Linear equation in one variable is an equation which can be written in the form of $ax + b = 0$, where a and b are real-number constants and $a \neq 0$.
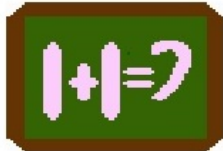
Ex.

$x + 7 = 12$

Equation is a mathematical sentence indicating that two expressions are equal. The symbol "=" is used to indicate equality.

Ex.

$2x + 5 = 9$ is a conditional equation since its truth or falsity depends on the value of x

$2 + 9 = 11$ is identity equation since both of its sides are identical to the same number 11.

Solution Set of a Linear Equation

Example

$$4x + 2 = 10$$

this statement is either true of false

If x = 1, then $4x + 2 = 10$ is false because 4(1) + 2 is ≠ 10

If x = 2, then $4x + 2 = 10$ is true because 4(2) + 2 = 10

ONE STEP SUBTRACTION EXAMPLE

The Opposite of Subtraction is Addition

$$x - 120 = 80$$
$$+120 \quad +120$$
$$x \qquad = 200 \checkmark$$

The value which makes the equation true is 200.

x – 4 = 7	Original problem
x – 4 = 7	We want to remove the minus 4.
x – 4 +4 = 7 +4	The opposite of minus 4 is plus 4, so I added 4 to BOTH sides of the equation.
x = 11	-4+4 = 0, so x remains on the left and 7+4 = 11; therefore x = 11
Check: x – 4 = 7 11 – 4 = 7	This is a correct statement, so my answer is x = 11 is correct!

Solving simple two-step equations

To solve an equation, find the value that makes the equation true.

Solve $2x + 3 = 13$

This means: $x \;\boxed{\times 2}\;\boxed{+3} = 13$

To solve, we reverse the process:

$x \;\boxed{\times 2}\;\boxed{+3}\; 13$

$x \;\boxed{\div 2}\;\boxed{-3}\; 13$

Use the opposite (inverse) operation and undo in reverse order.

$$2x + 3 = 13$$
$$\quad\qquad \Big|\; -3$$
$$2x = 10$$
$$\quad\qquad \Big|\; \div 2$$
$$x = 5$$

We have solved the equation when we get to a single value of x (here, x = 5).

Solve $4x + 6 = 14$

$$4x + 6 = 14$$
$$\quad\qquad \Big|\; -6$$
$$4x = 8$$
$$\quad\qquad \Big|\; \div 4$$
$$x = 2$$

Solve $3x - 8 = 19$

$$3x - 8 = 19$$
$$\quad\qquad \Big|\; +8$$
$$3x = 27$$
$$\quad\qquad \Big|\; \div 3$$
$$x = 9$$

Q1

Answer :

(i) Let the required number be x.
 So, five times the number will be 5x.
 $\therefore 5x = 40$

(ii) Let the required number be x.
 So, when it is increased by 8, we get x + 8.
 $\therefore x + 8 = 15$

(iii) Let the required number be x.
 So, when 25 exceeds the number, we get 25 − x.
 $\therefore 25 - x = 7$

(iv) Let the required number be x.
 So, when the number exceeds 5, we get x − 5.
 $\therefore x - 5 = 3$

(v) Let the required number be x.
 So, thrice the number will be 3x.
 $\therefore 3x - 5 = 16$

(vi) Let the required number be x.
 So, 12 subtracted from the number will be x − 12.
 $\therefore x - 12 = 24$

(vii) Let the required number be x.
 So, twice the number will be 2x.
 $\therefore 19 - 2x = 11$

(viii) Let the required number be x.
 So, the number when divided by 8 will be $\frac{x}{8}$.
 $\therefore \frac{x}{8} = 7$

(ix) Let the required number be x.
 So, four times the number will be 4x.
 $\therefore 4x - 3 = 17$

(x) Let the required number be x.
 So, 6 times the number will be 6x.
 $\therefore 6x = x + 5$

Q2

Answer :

(i) 7 less than the number x equals 14.

