraction be x and the denominator be y.

So, the fraction is $\frac{x}{y}$.

According to the question,

$\frac{2x}{y + 1} = 1 \Rightarrow 2x = y + 1 \Rightarrow 2x - y = 1$...(i)

and $\frac{x + 4}{2y} = \frac{1}{2} \Rightarrow 2x + 8 = 2y \Rightarrow 2x - 2y = -8$...(ii)

Solving equations (i) and (ii), we get

$y = 9$

Putting the value of y in (i), we get

$2x - (9) = 1 \Rightarrow 2x = 1 + 9 \Rightarrow x = 5$

So, the fraction is $\frac{5}{9}$.

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Solution 8:

Let the numerator of the fraction be x and denominator of the fraction be y.

Then, the fraction $= \dfrac{x}{y}$

According to given condition, we have

$\dfrac{x-5}{y-3} = \dfrac{1}{2}$

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

$\Rightarrow 2x - y = 7 \qquad ....(i)$

And,

$x + 5 = y$

$\Rightarrow x - y = -5 \qquad ....(ii)$

Subtracting (ii) from (i), we get

$x = 12$

$\Rightarrow y = x + 5 = 12 + 5 = 17$

hence, the fraction is $\dfrac{12}{17}$.

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Solution 9:

Let the numerator of the fraction be x and denominator of the fraction be y.

Then, the fraction $= \dfrac{x}{y}$

According to given condition, we have

$\dfrac{x-5}{y-3} = \dfrac{1}{2}$

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

$\Rightarrow 2x - y = 7 \qquad \text{....(i)}$

And,

$x + 5 = y$

$\Rightarrow x - y = -5 \qquad \text{....(ii)}$

Subtracting (ii) from (i), we get

$x = 12$

$\Rightarrow y = x + 5 = 12 + 5 = 17$

hence, the fraction is $\dfrac{12}{17}$.

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Solution 10:

Let the digit at unit's place be x and the digit at ten's place be y.

Required no. = 10y + x

If the digit's are reversed

Reversed no. = 10x + y

According to the question,

x + y = 7...(1)

and,

10x + y - 2 = 2(10y + x).

8x - 19y = 2...(2)

Multiplying equation no. (1) by 19.

$$19x + 19y = 133 \quad \dots(3)$$

Now adding equation(2) and (3)

$$19x + 19y = 133 \quad \dots(3)$$

$$\underline{8x - 19y = 2 \quad \dots(2)}$$

$$27x = 135$$

x = 5

From (1)

5 +y = 7

y = 2

Required number is

10(2) + 5

= 25.

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Solution 11:

Let the digit at unit's place be x and the digit at ten's place be y.

Required no. = 10y + x

According to the question

$y = 3x \Rightarrow 3x - y = 0...(1)$

and, $10y + x + x = 32$

$10y + 2x = 32...(2)$

Multiplying equation no. (1) by 10

$30x - 10y = 0 \qquad ...(3)$

Now adding (3) and (2)

$$30x - 10y = 0 \qquad ...(3)$$

$$\underline{2x + 10y = 32} \qquad ...(2)$$

$$32x = 32$$

$x = 1$

From (1), we get

$y = 3(1) = 3$

Required no is

$10(3) + 1 = 31$

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Solution 12:

Let x be the number at the ten's place
and y be the number at the unit's place.
So, the number is $10x + y$.

Four times a certain two-digit number is seven times
the number obtained on interchanging its digits.
$\Rightarrow 4(10x + y) = 7(10y + x)$
$\Rightarrow 40x + 4y = 70y + 7x$
$\Rightarrow 33x - 66y = 0$
$\Rightarrow x - 2y = 0$ ....(i)

If the difference between the digits is 4, then
$\Rightarrow x - y = 4$ ....(ii)

Subtracting equation (i) from equation (ii), we get:
$x - y = 4$
$x - 2y = 0$ [Equation (i)]
$-$ $+$ [Subtracting]
―――――
$y = 4$

Substituting $y = 4$ in equation (i), we get
$x - 2(4) = 0$
$\Rightarrow x = 8$

$\therefore$ The number is $10x + y = 10(8) + 4 = 84$.

