Exercise 13.1

1.

$$\frac{3x}{5} + 7 = 22$$

$$\frac{3x}{5} = 22 - 7$$

$$\frac{3x}{5} = 15$$

$$x = \frac{15 \times 5}{3}$$

$$x = 25$$

2.

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

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

$$\frac{3x}{4} = -9$$

$$x = \frac{-9 \times 4}{3}$$

$$x = -12$$

3.

$$4p - 3.8 = 4.2$$

$$4p = 4.2 + 3.8$$

$$4p = 8$$

$$p = 2$$

4.

$$\frac{a}{1.5} + 1.7 = 4.7$$

$$\frac{a}{1.5} = 4.7 - 1.7$$

$$\frac{a}{1.5} = 3$$

$$p = 3 \times 1.5$$

$$a = 4.5$$

5.

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

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

$$2x - 8 = 8$$

$$2x = 8 + 8$$

$$2x = 16$$

$$x = 8$$

6. $\frac{0.5x+2.5}{1.2x+4} = \frac{1}{2}$

$$\Rightarrow 2(0.5x + 2.5) = 1(1.2x + 4)$$

$$\Rightarrow (x + 5) = 1.2x + 4$$

$$\Rightarrow 1.2x - x = 5 - 4 \Rightarrow x = 5$$

7.

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

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

$$\frac{5x - 25 - 4x - 6}{10} = \frac{3}{2}$$

$$\frac{x-31}{10} = \frac{3}{2}$$

$$2(x - 31) = 3 \times 10$$

$$2x - 62 = 30$$

$$2x = 30 + 62$$

$$2x = 92$$

$$x = 46$$

8.

$$\frac{x}{2} + \frac{x}{4} + \frac{x}{8} = 14$$

$$\frac{4x + 2x + x}{8} = 14$$

$$\frac{7x}{8} = 14$$

$$7x = 14 \times 8$$

$$7x = 112$$

$$x = \frac{112}{7}$$

$$x = 16$$

9.

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

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

$$\frac{-20x}{1 - 3x} = 10$$

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

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

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

$$10x = 10$$

$$x = 1$$

10. $\frac{0.4m - 5}{1.5m + 1} = -\frac{1}{3}$

$\Rightarrow 3(0.4m - 5) = -1.5m - 1$

$\Rightarrow 1.2m - 15 = -1.5m - 1$

$\Rightarrow 1.5m + 1.2m = 15 - 1$

$\Rightarrow 2.7m = 14 \Rightarrow m = \frac{14}{2.7} = \frac{140}{27}$

11. $4p - \frac{p-1}{3} = 1 - \frac{p-2}{2}$

$\Rightarrow \frac{12p - p + 1}{3} = \frac{2 - p + 2}{2}$

$\Rightarrow \frac{11p + 1}{3} = \frac{4 - p}{2}$

$\Rightarrow 2(11p + 1) = 3(4 - p)$

$\Rightarrow 22p + 2 = 12 - 3p$

$\Rightarrow 22p + 3p = 12 - 2$

$\Rightarrow 25p = 10 \Rightarrow p = \frac{2}{5}$

12. $\frac{(y-1) - (2y+3)}{(3 - 2y)} = \frac{1}{4}$

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

$\Rightarrow 4(-y - 4) = (3 - 2y)$

$\Rightarrow -4y - 16 = 3 - 2y$

$\Rightarrow -4y + 2y = 3 + 16$

$\Rightarrow -2y = 19$

$\Rightarrow y = -\frac{19}{2}$

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

$\Rightarrow 2(-2x + 1) = 6(x + 4)$

$\Rightarrow -4x + 2 = 6x + 24$

$\Rightarrow -4x - 6x = 24 - 2$

$\Rightarrow -10x = 22$

$\Rightarrow x = -\frac{22}{10} = -\frac{11}{5}$

14.