(ii) Twice the number y equals 18.

(iii) 11 more than thrice the number x equals 17.

(iv) 3 less than twice the number x equals 13.

(v) 30 less than 12 times the number y equals 6.

(vi) When twice the number z is divided by 3, it equals 8.

Q3

Answer :

(i)

$3x - 5 = 7$
Substituting $x = 4$ *in the given equation :*
$L.H.S.$:
$3 \times 4 - 5$
or, $12 - 5 = 7 = R.H.S.$
$L.H.S. = R.H.S.$
Hence, $x = 4$ *is the root of the given equation.*

(ii)

$3 + 2x = 9$
Substituting $x = 3$ *in the given equation :*
$L.H.S.$:
$3 + 2 \times 3$
or, $3 + 6 = 9 = R.H.S.$
$L.H.S. = R.H.S.$
Hence, $x = 3$ *is the root of the given equation.*

(iii)

$5x - 8 = 2x - 2$
Substituting $x = 2$ *in the given equation :*

$L.H.S.$:	$R.H.S.$:
$5 \times 2 - 8$	$= 2 \times 2 - 2$
or, $10 - 8 = 2$	$= 4 - 2 = 2$

$L.H.S. = R.H.S.$
Hence, $x = 2$ *is the root of the given equation.*

(iv)

$8 - 7y = 1$
Substituting $y = 1$ *in the given equation :*
$L.H.S.$:
$8 - 7 \times 1$
or, $8 - 7 = 1 = R.H.S.$
$L.H.S. = R.H.S.$
Hence, $y = 1$ *is the root of the given equation.*

(v)

$\frac{z}{7} = 8$
Substituting $z = 56$ *in the given equation :*
$L.H.S.$:
$\frac{56}{7} = 8 = R.H.S.$
$L.H.S. = R.H.S.$
Hence, $z = 56$ *is the root of the given equation.*

Q4

Answer :

(i) y + 9 = 13

We try several values of y until we get the L.H.S. equal to the R.H.S.

y	L.H.S.	R.H.S.	Is LHS =RHS ?
1	1 + 9 = 10	13	No
2	2 + 9 = 11	13	No
3	3 + 9 = 12	13	No
4	4 + 9 = 13	13	Yes

∴ y = 4

(ii) x − 7 = 10

We try several values of x until we get the L.H.S. equal to the R.H.S.

x	L.H.S.	R.H.S.	Is L.H.S. = R.H.S.?
10	10 − 7 = 3	10	No
11	11 − 7 = 4	10	No
12	12 − 7 = 5	10	No
13	13 − 7 = 6	10	No
14	14 − 7 = 7	10	No
15	15 − 7 = 8	10	No
16	16 − 7 = 9	10	No
17	17 − 7 = 10	10	Yes

∴ x = 17

(iii) 4x = 28

We try several values of x until we get the L.H.S. equal to the R.H.S.

x	L.H.S.	R.H.S.	Is L.H.S. = R.H.S.?
1	4 × 1 = 4	28	No
2	4 × 2 = 8	28	No
3	4 × 3 = 12	28	No
4	4 × 4 = 16	28	No
5	4 × 5 = 20	28	No
6	4 × 6 = 24	28	No
7	4 × 7 = 28	28	Yes

∴ x = 7

(iv) 3y = 36

We try several values of x until we get the L.H.S. equal to the R.H.S.

y	L.H.S.	R.H.S.	Is L.H.S. = R.H.S.?
6	3 × 6 = 18	36	No
7	3 × 7 = 21	36	No
8	3 × 8 = 24	36	No
9	3 × 9 = 27	36	No
10	3 × 10 = 30	36	No
11	3 × 11 = 33	36	No
12	3 × 12 = 36	36	Yes

∴ y = 12

(v) 11 + x = 19

We try several values of x until we get the L.H.S. equal to the R.H.S.