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Solution 13:

Let x be the number at the ten's place
and y be the number at the unit's place.
So, the number is $10x + y$.

Four times a certain two-digit number is seven times
the number obtained on interchanging its digits.

$\Rightarrow 4(10x + y) = 7(10y + x)$
$\Rightarrow 40x + 4y = 70y + 7x$
$\Rightarrow 33x - 66y = 0$
$\Rightarrow x - 2y = 0$ ....(i)

If the difference between the digits is 4, then
$\Rightarrow x - y = 4$ ....(ii)

Subtracting equation (i) from equation (ii), we get:

$\begin{aligned} x - y &= 4 \\ x - 2y &= 0 \qquad \text{[Equation (i)]} \\ \underline{- \quad +} & \qquad\qquad \text{[Subtracting]} \\ y &= 4 \end{aligned}$

Substituting $y = 4$ in equation (i), we get
$x - 2(4) = 0$
$\Rightarrow x = 8$

$\therefore$ The number is $10x + y = 10(8) + 4 = 84$.

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Solution 14:

Let the tens digit of the number be x and the units digit be y.

So, the number is $10x + y$.

The number obtained by interchanging the digits will be $10y + x$.

According to question, we have

$10x + y + 10y + x = 121$

$\Rightarrow 11x + 11y = 121$

$\Rightarrow 11(x + y) = 121$

$\Rightarrow x + y = 11$ ....(i)

And,

$x - y = 3$ ....(ii)

Adding (i) and (ii), we get

$2x = 14$

$\Rightarrow x = 7$

$\Rightarrow y = 11 - x = 11 - 7 = 4$

Hence, the number is 74.

Solution 15:

Let the tens digit of the number be x and the units digit be y.

So, the number is $10x + y$.

According to the question,

$10x + y = 8(x + y) \Rightarrow 2x = 7y...$(i)

and $10x + y = 14(x - y) + 2$ or $10x + y = 14(y - x) + 2$

$\Rightarrow 4x - 15y = -2...$(ii) or $24x - 13y = 2...$(iii)

Solving (i) and (ii), we get

$y = 2$ and $x = 7$

Solving (i) and (iii), we get

$y = \dfrac{2}{71}$

This is not possible, since y is a digit and cannot be in fraction form.

So the number is 72.

Exercise 6(F)

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Solution 1:

Let present age of A = x years
And present age of B = y years
According to the question,
Five years ago,
$x - 5 = 4(y - 5)$
$x - 4y = -15 \ldots(1)$
Five years later,
$x + 5 = 2(y + 5)$
$x - 2y = 5 \qquad \ldots(2)$
Now subtracting (1) from (2)

$$x - 2y = 5 \qquad \ldots(2)$$
$$x - 4y = -15 \qquad \ldots(1)$$
$$\underline{- \quad + \qquad +}$$
$$2y = 20$$
$$y = 10$$

From (1)
$x - 4 (10) = -15$
$x = 25$
Present ages of A and B are 25 years and 10 years respectively.

Solution 2:

Let A's presentage be x years
and B's present age be y years
According to the question
$x = y + 20$
$x - y = 20 \ldots(1)$
Five years ago,
$x - 5 = 3(y - 5)$
$x - 3y = -10 \qquad \ldots(2)$
Subtracting (1) from (2),

$$x - 3y = -10 \qquad \ldots(2)$$
$$x - y = 20 \qquad \ldots(1)$$
$$\underline{- \quad + \qquad -}$$
$$-2y = -30$$

$y = 15$
From (1)
$x = 15 + 20$
$x = 35$
Thus, present ages of A and B are 35 years and 15 years.

