

EXERCISE 11

Solve:

Q.1. (i) $3x + 20 = 44$

Sol. $3x = 44 - 20$

$$3x = 24$$

$$\frac{3x}{3} = \frac{24}{3} \quad (\text{Dividing by 3})$$

$$x = 8$$

(ii) $\frac{4x}{5} - \frac{3x}{4} = 4$

Sol. Multiplied by 4, 5 L.C.M. 20.

$$\frac{4x}{5}(20) - \frac{3x}{4}(20) = 4(20)$$

$$16x - 15x = 80$$

$$x = 80$$

(iii) $3x + 3(x + 1) = 69$

Sol. $3x + 3x + 3 = 69$

$$6x + 3 = 69$$

$$6x = 69 - 3$$

$$6x = 66$$

$$\frac{6x}{6} = \frac{66}{6} \quad (\text{Dividing by 6})$$

$$x = 11$$

(iv) $(90 - 9x) + 27 = 90 + 9$

Sol. $90 - 9x + 27 = 99$

$$-9x = 99 - 90 - 27$$

$$-9x = -18$$

$$\frac{-9x}{-9} = \frac{-18}{-9} \quad (\text{Dividing by } -9)$$

$$x = 2$$

Q.2. $3(x + 3) = 14 + x$

Sol. $3x + 9 = 14 + x$

$$3x - x = 14 - 9$$

$$2x = 5$$

$$\frac{2x}{2} = \frac{5}{2} \quad (\text{Dividing by } 2)$$

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

Q.3. $3(2x + 5) = 25 + x$

Sol. $6x + 15 = 25 + x$

$$6x - x = 25 - 15$$

$$5x = 10$$

$$\frac{5x}{5} = \frac{10}{5} \quad (\text{Dividing by } 5)$$

$$x = 2$$

Q.4. $9x - 3 = 3(2x - 8)$

Sol. $9x - 3 = 6x - 24$

$$9x - 6x = -24 + 3$$

$$3x = -21$$

$$\frac{3x}{3} = \frac{-21}{3} \text{ (Dividing by 3)}$$

$$x = -7$$

Q.5. $3(2x - 1) = 5(x - 1)$

Sol. $6x - 3 = 5x - 5$

$$6x - 5x = -5 + 3 \text{ (By Transposing)}$$

$$x = -2$$

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

Sol. $14x - 12 = 3 + 9x$

$$14x - 9x = 3 + 12$$

$$5x = 15$$

$$\frac{x}{5} = \frac{15}{5} \text{ (Dividing by 5)}$$

$$x = 3$$

Q.7. $\frac{10x - 1}{2x + 5} = 3$

Sol. $10x - 1 = 3(2x + 5)$

$$10x - 1 = 6x + 15$$

$$10x - 6x = 15 + 1$$

$$4x = 16$$

$$\frac{x}{4} = \frac{16}{4} \text{ (Dividing by 4)}$$

$$x = 4$$

Q.8. $\frac{2x+1}{x+5} = 1$

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

Q.9. $\frac{5x+3}{x+6} = 2$

Sol. $5x + 3 = 2(x + 6)$
 $5x + 3 = 2x + 12$
 $5x - 2x = 12 - 3$
 $3x = 9$
 $\frac{x}{3} = \frac{9}{3}$ (Dividing by 3)
 $x = 3$

Q.10. $y - 6 + \sqrt{y} = 0$

Sol. $\sqrt{y} = 6 - y$
 $(\sqrt{y})^2 = (6 - y)^2$ (Squaring on both sides)
 $y = 36 + y^2 - 12y$
 $0 = 36 + y^2 - 12y - y$
 $0 = 36 + y^2 - 13y$

$$\Rightarrow y^2 - 13y + 36 = 0$$

$$y^2 - 4y - 9y + 36 = 0$$

$$y(y - 4) - 9(y - 4) = 0$$

$$(y - 4)(y - 9) = 0$$

If $y - 4 = 0$

Then, $y = 4$

and if $y - 9 = 0$

Then, $y = 9$

Check to eliminate extraneous root $y = 9$.