x	L.H.S.	R.H.S.	Is L.H.S. = R.H.S.?
1	11 + 1 = 12	19	No
2	11 + 2 = 13	19	No
3	11 + 3 = 14	19	No
4	11 + 4 = 15	19	No
5	11 + 5 = 16	19	No
6	11 + 6 = 17	19	No
7	11 + 7 = 18	19	No
8	11 + 8 = 19	19	Yes

∴ x = 8

(vi) $\frac{x}{3} = 4$

Since R.H.S. is an natural number so L.H.S. must also be a natural number. Thus, x has to be a multiple of 3.

x	L.H.S.	R.H.S.	Is L.H.S. = R.H.S.?
3	$\frac{3}{3} = 1$	4	No
6	$\frac{6}{3} = 2$	4	No
9	$\frac{9}{3} = 3$	4	No
12	$\frac{12}{3} = 4$	4	Yes

∴ x = 12

(vii) $2x - 3 = 9$

We try several values of x until we get the L.H.S. equal to the R.H.S.

x	L.H.S.	R.H.S.	Is L.H.S. = R.H.S.?
1	2 × 1 – 3 = –1	9	No
2	2 × 2 – 3 = 1	9	No
3	2 × 3 – 3 = 3	9	No
4	2 × 4 – 3 = 5	9	No
5	2 × 5 – 3 = 7	9	No
6	2 × 6 – 3 = 9	9	Yes

∴ x = 6

(viii) $\frac{1}{2}x + 7 = 11$

Since, R.H.S. is a natural number so L.H.S. must be a natural number Thus, we will try values if x which are multiples of 'x'

x	L.H.S.	R.H.S.	Is L.H.S. = R.H.S.?
2	2/2 + 7 = 8	11	No
4	4/2 + 7 = 9	11	No
6	6/2 + 7 = 10	11	No
8	8/2 + 7 = 11	11	Yes

∴ x = 8

(ix) $2y + 4 = 3y$

We try several values of y until we get the L.H.S. equal to the R.H.S.

y	L.H.S.	R.H.S.	Is L.H.S. = R.H.S.?
1	2 × 1 + 4 = 6	3 × 1 = 3	No
2	2 × 2 + 4 = 8	3 × 2 = 6	No
3	2 × 3 + 4 = 10	3 × 3 = 9	No
4	2 × 4 + 4 = 12	3 × 4 = 12	Yes

∴ y = 4

(x) $z - 3 = 2z - 5$

We try several values of z till we get the L.H.S. equal to the R.H.S.

z	L.H.S.	R.H.S.	Is L.H.S. = R.H.S.?
1	1 – 3 = –2	2 × 1 – 5 = –3	No
2	2 – 3 = –1	2 × 2 – 5 = –1	Yes

∴ z = 2

Linear Equation In One Variable
Ex 9B

Q1

Answer :

x + 5 = 12

Subtracting 5 from both the sides:
⇒ x + 5 − 5 = 12 − 5
⇒ x = 7
Verification:
Substituting x = 7 in the L.H.S.:
⇒ 7 + 5 = 12 = R.H.S.
L.H.S. = R.H.S.
Hence, verified.

Q2

Answer :

x + 3 = −2

Subtracting 3 from both the sides:
⇒ x + 3 − 3 = −2 − 3
⇒ x = −5

Verification:
Substituting x = −5 in the L.H.S.:
⇒ −5 + 3 = −2 = R.H.S.
L.H.S. = R.H.S.
Hence, verified.

Q3

Answer :

$x - 7 = 6$

Adding 7 on both the sides:

$\Rightarrow x - 7 + 7 = 6 + 7$

$\Rightarrow x = 13$

Verification:

Substituting x = 13 in the L.H.S.:

$\Rightarrow 13 - 7 = 6 = $ R.H.S.

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

Hence, verified.