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Solution 3:

Let the present age of the mother be x years
and the present age of the daughter be y year.
According to the question,

$x - 4 = 4(y - 4) \Rightarrow x - 4 = 4y - 16 \Rightarrow x - 4y = -12 ...(i)$

and $x + 6 = 2\frac{1}{2}(y + 6) \Rightarrow x + 6 = \frac{5}{2}y + 15 \Rightarrow x - \frac{5}{2}y = 9 ...(ii)$

Solving (i) and (ii), we get

$y = 14$ and $x = 44$

Hence, the present age of the mother is 44 years
and the present age of the daughter is 14 years.

Solution 4:

Let the present age of the man be x years
and let the sum of the ages of his two children be y years.
According to the question,

$x = 2y ...(i)$

and $x + 20 = y + 40 ...(ii)...$(Since he has two children)

Solving (i) and (ii), we get

$2y + 20 = y + 40 \Rightarrow y = 20$

So, $x = 2y \Rightarrow x = 40$

Hence, the present age of the man is 40 years.

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Solution 5:

Let A's annual in come = Rs.x
and B's annual income = Rs. y
According to the question,

$$\frac{x}{y} = \frac{3}{4}$$

$4x - 3y = 0 \ldots(1)$

and, $\dfrac{x - 5000}{y - 5000} = \dfrac{5}{7}$

$7x - 5y = 10000 \ldots(2)$

Multiplying equation no. (1) by 7 and (2) by 4. and subtracting (4) from (3)

$$28x - 21y = 0 \qquad \ldots(3)$$

$$28x - 20y = 40000 \qquad \ldots(4)$$

$$\underline{\quad - \quad + \qquad - \qquad}$$

$$- y = -40000$$

$$y = 40,000$$

From (1)
$4x - 3 (40000) = 0$
$x = 30000$
Thus, A's income in Rs. 30,000 and B's income is Rs. 40,000.

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Solution 6:

Let the no. of pass candidates be x
and the no. of fail candidates be y.
According to the question,

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

x - 4y = 0...(1)

$$\text{and } \frac{x - 20}{y - 10} = \frac{5}{1}$$

x - 5y = -30...(2)

$$x - 4y = 0 \qquad \ldots(1)$$
$$x - 5y = -30 \qquad \ldots(2)$$
$$\underline{- \quad + \qquad +}$$
$$y = 30$$

From (1)
- 4(30) = 0
x = 120
Total students appeared = x + y
= 120 + 30
= 150

Solution 7:

Let the number of pencils with A = x
and the number of pencils with B = y.
If A gives 10 pencils to B,
y + 10 = 2(x - 10)
2x - y = 30...(1)
If B gives to pencils to A
y - 10 = x + 10

$$x - y = -20 \qquad \ldots(2)$$
$$2x - y = 30 \qquad \ldots(1)$$
$$\underline{- \quad + \quad -}$$
$$- x = -50$$
$$x = 50$$

From (1)
2(50) - y = 30
y = 70
Thus, A has 50 pencils and B has 70 pencils.

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Solution 8:

Let the number of adults = x
and the number of children = y
According to the question,
x + y = 1250...(1)
and 75x + 25y = 61250

$$3x + y = 2450 \qquad ...(2)$$
$$x + y = 1250 \qquad ...(1)$$
$$- \quad - \qquad -$$
$$\overline{}$$
$$2x = 1200$$

x = 6000
From (1)
600 + y = 1250
y = 650
Thus, number of adults = 600
and the number of children = 650.

