

Linear Equations and Inequalities

EXERCISE 9.1

(i) $2(3-2x) = 13$

$$6 - 4x = 13$$

$$-4x = 13 - 6$$

$$-4x = 7$$

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

(ii) $\frac{3}{5}y - 2 = \frac{7}{10}$

$$\frac{3}{5}y = \frac{7}{10} + 2$$

$$\frac{3}{5}y = \frac{27}{10}$$

$$y = \frac{27}{10} \times \frac{5}{3} = \frac{9}{2}$$

$$y = \frac{9}{2}$$

2. (i) $\frac{x}{2} = 5 + \frac{x}{3}$

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

$$\frac{3x - 2x}{6} = 5$$

$$x = 5 \times 6$$

$$x = 30$$

$$(ii) \quad 2(x - 3/2) = 11$$

$$2x - 2 \times \frac{3}{2} = 11$$

$$2x - 3 = 11$$

$$2x = 3 + 11$$

$$x = \frac{14}{2}$$

$$\boxed{x = 7}$$

$$3 (i) \quad 7(x - 2) = 2(2x - 4)$$

$$7x - 14 = 4x - 8$$

$$7x - 4x = 14 - 8$$

$$3x = 6$$

$$x = \frac{6}{3}$$

$$\boxed{x = 2}$$

$$(ii) \quad 21 - 3(x - 7) = x + 20$$

$$21 - 3x + 21 = x + 20$$

$$4x = 42 - 20$$

$$4x = \frac{22}{1}$$

$$x = \frac{22}{4}$$

$$\boxed{x = \frac{11}{2}}$$

$$4 \text{ (i)} \quad 3x - \frac{1}{3} = 2\left(x - \frac{1}{2}\right) + 5$$

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

$$\frac{9x-1}{3} = 2x-1+5$$

$$\frac{9x-1}{3} = 2x+4$$

$$9x-1 = 6x+12$$

$$9x-6x = 12+1$$

$$3x = 13$$

$$x = \frac{13}{3}$$

$$(ii) \quad \frac{2m}{3} - \frac{m}{5} = 7$$

$$\frac{(2m) \times 5 - 3m}{15} = 7$$

$$\frac{10m - 3m}{15} = 7$$

$$\frac{7m}{15} = 7$$

$$m = 7 \times \frac{15}{7}$$

$$m = 15$$

$$5 \text{ (i)} \quad \frac{x+1}{5} - \frac{x-7}{2} = 1$$

$$\frac{2(x+1) - 5(x-7)}{10} = 1$$

$$2x + 2 - 5x + 35 = 10$$

$$-3x = 10 - 35 - 2$$

$$-3x = -27$$

$$x = \frac{-27}{-3}$$

$$\boxed{x = 9}$$

$$\text{(ii)} \quad \frac{3p-2}{7} - \frac{p-2}{4} = 2$$

$$\frac{4(3p-2) - 7(p-2)}{7 \times 4} = 2$$

$$\frac{12p - 8 - 7p + 14}{28} = 2$$

$$5p + 6 = 56$$

$$5p = 56 - 6$$

$$5p = 50$$

$$p = \frac{50}{5}$$

$$\boxed{p = 10}$$

$$6 \text{ (i)} \quad \frac{1}{2}(x+5) - \frac{1}{3}(x-2) = 4$$

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

$$3x+15 - 2x+4 = 4 \times 6$$

$$x+19 = 24$$

$$x = 24 - 19$$

$$\boxed{x = 5}$$

$$6 \text{ (ii)} \quad \frac{2x-3}{6} - \frac{x-5}{2} = \frac{x}{6}$$

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

$$4x-6 - 6x+30 = \frac{x}{6} \times 12$$

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

$$4x = 24$$

$$x = \frac{24}{4}$$

$$\boxed{x = 6}$$

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

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

$$5x - 20 - 7x - 28 = \frac{x+3}{7} \times 5$$

$$-2x - 48 = 5x + 15$$

$$-48 - 15 = 5x + 2x$$

$$7x = -63$$

$$x = \frac{-63}{7}$$

$$x = -9$$

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

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

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

$$\frac{7x-12}{10} = \frac{x+3}{3}$$

$$3(7x-12) = 10(x+3)$$

$$21x - 36 = 10x + 30$$

$$11x = 66$$

$$x = \frac{66}{11}$$

$$x = 6$$

8 (i)

$$y + 1.2y = 4.4$$

$$2.2y = 4.4$$

$$y = \frac{4.4}{2.2}$$

$$\boxed{y = 2}$$

(ii)

$$15\% \text{ of } x = 21$$

$$\frac{15}{100} \times x = 21$$

$$x = \frac{21 \times 100}{15}$$

$$\boxed{x = 140}$$

9 (i)