Q4

Answer :

$x - 2 = -5$

Adding 2 on both sides:

$\Rightarrow x - 2 + 2 = -5 + 2$

$\Rightarrow x = -3$

Verification:

Substituting x = −3 in the L.H.S.:

$\Rightarrow -3 - 2 = -5 = $ R.H.S.

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

Hence, verified.

Q5

Answer :

$3x - 5 = 13$

$\Rightarrow 3x - 5 + 5 = 13 + 5$ [Adding 5 on both the sides]

$\Rightarrow 3x = 18$

$\Rightarrow \dfrac{3x}{3} = \dfrac{18}{3}$ [Dividing both the sides by 3]

$\Rightarrow x = 6$

Verification:

Substituting x = 6 in the L.H.S.:

$\Rightarrow 3 \times 6 - 5 = 18 - 5 = 13 = $ R.H.S.

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

Hence, verified.

Q6

Answer :

$4x + 7 = 15$

$\Rightarrow 4x + 7 - 7 = 15 - 7$ [Subtracting 7 from both the sides]

$\Rightarrow 4x = 8$

$\Rightarrow \dfrac{4x}{4} = \dfrac{8}{4}$ [Dividing both the sides by 4]

$\Rightarrow x = 2$

Verification:

Substituting x = 2 in the L.H.S.:

$\Rightarrow 4 \times 2 + 7 = 8 + 7 = 15 = $ R.H.S.

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

Hence, verified.

Q7

Answer :

$\dfrac{x}{5} = 12$

$\Rightarrow \dfrac{x}{5} \times 5 = 12 \times 5$ [Multiplying both the sides by 5]

$\Rightarrow x = 60$

Verification:

Substituting x = 60 in the L.H.S.:

$\Rightarrow \dfrac{60}{5} = 12 = $ R.H.S.

$\Rightarrow$ L.H.S. = R.H.S.

Hence, verified.

Q8

Answer :

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

$\Rightarrow \frac{3x}{5} \times 5 = 15 \times 5$ [Multiplying both the sides by 5]

$\Rightarrow 3x = 75$

$\Rightarrow \frac{3x}{3} = \frac{75}{3}$

$\Rightarrow x = 25$

Verification:

Substituting x = 25 in the L.H.S.:

$\Rightarrow \frac{3 \times 25}{5} = 15 =$ R.H.S.

$\Rightarrow$ L.H.S. = R.H.S.

Hence, verified.

Q9

Answer :

$5x - 3 = x + 17$

$\Rightarrow 5x - x = 17 + 3$ [Transposing x to the L.H.S. and 3 to the R.H.S.]

$\Rightarrow 4x = 20$

$\Rightarrow \frac{4x}{4} = \frac{20}{4}$ [Dividing both the sides by 4]

$\Rightarrow x = 5$

Verification:

Substituting x = 5 on both the sides:

L.H.S.: 5(5) – 3

$\Rightarrow$ 25 – 3

$\Rightarrow$ 22

R.H.S.: 5 + 17 = 22

$\Rightarrow$ L.H.S. = R.H.S.

Hence, verified.

Q10

Answer :

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

$\Rightarrow 2x - \frac{1}{2} + \frac{1}{2} = 3 + \frac{1}{2}$ [Adding $\frac{1}{2}$ on both the sides]

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

$\Rightarrow 2x = \frac{7}{2}$

$\Rightarrow \frac{2x}{2} = \frac{7}{2 \times 2}$ [Dividing both the sides by 3]

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

Verification:

Substituting $x = \frac{7}{4}$ in the L.H.S.:

$$2\left(\frac{7}{4}\right) - \frac{1}{2}$$

$$= \frac{7}{2} - \frac{1}{2} = \frac{6}{2} = 3 = R.H.S.$$

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

Hence, verified.