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Solution 9:

Let the cost price of article A = Rs. x
and the cost price of articles B = Rs. y
According to the question,
$(x + 5\%$ of $x) + (y + 7\%$ of $y) = 1167$

$$\left(x + \frac{5}{100}x\right) + \left(y\,\frac{7}{100}\,y\right) = 1167$$

$$\frac{21x}{20} + \frac{107y}{100} = 1167$$

$105x + 107y = 1167...(1)$
and $\dfrac{107x}{100} + \dfrac{105y}{100} = 1165$

$107x + 105y = 116500...(2)$
Adding(1) and (2)
$212x + 212y = 233200$
$x + y = 1100...(3)$
subtracting (2)from (1)
$-2x + 2y = 200$

$$-x + y = 100 \qquad ...(4)$$
$$\underline{x + y = 1100 \qquad ...(3)}$$
$$2y = 1200$$

$y = 600$
from (3)
$x + 600 = 1100$
$x = 500$
Thus, cost price of article A is Rs. 500.
and that of article B is Rs. 600.

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Solution 10:

Let Pooja's 1 day work = $\dfrac{1}{x}$

and Ritu's 1 day work = $\dfrac{1}{y}$

According the question,

$$\dfrac{1}{x} + \dfrac{1}{y} = \dfrac{7}{120} \qquad \cdots(1)$$

and, $\dfrac{1}{x} = \dfrac{3}{4} \cdot \dfrac{1}{y}$

$$y = \dfrac{3}{4}x \qquad \cdots(2)$$

Using the value of y from (2) in (1)

$$\dfrac{1}{x} + \dfrac{4}{3x} = \dfrac{7}{120}$$

$$\dfrac{1}{x}\left(\dfrac{7}{3}\right) = \dfrac{7}{120}$$

$$x = 40$$

From (2) $y = \dfrac{3}{4}(40) = 30$

$y = 30$

Pooja will complete the work in 40 days and Ritu will complete the work in 30 days.

Exercise 6(G)

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Solution 1:

Let Rohit has Rs. x
and Ajay has Rs. y
When Ajay gives Rs. 100 to Rohit
$x + 100 = 2(y - 100)$
$x - 2y = -300...(1)$
When Rohit gives Rs. 10 to Ajay
$6(x-10) = y + 10$
$6x - y = 70...(2)$
Multiplying equation no. (2) By 2.

$$12x - 2y = 140 \qquad ...(3)$$
$$x - 2y = -300$$

$$\underline{- \qquad + \qquad +}$$
$$11x = 440$$

$x = 40$

From (1)
$40 - 2y = -300$
$\Rightarrow -2y = -340$
$\Rightarrow y = 170$

Thus, Rohit has Rs. 40
and Ajay has Rs. 170

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Solution 2:

Let the digits in the tens place be x and the digit in the units place be y.

$\therefore$ Number $= 10x + y$

Number on reversing the digits $= 10y + x$

The difference between the digits $= x - y$ or $y - x$

Given : $(10x + y) + (10y + x) = 99$

$\Rightarrow 11x + 11y = 99$

$\Rightarrow x + y = 9 \ldots (i)$

$x - y = 3 \ldots (ii)$

or $y - x = 3 \ldots (iii)$

On solving equations (i) and (ii), we get

$2x = 12 \Rightarrow x = 6$

So, $y = 3$

On solving equations (i) and (iii), we get

$2y = 12 \Rightarrow y = 6$

So, $x = 3$

Number $= 10x + y = 10(6) + 3 = 63$

or Number $= 10x + y = 10(3) + 6 = 36$

$\therefore$ Required number $= 63$ or 36.

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Solution 3:

3Let the digit at ten's place be x
And the digit at unit's place be y
Required number = $10x + y$
When the digits are interchanged,
Reversed number = $10y + x$
According to the question,
$7(10x + y) = 4(10y + x)$
$66x = 33y$
$2x - y = 0 ...(1)$
Also,

$$y - x = 3 \qquad ...(2)$$
$$\underline{-y + 2x = 0 \qquad ...(1)}$$
$$x = 3$$

From (1) $2(3) - y = 0$
$y = 6$
Thus, Required number = $10(3) + 6 = 36$

Solution 4:

Let, the fare of ticket for station A be Rs. x
and the fare of ticket for station B be Rs. y
According, to the question
$2x + 3y = 77 ....(1)$
and $3x + 5y = 124 ...(2)$
Multiplying equation no. (1) by 3 and (2) by 2.

$$6x + 9y = 231 \qquad ...(1)$$
$$6x + 10y = 248 \qquad ...(4)$$
$$\underline{- \quad - \qquad - \quad}$$
$$- y = -17$$

$y = 17$
From (1) $2x + 3(17) = 77$
$2x = 77 - 51$
$2x = 26$
$x = 13$
Thus, fare for station A = Rs. 13
and, fare for station B = Rs. 17.