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

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

$$\frac{7x - 7}{5x - 3} = \frac{7}{6}$$

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

$$42x - 42 = 35x - 21$$

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

$$7x = 21$$

$$x = 3$$

15.

$$\frac{}{5x-3} = \frac{}{6}$$
$$(7x-7)6 = 7(5x-3)$$
$$42x - 42 = 35x - 21$$
$$42x - 35x = -21 + 42$$
$$7x = 21$$
$$x = 3$$

15.

$$\frac{2(3x-1)-(2x+1)}{7x-2} = \frac{1}{2}$$
$$\frac{6x-2-2x-1}{7x-2} = \frac{1}{2}$$
$$\frac{4x-3}{7x-2} = \frac{1}{2}$$
$$2(4x-3) = 7x-2$$
$$8x-6 = 7x-2$$
$$8x-7x = -2+6$$
$$x = 4$$

16.

$$\frac{4a+1}{3} - \frac{3a-1}{5} + \frac{2a-1}{2} = 6$$
$$\frac{10(4a+1)-6(3a-1)+15(2a-1)}{30} = \frac{1}{2}$$
$$40a + 10 - 18a + 6 + 30a - 15 = 180$$
$$40a - 18a + 30a = 180 - 10 - 6 + 15$$
$$52a = 179$$
$$a = \frac{179}{52}$$

17.

$$\frac{2}{6a-19} = \frac{3}{2a-11}$$
$$2(2a-11) = 3(6a-19)$$
$$4a - 22 = 18a - 57$$
$$4a - 18a = -57 + 22$$
$$-14a = -35$$
$$a = \frac{35}{14} = \frac{5}{2}$$

18.

$$5p - \frac{1}{3}(p+1) = 5\left(p + \frac{1}{30}\right)$$
$$5p - \frac{p+1}{3} = 5p + \frac{1}{6}$$
$$5p - 5p = \frac{1}{6} + \frac{p+1}{3}$$
$$\frac{1}{6} + \frac{p+1}{3} = 0$$
$$\frac{1+2p+2}{6} = 0$$
$$2p + 3 = 0$$
$$2p = -3$$
$$p = \frac{-3}{2}$$

Exercise 13.2

1. Let the number be x. According to the questions,

$$\frac{x}{4} - 20 = \frac{x}{5} + 30$$
$$\frac{x}{4} - \frac{x}{5} = 50$$
$$\frac{x}{20} = 50$$
$$x = 20 \times 50 = 1000$$

$$\frac{x}{20} = 50$$
$$x = 20 \times 50 = 1000$$

2.

The numbers are in the ratio $2 : 3$.

Let the numbers be $2x$ and $3x$.

According to the question,

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

$$\Rightarrow 4(2x + 7) = 3(3x + 7)$$
$$\Rightarrow 8x + 28 = 9x + 21$$
$$\Rightarrow 28 - 21 = 9x - 8x$$
$$\Rightarrow x = 7$$

$\therefore$ Original numbers are 14 and 21.

3. $\frac{3x}{(3x+4)} = \frac{3}{4}$

$$\Rightarrow 3x \times 4 = 3(3x + 4)$$
$$\Rightarrow 12x = 9x + 12$$
$$\Rightarrow 3x = 12 \Rightarrow x = 4$$

4.

Let the digit at ones place be x and the digit at tens place be $4x$.

Original number $= 40x + x = 41x$

The number by reversing the digit $= 14x$

According to the question

$$14x + 27 = 41x$$
$$\Rightarrow 41x - 14x = 27$$
$$\Rightarrow 27x = 27$$
$$\Rightarrow x = 1$$

$\therefore$ Number $= 41$

5.

Reena's share $= ₹x$

Rami's share $= ₹(1000 - x)$

According to the question,

$$\frac{1}{3}(x) = \frac{1}{2}(1000 - x)$$

$$\Rightarrow \frac{x}{3} = \frac{1000 - x}{2}$$

$$\Rightarrow 2x = 3000 - 3x \qquad \Rightarrow x = 600$$
$$\Rightarrow 2x + 3x = 3000 \qquad \text{Reena's share} = ₹600$$
$$\Rightarrow 5x = 3000 \qquad \text{Rami's share} = ₹1000 - 600 = ₹400$$

6.