Q11

Answer :

$3(x + 6) = 24$

$\Rightarrow 3 \times x + 3 \times 6 = 24$ [On expanding the brackets]

$\Rightarrow 3x + 18 = 24$

$\Rightarrow 3x + 18 - 18 = 24 - 18$ [Subtracting 18 from both the sides]

$\Rightarrow 3x = 6$

$\Rightarrow \frac{3x}{3} = \frac{6}{3}$ [Dividing both the sides by 3]

$\Rightarrow x = 2$

Verification:

Substituting x = 2 in the L.H.S.:

3(2 + 6) = 3 ×8 = 24 = R.H.S.

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

Hence, verified.

Q12

Answer :

$6x + 5 = 2x + 17$

$\Rightarrow 6x - 2x = 17 - 5$ [Transposing 2x to the L.H.S. and 5 to the R.H.S.]

$\Rightarrow 4x = 12$

$\Rightarrow \frac{4x}{4} = \frac{12}{4}$ [Dividing both the sides by 4]

$\Rightarrow x = 3$

Verification:

Substituting x = 3 on both the sides:

L.H.S.: 6(3) + 5

=18 + 5

=23

R.H.S.: 2(3) + 17

= 6 + 17

= 23

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

Hence, verified.

Q13

Answer :

$\frac{x}{4} - 8 = 1$

$\Rightarrow \frac{x}{4} - 8 + 8 = 1 + 8$ [Adding 8 on both the sides]

$\Rightarrow \frac{x}{4} = 9$

$\Rightarrow \frac{x}{4} \times 4 = 9 \times 4$ [Multiplying both the sides by 4]

or, x = 36

Verification:

Substituting x = 36 in the L.H.S.:

or, $\frac{36}{4} - 8 = 9 - 8 = 1$ = R.H.S.

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

Hence, verified.

Q14

Answer :

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

$\Rightarrow \frac{x}{2} - \frac{x}{3} = 1$ [Transposing $\frac{x}{3}$ to the L.H.S.]

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

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

$\Rightarrow \frac{x}{6} \times 6 = 1 \times 6$ [Multiplying both the sides by 6]

or, x = 6

Verification:

Substituting x = 6 on both the sides:

L.H.S.: $\frac{6}{2}$ = 3

R.H.S.: $\frac{6}{3}$ + 1 = 2 + 1 = 3

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

Hence, verified.

Q15

Answer :

3(x + 2) − 2(x − 1) = 7

$\Rightarrow 3 \times x + 3 \times 2 - 2 \times x - 2 \times (-1) = 7$ [On expanding the brackets]

or, 3x + 6 −2x + 2 = 7

or, x + 8 = 7

or, x + 8 − 8 = 7 − 8   [Subtracting 8 from both the sides]

or, x = −1

Verification:

Substituting x = −1 in the L.H.S.:

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

$or,\ 3(1) - 2(-2)$

$or,\ 3 + 4 = 7 = R.H.S.$

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

Hence, verified.

Q16

Answer :

5(x-1) +2(x+3) + 6 = 0

⇒5x -5 +2x +6 +6 = 0   (Expanding within the brackets)

⇒7x +7 = 0

⇒x +1 = 0   (Dividing by 7)

⇒x = -1

Verification:

Putting x = -1 in the L.H.S.:

L.H.S.: 5(-1 -1) + 2(-1 + 3) + 6

      = 5(-2) + 2(2) + 6

      = -10 + 4 + 6 = 0 = R.H.S.

Hence, verified.

Q17

Answer :

6(1 − 4x) + 7(2 + 5x) = 53

or, $6 \times 1 - 6 \times 4x + 7 \times 2 + 7 \times 5x = 53$ [On expanding the brackets]

or, 6 − 24x + 14 + 35x = 53

or, 11x + 20 = 53

or, 11x + 20 − 20 = 53 − 20   [Subtracting 20 from both the sides]

or, 11x = 33

or, $\frac{11x}{11} = \frac{33}{11}$ [Dividing both the sides by 11]

or, x = 3

Verification:

Substituting x = 3 in the L.H.S.:

$6(1 - 4 \times 3) + 7(2 + 5 \times 3)$

$\Rightarrow 6(1 - 12) + 7(2 + 15)$

$\Rightarrow 6(-11) + 7(17)$

$\Rightarrow -66 + 119 \ = 53 = \boldsymbol{R.H.S.}$

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

Hence, verified.