$$2P + 20\% \text{ of } (2P-1) = 7$$

$$2P + \frac{20}{100} (2P-1) = 7$$

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

$$5 \times 2P + 2P - 1 = 35$$

$$10P + 2P = 1 + 35$$

$$12P = 36$$

$$P = \frac{36}{12}$$

$$\boxed{P = 3}$$

$$(ii) \quad 3(2x-1) + 25\% \text{ of } x = 97$$

$$3(2x-1) + \frac{25}{100} \times x = 97$$

$$6x - 3 + \frac{1}{4} \times x = 97$$

$$\frac{4(6x-3) + x}{4} = 97$$

$$24x - 12 + x = 97 \times 4$$

$$25x = 388 + 12$$

$$25x = 400$$

$$x = \frac{400}{25} = 16$$

$$\boxed{x = 16}$$

10

$$x^4 - 3x^3 - px - 5 = 23$$

$$\text{Given } x = -2$$

$$(-2)^4 - 3(-2)^3 - p(-2) - 5 = 23$$

$$16 - 3(-8) + 2p - 5 = 23$$

$$16 + 24 + 2p - 5 = 23$$

$$2p = 23 - 35$$

$$2p = -12$$

$$p = \frac{-12}{2}$$

$$\boxed{p = -6}$$

Exercise 9.2

①

Let the required number = x

5 times the number = $5x$

7 added to 5 times the number = $5x + 7$

According to the problem

$$5x + 7 = 57$$

$$5x = 50$$

$$x = \frac{50}{5}$$

$$\boxed{x = 10}$$

②

Let the required number = x

$\frac{1}{4}$ th of the number is 3 more than 7

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

$$\frac{1}{4}x = 10$$

$$\boxed{x = 40}$$

③ Let required number = x

A number is greater than 15 and it is

less than 51 then

$$x - 15 = 51 - x$$

$$2x = 66$$

$$x = 33$$

④ Let required number = x

$\frac{1}{2}$ is subtracted from a number = $x - \frac{1}{2}$

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

Given result = 5

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

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

$$4x - 2 = 5$$

$$4x = 5 + 2$$

$$4x = 7$$

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

⑤ Let the required numbers = $x, 80-x$

The greater number exceeds twice the smaller
by 11 is

$$x = 2(80-x) + 11$$

$$x = 160 - 2x + 11$$

$$3x = 171$$

$$x = 171/3$$

$$\boxed{x = 57} \quad \text{and other number is } 80 - 57 = 23$$

⑥

Three consecutive odd natural numbers are

$$2x+1, 2x+3, 2x+5$$

Given sum is = 87

$$2x+1 + 2x+3 + 2x+5 = 87$$

$$6x = 87 - 9$$

$$6x = 78$$

$$x = \frac{78}{6}$$

$$\boxed{x = 13}$$

Required numbers are. 27, 29, 31

④

Let number of boys = x .

number of girls = $\frac{2}{5}x$.

Total no of students = 35

$$x + \frac{2}{5}x = 35$$

$$5x + 2x = 35 \times 5$$

$$7x = 35 \times 5$$

$$x = \frac{35 \times 5}{7}$$

$$x = 25$$

number of girls in the class is = $\frac{2}{5} \times 25$

$$= 10$$

⑤

Let number of chairs = x .

A House wife purchased certain number of chairs

and two tables = 2800

$$(250 \times x) + (2 \times 400) = 2800$$

$$(250 \times x) + (800) = 2800$$

$$250 \times x = 2800 - 800$$

$$x = \frac{2000}{250}$$

$$x = 8$$

number of chairs she purchased = 8

9

Let Aparna's monthly salary = x

Then over time payment = $x - 16560$

According to the problem

$$x + x - 16560 = 27840$$

$$2x = 44,400$$

$$x = \frac{44,400}{2}$$

$$x = 22,200$$

Aparna monthly salary = 22,200

(10) Let 5 rupee coins = x

2 rupees coins = $80 - x$

According to the problem total amount
is 232 rupees

$$5x + 2(80 - x) = 232$$

$$5x + 160 - 2x = 232$$

$$3x = 232 - 160$$

$$3x = 72$$

$$x = \frac{72}{3}$$

$$x = 24$$

number of 5 rupees coins = 24

(11)

Let purse contains 10 rupees notes = x

50 rupees notes is one less = $x - 1$

According to the problem total amount

in purse is = 550

$$10x + 50(x - 1) = 550$$

$$10x + 50x - 50 = 550$$

$$60x = 600$$

$$x = 600/60$$

$$x = 10$$

number of 50 rupees note = $10 - 1 = 9$

12

Let present age = x

After 12 years = $x + 12$

3 times as old was 4 years ago

$$x + 12 = 3(x - 4)$$

$$x + 12 = 3x - 12$$

$$2x = 24$$

$$x = 24/2$$

$$x = 12$$

present age is 12

⑬ Given sides of isosceles triangle are

$$3x-1, 2x+2, 2x$$

Two equal sides are

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

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

$$x = 3$$

$$\begin{aligned} \text{perimeter of triangle} &= 3x-1 + 2x+2 + 2x \\ &= 7x+1 \\ &= 7(3)+1 \\ &= 22 \end{aligned}$$