Q.11 $x = 15 - 2\sqrt{x}$

Sol. $2\sqrt{x} = 15 - x$

$$(2\sqrt{x})^2 = (15 - x)^2 \text{ (Squaring on both sides)}$$

$$4x = 225 + x^2 - 30x$$

$$0 = 225 + x^2 - 30x - 4x$$

$$0 = x^2 + 225 - 34x$$

$$\Rightarrow x^2 - 34x + 225 = 0$$

$$x^2 - 9x - 25x + 225 = 0$$

$$x(x - 9) - 25(x - 9) = 0$$

$$(x - 9)(x - 25) = 0$$

If $x - 9 = 0$

then $x = 9$

And if $x - 25 = 0$

then $x = 25$

Check to eliminate extraneous roots $x = 25$

Q.12. $m - 13 = \sqrt{m + 7}$

Sol. $(m - 13)^2 = (\sqrt{m + 7})^2$ Squaring both sides

$$m^2 - 26m + 169 = m + 7$$

$$m^2 - 26m + 169 - m - 7 = 0$$

$$m^2 - 27m + 162 = 0$$

$$m^2 - 18m - 9m + 162 = 0$$

$$m(m - 18) - 9(m - 18) = 0$$

$$(m - 18)(m - 9) = 0$$

$$\text{If } m - 18 = 0$$

$$\text{then } m = 18$$

$$\text{If any } m - 9 = 0$$

$$\text{Then } m = 9$$

Check to eliminate extraneous roots $m = 9$

Q.13

$$\sqrt{5n+9} = n-1$$

Sol.

$$(\sqrt{5n+9})^2 = (n-1)^2 \text{ (Squaring both sides)}$$

$$5n+9 = n^2 - 2n + 1$$

$$0 = n^2 - 2n + 1 - 5n - 9$$

$$0 = n^2 - 7n - 8$$

$$\Rightarrow n^2 - 7n - 8 = 0$$

$$n^2 - 8n + n - 8 = 0$$

$$n(n-8) + 1(n-8) = 0$$

$$(n-8)(n+1) = 0$$

$$\text{If } n - 8 = 0$$

$$\text{Then } n = 8$$

$$\text{If any } n + 1 = 0$$

$$\text{then } n = -1$$

Check to eliminate extraneous roots $n = -1$

Q.14.

$$3 + \sqrt{2x-1} = 0$$

Sol.

$$\sqrt{2x-1} = 0 - 3$$

$$\sqrt{2x-1} = -3$$

Square root is always positive.

Therefore = { } S.S.

Let solve

$$\sqrt{2x-1} = -3$$

$$(\sqrt{2x-1})^2 = (-3)^2 \text{ (Squaring both sides)}$$

$$2x - 1 = 9$$

$$2x = 9 + 1$$

$$2x = 10$$

$$\frac{x}{2} = \frac{10}{2} \text{ (Dividing by 2)}$$

$$x = 5$$

$$\text{L. H. S.} = \sqrt{2x-1} \text{ To check}$$

$$= \sqrt{2 \times 5 - 1} \text{ (Putting } x = 5)$$

$$= \sqrt{10 - 1}$$

$$= \sqrt{9}$$

$$= 3$$

Square root is always positive.

Hence, S.S. = { }

Q.15

$$\sqrt{x+5} + 7 = 0$$

Sol.

$$\sqrt{x+5} = 0 - 7$$

$$\sqrt{x+5} = -7$$

Square root is always taken positive.

Hence, S.S. = { }

Q.16. $\sqrt{2x-1} - \sqrt{x-4} = 2$

Sol. $\sqrt{2x-1} = 2 + \sqrt{x-4}$

Squaring root on both sides

$$(\sqrt{2x-1})^2 = (2 + \sqrt{x-4})^2$$

$$2x - 1 = 4 + x - 4 + 4\sqrt{x-4}$$

$$2x - 1 - x = 4\sqrt{x-4}$$

$$x - 1 = 4\sqrt{x-4}$$

(Again squaring) $(x-1)^2 = (4\sqrt{x-4})^2$

$$x^2 - 2x + 1 = 16(x-4)$$

$$x^2 - 2x + 1 = 16x - 64$$

$$x^2 - 2x - 16x + 1 + 64 = 0$$

$$x^2 - 18x + 65 = 0$$

$$x^2 - 13x - 5x + 65 = 0$$

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

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

If $x - 13 = 0$

Then $x = 13$

If any $x - 5 = 0$

then $x = 5$

$$\text{S.S.} = \{13, 5\}$$

Q.17. $\sqrt{x+1} = 3$

Sol. $(\sqrt{x+1})^2 = (3)^2$ (Squaring both sides)

$$x + 1 = 9$$

$$x = 9 - 1$$

$$x = 8$$

Q.18. $\sqrt{2x-1} = 5$

Sol. $(\sqrt{2x-1})^2 = (5)^2$ (Squaring both sides)

$$2x - 1 = 25$$

$$2x = 25 + 1$$

$$2x = 26$$

$$x = \frac{26}{2}$$

$$x = 13$$

Q.19. $\sqrt{x-1} = 10$

Sol. $(\sqrt{x-1})^2 = (10)^2$ (Squaring both sides)

$$x - 1 = 100$$

$$x = 100 + 1$$

$$x = 101$$

Q.20. $\sqrt{3x+4} = 7$

Sol. $(\sqrt{3x+4})^2 = (7)^2$ (Squaring both sides)

$$3x + 4 = 49$$

$$3x = 49 - 4$$

$$3x = 45$$

$$x = \frac{45}{3}$$

$$x = 15$$

Exercise 4.2

Solve and Check:

Q.1. $|x| = 9$

Sol. $x = 9$ And $-x = 9$
 $x = 9$

Hence, $x = \pm 9$

Check, $|\pm 9| = 9$

Check

Q.2. $|x - 3| = 4$

Sol. $x - 3 = 4$ $x = 4 + 3$ $x = 7$	$-(x - 3) = 4$ $-x + 3 = 4$ $-x = 4 - 3$ $-x = 1$ $x = -1$
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Hence: $x = -1, 7$

Check: $|-1 - 3| = |-4| = 4$ and $|7 - 3| = |4| = 4$

Q.3. $|x + 1| = 5$

Sol. $x + 1 = 5$ $x = 5 - 1$ $x = 4$	$-(x + 1) = 5$ $-x - 1 = 5$ $-x = 5 + 1$ $-x = 6$ $x = -6$
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Hence, $x = 4, -6$

Check: $|4 + 1| = |5| = 5$ and $|-6 + 1| = |-5| = 5$

Q.4. $|2x - 3| = 5$

Sol. $2x - 3 = 5$ $2x = 5 + 3$ $2x = 8$ $\frac{x}{2} = \frac{8}{2}$ $x = 4$	$-(2x - 3) = 5$ $-2x + 3 = 5$ $-2x = 5 - 3$ $\frac{-2x}{2} = \frac{2}{-2}$ $x = -1$
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$$\text{S.S.} = \{4, -1\}$$

Check: $|2(4) - 3| = |8 - 3| = |5| = 5$ and $|2(-1) - 3|$
 $= |-2 - 3| = |-5| = 5$

Q.5. $|3x + 4| = 9$

Sol. $3x + 4 = 9$ $3x = 9 - 4$ $3x = 5$ $x = \frac{5}{3}$	$-(3x + 4) = 9$ $-3x - 4 = 9$ $-3x = 9 + 4$ $-3x = 13$ $x = -\frac{13}{3}$
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$$\text{S. S.} = \left\{ \frac{5}{3}, -\frac{13}{3} \right\}$$

Check: Putting $\frac{5}{3}$

$$\left| 3\left(\frac{5}{3}\right) + 4 \right| = |5 + 4| = |9| = 9$$

Putting $-\frac{13}{3}$

$$\left| 3\left(-\frac{13}{3}\right) + 4 \right| = |-13 + 4| = |-9| = 9$$

Q.6. $3(x - 2) < 2x + 1$

Sol. $3x - 6 < 2x + 1$

$$3x - 2x < 1 + 6$$

$$x < 7$$

Check: Let $x = 6$

These putting values

$$3(6 - 2) < 2(6) + 1$$

$$3(4) < 12 + 1$$

$$12 < 13$$

Which is true

Therefore, $x < 7$

Q.7. $3(x + 5) > 2(x + 2) + 8$

Sol. $3x + 15 > 2x + 4 + 8$

$$3x - 2x > 4 + 8 - 15$$

$$x > -3$$

Check: Suppose that $x = -2$

$$3(-2 + 5) > 2(-2 + 2) + 8$$

$$3(3) > 2(0) + 8$$

$$9 > 8$$

Which is true

Hence, $x > -3$

Q.8. $\frac{1}{2}(2-x) > \frac{1}{4}(3-x) + \frac{1}{2}$

Sol. $\frac{2}{2} - \frac{x}{2} > \frac{3}{4} - \frac{x}{4} + \frac{1}{2}$

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

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

$$\frac{-2x+x}{4} > \frac{3+2-4}{4}$$

$$-\frac{x}{4} > \frac{1}{4}$$

$$-x > 1 \quad (\text{Multiplying by 4})$$

Therefore, $x < -1$

Now, Suppose that $x = -2$

$$\bullet \quad x$$

Putting values $x = -2$

$$\frac{1}{2}(2+2) > \frac{1}{4}(3+2) + \frac{1}{2}$$

$$\frac{4}{2} > \frac{5}{4} + \frac{1}{2}$$

$$2 > \frac{5+2}{4}$$

$$2 > \frac{7}{4} \quad (\text{Which is true})$$

Hence, $x < -1$

Q.9. $\frac{x-2}{4} + \frac{2}{3} < \frac{x-4}{6}$

Sol. Multiply by L.C.M. of 4, 3, 6 by 12.