Q18

Answer :

16(3x − 5) − 10(4x − 8) = 40

or, $16 \times 3x - 16 \times 5 - 10 \times 4x - 10 \times (-8) = 40$ [On expanding the brackets]

or, 48x − 80 − 40x + 80 = 40

or, 8x = 40

or, $\frac{8x}{8} = \frac{40}{8}$ [Dividing both the sides by 8]

or, x = 5

Verification:

Substituting x = 5 in the L.H.S.:

$16(3 \times 5 - 5) - 10(4 \times 5 - 8)$

$\Rightarrow 16(15 - 5) - 10(20 - 8)$

$\Rightarrow 16(10) - 10(12)$

$\Rightarrow 160 - 120 \ = 40 = \boldsymbol{R.H.S.}$

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

Hence, verified.

Q19

Answer :

3(x + 6) + 2(x + 3) = 64

$\Rightarrow 3 \times x + 3 \times 6 + 2 \times x + 2 \times 3 = 64$ [On expanding the brackets]

$\Rightarrow 3x + 18 + 2x + 6 = 64$

$\Rightarrow 5x + 24 = 64$

$\Rightarrow 5x + 24 - 24 = 64 - 24$ [Subtracting 24 from both the sides]

$\Rightarrow 5x = 40$

$\Rightarrow \frac{5x}{5} = \frac{40}{5}$ [Dividing both the sides by 5]

$\Rightarrow x = 8$

Verification:

Substituting x = 8 in the L.H.S.:

$3(8 + 6) + 2(8 + 3)$

$3(14) + 2(11)$

$42 + 22 = 64 = R.H.S.$

L.H.S. = R.H.S.
Hence, verified.

Q20

Answer :

3(2 − 5x) − 2(1 − 6x) = 1

or, $3 \times 2 + 3 \times (-5x) - 2 \times 1 - 2 \times (-6x) = 1$ [On expanding the brackets]

or, 6 − 15x − 2 + 12x = 1

or, 4 - 3x = 1

or, 3 =3x

or, x = 1

Verification:

Substituting x = 1 in the L.H.S.:

$3(2 - 5 \times 1) - 2(1 - 6 \times 1)$

$\Rightarrow 3(2 - 5) - 2(1 - 6)$

$\Rightarrow 3(-3) - 2(-5)$

$\Rightarrow -9 + 10 = 1 = R.H.S.$

L.H.S. = R.H.S.
Hence, verified.

Q21

Answer :

$\frac{n}{4} - 5 = \frac{n}{6} + \frac{1}{2}$

or, $\frac{n}{4} - \frac{n}{6} = \frac{1}{2} + 5$ [Transposing n/6 to the L.H.S. and 5 to the R.H.S.]

or, $\frac{3n-2n}{12} = \frac{1+10}{2}$

or, $\frac{n}{12} = \frac{11}{2}$

or, $\frac{n}{12} \times 12 = \frac{11}{2} \times 12$ [Dividing both the sides by 12]

or, n = 66

Verification:

Substituting n = 66 on both the sides:

L.H.S.:

$\frac{66}{4} - 5 = \frac{33}{2} - 5 = \frac{33-10}{2} = \frac{23}{2} = \frac{23}{2}$ $R.H.S.: \frac{66}{6} + \frac{1}{2} = 11 + \frac{1}{2} = \frac{22+1}{2} = \frac{23}{2}$

L.H.S. = R.H.S.
Hence, verified.