Perimeter $= 120$ m

Let length be x m and breadth be $(60 - x)$ m.

According to the question,

$$2\left[\left\{x - \frac{10}{100}x\right\} + \left\{60 - x + \frac{12}{10}x\right\}\right] = 120$$

$$\Rightarrow \frac{9}{10}x + \frac{12}{10}(60 - x) = 60$$
$$\Rightarrow 9x + 720 - 12x = 600$$
$$\Rightarrow x = 40$$

Length $= 40$ m

Breadth $= 60 - 40 = 20$ m

7.

Let the three consecutive even numbers be x, $x + 2$, and $x + 4$.

According to the question,

$$x + x + 4 = x + 2 + 18$$
$$\Rightarrow 2x + 4 = x + 20$$
$$\Rightarrow 2x - x = 20 - 4$$
$$\Rightarrow x = 16$$

Numbers are 16, 18, and 20.

8. Let the speed of the streamer be x km/h. It is given that the speed of the stream $= 2$ km/h.

$\Rightarrow 2x - x = 20 - 4$
$\Rightarrow x = 16$

Numbers are 16, 18, and 20.

8. Let the speed of the streamer be x km/h. It is given that the speed of the stream = 2 km/h.

It is given that while going downstream, the streamer takes 5 hours to cover the distance between two ports.

Speed of the streamer downstream = $(x + 2)$ km/h

Distance covered in 1 hour = $(x + 2)$ km

Distance covered in 5 hours = $5(x + 2)$ km

$\therefore$ Distance between 2 ports = $5(x + 2)$ km   ...(i)

It is given that while going, upstream the streamer takes 6 hours to cover the distance.

Speed of the streamer upstream = $(x - 2)$ km/h

Distance covered in 1 hour = $(x - 2)$ km

Distance covered in 6 hours = $6(x - 2)$ km

$\therefore$ Distance between two ports in this case = $6(x - 2)$ km   ...(ii)

$\because$ The distance between two ports is the same.

$\therefore$ From (i) and (ii) we get,

$5(x + 2) = 6(x - 2)$ $\Rightarrow$ $5x + 10 = 6x - 12$

$6x - 5x = 10 + 12$ $\Rightarrow$ $x = 22$

$\therefore$ The speed of the streamer in still water = 22 km/h.

9. Let one part be x and other part will be $6300 - x$.

$15\% \ of \ x = 12\% \ of \ (6300 - x)$

$\dfrac{15}{100} \times x = \dfrac{12}{100} \times (6300 - x)$

$5x = 4(6300 - x)$

$5x = 25200 - 4x$

$5x + 4x = 25200$ $\Rightarrow$ $9x = 25200$ $\Rightarrow$ $x = 2800$

So other part will be = $6300 - x = 3500$.

10. Let the number of flowers be x and the number of bees be y.
According to the question, if one bee lands on each flower than one bee is left.
Thus, total number of bees = total number of flowers + one bee.

i.e, $\Rightarrow y = x + 1$-------------(1)

Also, it is said that, if two bees land on each flower than one flower is left.
Thus, total number of flowers = half the number of total bees + one flower.

ie; $x = \dfrac{y}{2} + 1$ $\Rightarrow$ $x = \dfrac{(y+2)}{2}$

$\Rightarrow 2x = y + 2$ $\Rightarrow$ $y = 2x - 2$ ----------(2)

From equations (1) and (2), we have,

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

Now, putting $x = 3$ in equation (1) we get,

$y = x + 1$ $\Rightarrow$ $y = 3 + 1$ $\Rightarrow$ $y = 4$

Hence, the number of flowers is 3 and the number of bees is 4.

11. Let the speed of one train is $x \ km/h$.
Distance travelled by both train = $625 - 25 = 600$ km.
Then, the speed of another train is $(x + 10)km/h$.
Distance travelled by first train in two hour is $x \times 3 = 3x$
Distance travelled by another train is = $3(x + 10) = 3x + 30$
The total distance travelled by two trains are = $3x + 3x + 30 = 6x + 30$

According to question,

$$6x + 30 = 600$$
$$6x = 600 - 30 = 570$$
$$x = \dfrac{570}{6} = 95 \dfrac{km}{h}$$

Speed of another train = $95 + 10 = 105 \ km/h$.