$$12 \frac{(x-2)}{4} + 12 \left(\frac{2}{3} \right) < 12 \frac{(x-4)}{6}$$

$$3(x-2) + 4(2) < 2(x-4)$$

$$3x - 6 + 8 < 2x - 8$$

$$3x - 2x < -8 - 8 + 6$$

$$x < -10$$

Q.10. $\frac{3x+4}{5} - \frac{x+1}{3} > 1 - \frac{x+5}{3}$

Sol. Multiply by L.C.M of 5, 3 by 15.

$$15 \left(\frac{3x+4}{5} \right) - 15 \left(\frac{x+1}{3} \right) > 15 \times 1 - 15 \left(\frac{x+5}{3} \right)$$

$$3(3x+4) - 5(x+1) > 15 - 5(x+5)$$

$$9x + 12 - 5x - 5 > 15 - 5x - 25$$

$$9x - 5x + 5x > 15 - 25 - 12 + 5$$

$$9x > -17$$

$$x > -\frac{17}{9}$$

Q.11. $\frac{x+1}{2} - \frac{x+3}{3} > \frac{x+1}{4} + 1$

Sol. Multiply by 12, L.C.M of 4, 3, 2.

$$12 \left(\frac{x+1}{2} \right) - 12 \left(\frac{x+3}{3} \right) > 12 \left(\frac{x+1}{4} \right) + 12 \times 1$$

$$6(x+1) - 4(x+3) > 3(x+1) + 12$$

$$6x + 6 - 4x - 12 > 3x + 3 + 12$$

$$6x - 4x - 3x > 3 + 12 - 6 + 12$$

$$-x > 21$$

Therefore, $x < -21$ N.T.S

Q.12.
$$\frac{x+3}{4} - \frac{x+2}{5} < 1 + \frac{x+5}{6}$$

Sol. Multiply by 60, L.C.M. of 4, 5, 6.

$$60\left(\frac{x+3}{4}\right) - 60\left(\frac{x+2}{5}\right) < 60 \times 1 + 60\left(\frac{x+5}{6}\right)$$

$$15(x+3) - 12(x+2) < 60 + 10(x+5)$$

$$15x + 45 - 12x - 24 < 60 + 10x + 50$$

$$15x - 12x - 10x < 60 + 50 - 45 - 24$$

$$-7x < 89$$

$$7x < -89 \text{ (Changing symbol)}$$

$$x > -\frac{89}{7}$$

$$x > -12\frac{5}{7}$$

Q.13.
$$\frac{1}{2}x \geq 1 + \frac{1}{3}x$$

Sol. Multiply by 6, L.C.M. of 2, 3.

$$6\left(\frac{1}{2}x\right) \geq 6 \times 1 + 6 \times \frac{1}{3}x$$

$$3x \geq 6 + 2x$$

$$3x - 2x \geq 6$$

$$x \geq 6$$

Q.14.
$$\frac{1}{4}(2x+3) \leq (7-4x)$$

Sol.
$$4 \times \frac{1}{4}(2x+3) \leq 4(7-4x) \text{ (Multiply by 4)}$$

$$2x + 3 \leq 28 - 16x$$

$$\{ \quad + 16x \leq 28 - 3$$

$$18x \leq 25$$

$$\frac{18x}{18} \leq \frac{25}{18} \quad (\text{Dividing by } 18)$$

$$x \leq 1\frac{7}{18}$$

Q.15.

$$\frac{4}{3}(2x+3) \geq 10 - \frac{4x}{3}$$

Sol

$$3 \times \frac{4}{3}(2x+3) \geq 3 \times 10 - 3 \times \frac{4x}{3} \quad (\text{Multiply by } 3)$$

$$4(2x+3) \geq 30 - 4x$$

$$8x + 12 \geq 30 - 4x$$

$$8x + 4x \geq 30 - 12$$

$$12x \geq 18$$

$$x \geq \frac{18}{12}$$

$$x \geq \frac{3}{2}$$

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

Q.16.

$$\frac{x-2}{4} - \frac{x-5}{6} \geq \frac{1}{3}$$

Sol.

Multiply by 12, L.C.M. of 4, 6, 3.

$$12\left(\frac{x-2}{4}\right) - 12\left(\frac{x-5}{6}\right) \geq 12 \times \frac{1}{3}$$

$$3(x-2) - 2(x-5) \geq 4$$

$$3x - 6 - 2x + 10 \geq 4$$

$$3x - 2x \geq 4 + 6 - 10$$

$$x \geq 0$$