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Solution 5:

Let x be the number at the ten's place
and y be the number at the unit's place.
So the number is $10x + y$.

The sum of digit of a two digit number is 11.
$\Rightarrow x + y = 11\ldots\ldots\ldots\ldots(i)$

If the digit at ten's place is increased by 5
and the digit at unit place is decreased by 5,
the digits of the number are found to be reversed.
$\Rightarrow 10(x + 5) + (y - 5) = 10y + x$
$\Rightarrow 9x - 9y = -45$
$\Rightarrow x - y = -5\ldots\ldots\ldots\ldots(ii)$

Subtracting equation (i) from equation (ii), we get:

$$
\begin{array}{ll}
x - y = -5 & \\
x + y = 11 & \text{[Equation } (i)] \\
\underline{-\quad - \quad -} & \text{[Subtracting]} \\
\;\;-2y = -16 &
\end{array}
$$

$\Rightarrow y = 8$

Substituting $y = 8$ in equation (i), we get
$x + 8 = 11$
$\Rightarrow x = 3$

$\therefore$ The number is $10x + y = 10(3) + 8 = 38$.

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Solution 6:

Let the quantity of 90% acid solution be x litres and
The quantity of 97% acid solution be y litres
According to the question,
x + y = 21...(1)
and 90% of x + 97% of y = 95% of 21
90x + 97y = 1995...(2)
Multiplying equation no. (1) by 90, we get,

$$90x + 90y = 1890 \qquad ...(3)$$

$$90x + 97y = 1995 \qquad ...(2)$$

$$\underline{\quad - \qquad - \qquad + \qquad\qquad}$$

$$-7y = -105$$

$$y = 15$$

From (1) x + 15 = 21
x = 6
Hence, 90% acid solution is 6 litres and 97% acid solution is 15 litres.

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Solution 7:

Assume x kg of the first kind costing Rs. 250 per kg and y kg of the second kind costing Rs. 350 per kg sweets were bought.

It is estimated that 40 kg of sweets were needed.
$\Rightarrow x + y = 40$...............(i)

The total budget for the sweets was Rs. 11,800.
$\Rightarrow 250x + 350y = 11,800$...............(ii)

Multiply equation (i) by 250, we get:

$250x + 250y = 10000$
$250x + 350y = 11,800$ [Equation (ii)]
–   –   –   [Subtracting]
_____
       $-100y = -1800$
$\Rightarrow y = 18$

Substituting y = 18 in equation (i), we get
$x + 18 = 40$
$\Rightarrow x = 22$

∴ 22 kgs of the first kind costing Rs. 250 per kg and 18 kgs of the second kind costing Rs. 350 per kg sweets were bought.

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Solution 8:

Weight of Mr. Ahuja = x kg
and weight of Mrs. Ahuja = y kg.
After the dieting,
x - 5 = y
x - y = 5...(1)

and, $y - 4 = \dfrac{7}{8}x$

7x - 8y = -32...(2)
Multiplying equation no. (1) by 7, we get

$\quad 7x - 7y = 35 \qquad ...(3)$

Now subtracting (2) from (3)

$\quad 7x - 7y = 35 \qquad ...(3)$

$\quad 7x - 8y = -32 \qquad ...(2)$

$\underline{\quad -\quad +\qquad +\qquad\qquad}$

$\qquad y = 67$

From (1)
x - 67 = 5 ⇒ x = 72
Thus, weight of Mr. Ahuja = 72 kg.
and that of Mr. Anuja = 67 kg.