12. Shaurya did not get the correct answer. Instead of $k, k + 1, k + 2$, he should use $k, k + 2, k + 4$ as we must take three consecutive integers. Also, k must be even.

$$x = \frac{570}{6} = 95 \frac{km}{h}$$

Speed of another train $= 95 + 10 = 105 \, km/h$.

12. Shaurya did not get the correct answer. Instead of $k, k + 1, k + 2$, he should use $k, k + 2, k + 4$ as we must take three consecutive integers. Also, k must be even.

$k + (k + 2) + (k + 4) = 6k \qquad \Rightarrow \qquad 3k + 6 = 6k$
$\Rightarrow 3k = 6 \Rightarrow \quad k = 2$

Indeed, $2 + 4 + 6 = 6 \times 2 = 12$.

Exercise 13.3

1. (a) $x \geq 4$
$\{5, 7, 9, 11\}$

(b) $x \leq -4$
$\{-5, -7, -9, -11\}$

(c) $-3 < x \leq 6$
$\{-1, 0, 1, 3, 5\}$
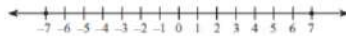
(d) $-9 < x < 0$
$\{-7, -5, -3, -1\}$

2. (a) $x \leq 7$

(b) $-4 \leq x \leq 5$

(c) $-7 \leq x \leq 7$

3. (a) $\{-6, -3, 0, 3, 6\}$ (b) $\{-30, -20, -10, 0\}$

(c) $\{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$

4. (a) $4x + 7 > 3$

Subtracting +3 on both sides

$\Rightarrow 4x + 7 - 3 > 3 - 3$

$\Rightarrow 4x + 4 > 0$

Subtracting -4 on both sides

$4x + 4 - 4 > 0 - 4$

$\Rightarrow 4x > -4$

$\Rightarrow x > -1$

$x \in \{0, 1, 2, 3, 4, \ldots\} \in I$

(b) $2x - 4 < 6$

Subtracting +6 on both sides

$\Rightarrow 2x - 4 - 6 < 6 - 6$

$\Rightarrow 2x - 10 < 0.$

Adding 10 to both sides

$2x - 10 + 10 < 0 + 10$

$\Rightarrow 2x < 10$

$\Rightarrow x < 5$

$x \in \{\ldots -5, -4, -3, -2, -1, 0, 1, 2, 3, 4\} \in I$

(c) $2(3x + 4) > 14$

$\Rightarrow 6x + 8 > 14$

Subtracting 8 on both sides

$\Rightarrow 6x + 8 - 8 > 14 - 8$

$\Rightarrow 6x > 6$

$\Rightarrow x > 1$

$x \in \{2, 3, 4, 5, 6, 7, \ldots\} \in I$

5. (a) $5x + 2 < 17$

Subtracting 2 on both sides

$\Rightarrow 5x + 2 - 2 < 17 - 2$

$\Rightarrow 5x < 15$

$\Rightarrow x < 3$

$x \in \{0, 1, 2\} \in W$

(b) $7x + 3 > -17$

Subtracting 3 on both sides

$\Rightarrow 7x + 3 - 3 > -17 - 3$

$\Rightarrow 7x > -20$

$\Rightarrow x > \frac{-20}{7}$

$\Rightarrow x > 2.85$

$x \in \{3, 6, 9\}$ [Given]