Q22

Answer :

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

or, $\frac{2m}{3} - \frac{m}{2} = -1 - 8$ [Transposing m/2 to the L.H.S. and 8 to the R.H.S.]

or, $\frac{4m-3m}{6} = -9$

or, $\frac{m}{6} = -9$

or, $\frac{m}{6} \times 6 = -9 \times 6$ [Multiplying both the sides by 6]

or, m = −54

Verification:

Substituting x = −54 on both the sides:

L.H.S.:

$\frac{2(-54)}{3} + 8 = \frac{-54}{2} - 1$

$= \frac{-108}{3} + 8$

$= -36 + 8$

$= -28$

R.H.S.:

$\frac{-54}{2} - 1$

$= -27 - 1$

$= -28$

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

Hence, verified.

Q23

Answer :

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

or, $\frac{2x}{5} - \frac{x}{2} = 1 + \frac{3}{2}$ [Transposing x/2 to the L.H.S. and 3/2 to R.H.S.]

or, $\frac{4x-5x}{10} = \frac{2+3}{2}$

or, $\frac{-x}{10} = \frac{5}{2}$

or, $\frac{-x}{10}(-10) = \frac{5}{2} \times (-10)$ [Multiplying both the sides by −10]

or, x = −25

Verification:

Substituting x = −25 on both the sides:

L.H.S.: $\frac{2(-25)}{5} - \frac{3}{2}$

$= \frac{-50}{5} - \frac{3}{2}$

$= -10 - \frac{3}{2} = \frac{-23}{2}$

R.H.S.: $\frac{-25}{2} + 1 = \frac{-25+2}{2} = \frac{-23}{2}$

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

Hence, verified.

Q24

Answer :

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

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

or, $-\frac{3}{5} - 2 = \frac{2x}{5} - \frac{x}{5}$ [Transposing x/5 to the R.H.S.]

or, $\frac{-3-10}{5} = \frac{x}{5}$

or, $\frac{-13}{5} = \frac{x}{5}$

or, $\frac{-13}{5}(5) = \frac{x}{5} \times (5)$ [Multiplying both the sides by 5]

or, x = −13

Verification:

Substituting x = −13 on both the sides:

L.H.S.: $\frac{-13-3}{5} - 2$

$= \frac{-16}{5} - 2 = \frac{-16-10}{5} = \frac{-26}{5}$ **R.H.S.:** $\frac{2 \times (-13)}{5} = \frac{-26}{5}$

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

Hence, verified.

Q25

Answer :

$\frac{3x}{10} - 4 = 14$

or, $\frac{3x}{10} - 4 + 4 = 14 + 4$ [Adding 4 on both the sides]

or, $\frac{3x}{10} = 18$

or, $\frac{3x}{10} \times 10 = 18 \times 10$ [Multiplying both the sides by 10]

or, $3x = 180$

or, $\frac{3x}{3} = \frac{180}{3}$ [Dividing both the sides by 3]

or, x = 60

Verification:

Substituting x = 60 on both the sides:

$\frac{3 \times 60}{10} - 4$

$= \frac{180}{10} - 4 = 18 - 4 = 14 = R.H.S.$

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

Hence, verified.

Q26

Answer :

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

$\Rightarrow \frac{3}{4} \times x - \frac{3}{4} \times 1 = x - 3$ [On expanding the brackets]

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

$\Rightarrow \frac{3x}{4} - x = -3 + \frac{3}{4}$ [Transposing x to the L.H.S. and $-\frac{3}{4}$ to the R.H.S.]

$\Rightarrow \frac{3x - 4x}{4} = \frac{-12 + 3}{4}$

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

$\Rightarrow \frac{-x}{4} \times (-4) = \frac{-9}{4} \times (-4)$ [Multiplying both the sides by -4]

or, x = 9

Verification:

Substituting x = 9 on both the sides:

$L.H.S. : \frac{3}{4}(9 - 1)$

$= \frac{3}{4}(8)$

$= 6$

$R.H.S.: 9 - 3 = 6$

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

Hence, verified.

Linear equation in one variable is an equation which can be written in the form of $ax + b = 0$, where a and b are real-number constants and $a \neq 0$.
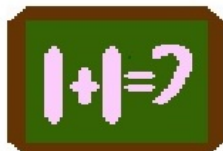
Ex.