⑭ Let breadth = x

length of the rectangular = $3x-6$

According to the problem perimeter is = 148

$$2(x + 3x-6) = 148$$

$$2(4x-6) = 148$$

$$8x-12 = 148$$

$$8x = 160$$

$$x = 20$$

length 54, breadth = 20

⑤ Difference of each angle = 20°

Let the angles be = x and $x+20$

Sum of two complementary angle is 90°

$$x + x + 20 = 90$$

$$2x = 90 - 20$$

$$2x = 70$$

$$x = 35$$

one angle 35° , other angle is $(35+20) = 55^\circ$

Exercise 9.3

(i) $x < -2$

Replacement set = $\{-5, -3, -1, 0, 1, 3, 4\}$

Solution set $\{-5, -3\}$

(ii) $x > 1$

Replacement set $\{-5, -3, -1, 0, 1, 3, 4\}$

Solution set $\{3, 4\}$

(iii) $x \geq -1$

Replacement set $\{-5, -3, -1, 0, 1, 3, 4\}$

Solution set $\{-1, 0, 1, 3, 4\}$

(iv) $-5 < x < 3$

Replacement set $\{-5, -3, -1, 0, 1, 3, 4\}$

Solution set $\{-3, -1, 0, 1\}$

(v) $-3 \leq x < 4$

Replacement set $\{-5, -3, -1, 0, 1, 3, 4\}$

Solution set $\{-3, -1, 0, 1, 3\}$

(vi) $0 \leq x < 7$

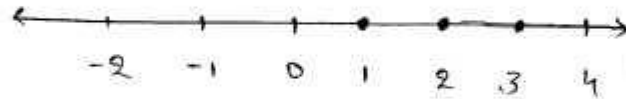
Replacement set $\{-5, -3, -1, 0, 1, 3, 4\}$

Solution set $\{0, 1, 3, 4\}$

2

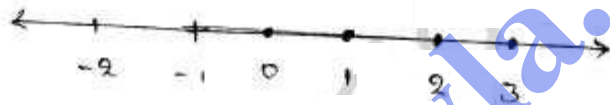
(i) $x \leq 3$

Solution set = $\{1, 2, 3\}$



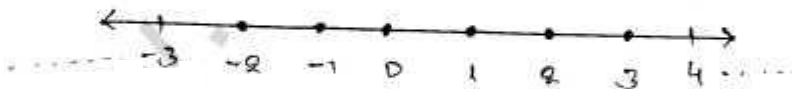
(ii) $x < 4$

Solution set = $\{0, 1, 2, 3\}$



(iii) $-2 \leq x < 4$

Solution set = $\{-2, -1, 0, 1, 2, 3\}$



(iv) $-3 \leq x < 2$

Solution set = $\{-3, -2, -1, 0, 1\}$



3

(i) $4 - x > -2$

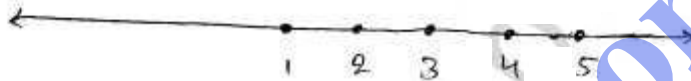
$-4 + 4 - x > -2 + (-4)$ Add both side (-4)

$-x > -6$

$x < 6$

Solution set = $\{1, 2, 3, 4, 5\}$

(ii)



(ii)

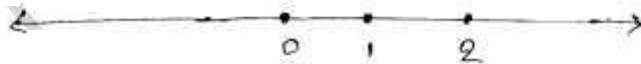
$3x + 1 \leq 8$

$3x + 1 - 1 \leq 8 - 1$

$3x \leq 7$

$x \leq 7/3$

Solution set = $\{0, 1, 2\}$



$$(4) \quad 3-4x < x-12 \quad x \in \{-1, 0, 1, 2, 3, 4, 5, 6, 7\}$$

$$3-4x-3 < x-12-3 \quad \text{Add } (-3) \text{ on both side}$$

$$-4x < x-15$$

$$-4x-x < x-15-x \quad \text{Add } (-x) \text{ on both side}$$

$$-5x < -15$$

$$x > \frac{15}{5}$$

$$x > 3$$

$$\text{Solution set} = \{4, 5, 6, 7\}$$

$$(5) \quad -7 < 4x+1 \leq 23$$

$$-7+1 < 4x+1-1 \leq 23-1 \quad \text{Add } (-1) \text{ on both side}$$

$$-8 < 4x \leq 22$$

$$\frac{-8}{4} < \frac{4x}{4} \leq \frac{22}{4} \quad \text{Divide } (4) \text{ on both side}$$

$$-2 < x \leq \frac{11}{2}$$

$$\text{Solution set} = \{-1, 0, 1, 2, 3, 4, 5\}$$