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Solution 9:

Let x be the constant expense per month of the family.
and y be the expense per month for a single member of the family.

For a family of 4 people,
the total monthly expense is Rs. 10,400.
$\Rightarrow x + 4y = 10,400 \ldots\ldots\ldots\ldots(i)$

For a family of 7 people,
the total monthly expense is Rs. 15,800.
$\Rightarrow x + 7y = 15,800 \ldots\ldots\ldots\ldots(ii)$

Subtracting equation (i) from equation (ii), we get:

$$
\begin{array}{ll}
x + 7y = 15800 & \\
x + 4y = 10400 & \text{[Equation } (i)\text{]} \\
- \quad - \quad \quad - & \text{[Subtracting]} \\
\hline
3y = 5400 & \\
\end{array}
$$

$\Rightarrow y = 1800$

Substituting $y = 1800$ in equation (i), we get
$x + 4(1800) = 10,400$
$\Rightarrow x = 3200$

∴ The constant expense is Rs. 3,200 per month and
the monthly expense of each member of a family is Rs. 1,800.

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Solution 10:

Let the fixed charge be Rs. x and the charge per kilometer be Rs. y.
The charges for 10 km = Rs. 10y
The charges for 15 km = Rs. 15y
According to the question,
$x + 10y = 315$.....(i)
$x + 15y = 465$.....(ii)
Solving the equations, we get
$-5y = -150 \Rightarrow y = 30$
and $x = 315 - 10y = 315 - 10(30) = 15$
So, the fixed charges is Rs. 15 and the charges per kilometer is Rs. 30.
To travel 32 km, a person has to pay
Rs. 15 + Rs. 30(32) = Rs. 15 + Rs. 960 = Rs. 975

Solution 11:

Let the fixed charges be Rs. x and the charge for each extra day be Rs. y.
According to the question,
$x + 4y = 27$......(i)
and $x + 2y = 21$......(ii)
Solving the equations, we get
$2y = 6 \Rightarrow y = 3$
and $x = 21 - 2y = 21 - 2(3) = 15$
Hence, the fixed charges is Rs. 15 and the charge for each extra day is Rs. 3.

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Solution 12:

Let the length of the rectangle be x units and the breadth of the rectangle be y units.

We know that, area of a rectangle = length × breadth = xy

According to the question,

$xy - 9 = (x - 5)(y + 3)$

$\Rightarrow xy - 9 = xy + 3x - 5y - 15$

$\Rightarrow 3x - 5y = 6$......(i)

$xy + 67 = (x + 3)(y + 2)$

$\Rightarrow xy + 67 = xy + 2x + 3y + 6$

$\Rightarrow 2x + 3y = 61$.....(ii)

Multiply (i) by 2 and (ii) by 3, we get

$6x - 10y = 12$....(iii)

and $6x + 9y = 183$....(iv)

Solving (iii) and (iv), we get

$-19y = -171 \Rightarrow y = 9$

and $x = 17$

Hence, the length of the rectangle is 17 units and the breadth of the rectangle is 9 units.

Solution 13:

Let the pipe with larger diameter and smaller diameter be pipes A and B respectively.

Also, let pipe A work at a rate of x hours / unit and pipe B work at a rate of y hours / unit.

According to the question,

$x + y = \dfrac{1}{12} \Rightarrow 12x + 12y = 1$.....(i)

and $4x + 9y = \dfrac{1}{2} \Rightarrow 8x + 18y = 1$.....(ii)

Multiply (i) by 2 and (ii) by 3, we get

$24x + 24y = 2$ and $24x + 54y = 3$

On solving we get, $30y = 1 \Rightarrow y = \dfrac{1}{30}$

and $x = \dfrac{1}{20}$

Hence, the pipe with larger diameter will take 20 hours to fill the swimming pool and the pipe with smaller diameter will take 30 hours to fill the swimming pool.