(c) $-18 \leq 11x + 15$

Adding 18 to both sides

$\Rightarrow -18 + 18 \leq 11x + 15 + 18$

$\Rightarrow 0 \leq 11x + 33$

Subtracting 33 on both sides

$\Rightarrow -33 \leq 11x + 33 - 33$

$\Rightarrow 11x \geq -33$

$\Rightarrow x \geq -3$

$x \in \{-3, -2, -1\} \in I$

(d) $\frac{3z - 4}{4} \leq 5$

$\Rightarrow 3z - 4 \leq 5 \times 4$

$\Rightarrow 3z - 4 \leq 20$

Adding 4 to both sides

$\Rightarrow 3z - 4 + 4 \leq 20 + 4$

$\Rightarrow 3z \leq 24$

$\Rightarrow z \leq 8.$ $x \in \{1, 2, 3, 4, 5, 6, 7, 8\} \in N$

(b) $7x + 3 > -17$

Subtracting 3 on both sides

$\Rightarrow 7x + 3 - 3 > -17 - 3$

$\Rightarrow 7x > -20$

$\Rightarrow x > \dfrac{-20}{7}$

$\Rightarrow x > 2.85$

$x \in \{3, 6, 9\}$ [Given]

(c) $-18 \le 11x + 15$

Adding 18 to both sides

$\Rightarrow -18 + 18 \le 11x + 15 + 18$

$\Rightarrow 0 \le 11x + 33$

Subtracting 33 on both sides

$\Rightarrow -33 \le 11x + 33 - 33$

$\Rightarrow 11x \ge -33$

$\Rightarrow x \ge -3$

$x \in \{-3, -2, -1\} \in I$

(d) $\dfrac{3z - 4}{4} \le 5$

$\Rightarrow 3z - 4 \le 5 \times 4$

$\Rightarrow 3z - 4 \le 20$

Adding 4 to both sides

$\Rightarrow 3z - 4 + 4 \le 20 + 4$

$\Rightarrow 3z \le 24$

$\Rightarrow z \le 8.$ $x \in \{1, 2, 3, 4, 5, 6, 7, 8\} \in N$

(e) $\dfrac{2y + 4}{6} < 2$

$\Rightarrow 2y + 4 < 12$

Subtracting 4 on both sides

$\Rightarrow 2y + 4 - 4 < 12 - 4$

$\Rightarrow 2y < 8$

$\Rightarrow y < 4$ $x \in \{0, 1, 2, 3,\} \in W$

6. $2x + 4 < x + 12, \quad x \in N$

Subtracting 4 on both sides

$\Rightarrow 2x + 4 - 4 < x + 12 - 4$

$\Rightarrow 2x < x + 8$

$\Rightarrow 2x - x < 8$

$\Rightarrow x < 8$ $x \in \{1, 2, 3, 4, 5, 6, 7\} \in N$

7. $20 - 2(3x - 5) \le -7x + 32$

$\Rightarrow 20 - 6x + 10 \le -7x + 32$

$\Rightarrow 30 - 6x \le -7x + 32$

$\Rightarrow -6x + 7x \le 32 - 30$

$\Rightarrow x \le 2$ $x \in \{0, 1, 2\} \in W$

8. The solution set for the height restriction of the is $\{0, 1, 2, 3 \ldots \ldots \ldots 54, 55, 56\}$. The height inequality for the given number line will be $x < 56$.

9. (a) Let weights that the other competitors dead lifted be x.

The winner dead lifted the weight = 500 kg. The other opponents lifted at least 50 kg less. So, the inequality becomes:

$$x \le 500 - 50$$
$$x \le 450$$

(b) Yes, other competitors able to dead lift 350 kg because it less than 450 (according to equation $x \le 450$).

10. (a) Let the additional weight that can be added be x.

As the weight of the bag is 3.8 kg and the total weight that can be carried out is 5 kg. Thus, we have the inequality:

$$3.8 + x \le 5$$
$$x \le 5 - 3.8 = 1.2$$
$$x \le 1.2$$

(b) No, the total weight becomes 1.4 kg (1 kg and 400 g) and it exceeds from the remaining limit of 1.2 kg.

11. Let t = number of hours.

$$55t \ge 110$$

On dividing both side by 55, we get $t \ge 2$.

12. Neeraj is correct because when multiplying or dividing both sides of an inequality by a negative value, flip the direction of the inequality sign.

It should be, $-3y < -42 \Rightarrow \dfrac{-3y}{-3} < \dfrac{-42}{-3} \Rightarrow y > 14$

MENTAL MATHS