$x + 7 = 12$

Equation is a mathematical sentence indicating that two expressions are equal. The symbol "=" is used to indicate equality.

Ex.

$2x + 5 = 9$ is a conditional equation since its truth or falsity depends on the value of x

$2 + 9 = 11$ is identity equation since both of its sides are identical to the same number 11.

Solution Set of a Linear Equation

Example

$$4x + 2 = 10$$

this statement is either true of false

If $x = 1$, then $4x + 2 = 10$ is false because $4(1) + 2$ is $\neq 10$

If $x = 2$, then $4x + 2 = 10$ is true because $4(2) + 2 = 10$

ONE STEP SUBTRACTION EXAMPLE

The Opposite of Subtraction is Addition

$$x - 120 = 80$$
$$+120 \qquad +120$$
$$x \qquad\qquad = 200 \checkmark$$

The value which makes the equation true is 200.

$x - 4 = 7$	Original problem
$x - 4 = 7$	We want to remove the minus 4.
$x - 4 +4 = 7 +4$	The opposite of minus 4 is plus 4, so I added 4 to BOTH sides of the equation.
$x = 11$	-4+4 = 0, so x remains on the left and 7+4 = 11; therefore x = 11
Check: $x - 4 = 7$ $11 - 4 = 7$	This is a correct statement, so my answer is x = 11 is correct!

Solving simple two-step equations

To solve an equation, find the value that makes the equation true.

Solve $2x + 3 = 13$

This means: x [× 2] [+ 3] $= 13$

To solve, we reverse the process:

x [× 2] [+ 3] 13
x [÷ 2] [- 3] 13

Use the opposite (inverse) operation and undo in reverse order.

$2x + 3 = 13$
$\qquad - 3$
$2x = 10$
$\qquad \div 2$
$x = 5$

We have solved the equation when we get to a single value of x (here, x = 5).

Solve $4x + 6 = 14$

$$4x + 6 = 14 \quad | \; - 6$$
$$4x = 8 \quad | \; \div 4$$
$$x = 2$$

Solve $3x - 8 = 19$

$$3x - 8 = 19 \quad | \; + 8$$
$$3x = 27 \quad | \; \div 3$$
$$x = 9$$

Q3

Answer :

Let the required number be x.
According to the question:
or, 5x = x + 80
or, 5x − x = 80   [Transposing x to the L.H.S.]
or, 4x = 80
or, $\frac{4x}{4} = \frac{80}{4}$ [Dividing both the sides by 4]
or, x = 20
Thus, the required number is 20.

Q4

Answer :

Let the three consecutive natural numbers be x, (x+1), (x+2).
According to the question:
x + (x + 1) + (x + 2) = 114
or, x + x + 1 + x + 2 = 114
or, 3x + 3 = 114
or, 3x + 3 − 3 = 114 − 3   [Subtracting 3 from both the sides]
or, 3x = 111
or, $\frac{3x}{3} = \frac{111}{3}$ [Dividing both the sides by 3]
or, x = 37
Required numbers are:
x = 37
or, x + 1 = 37 + 1 = 38
or ,x + 2 = 37 + 2 = 39
Thus, the required numbers are 37, 38 and 39.

Q5

Answer :

Let the required number be x.
When Raju multiplies it with 17, the number becomes 17x.
According to the question :
17x + 4 = 225
or, 17x + 4 − 4 = 225 − 4   [Subtracting 4 from both the sides]
or, 17x = 221
or, $\frac{17x}{17} = \frac{221}{17}$ [Dividing both the sides by 17]
or, x = 13
Thus, the required number is 13.

Q6

Answer :

Let the required number be x.
According to the question, the number is tripled and 5 is added to it
∴ 3x + 5
or, 3x + 5 = 50
or, 3x + 5 − 5 = 50 − 5   [Subtracting 5 from both the sides]
or, 3x = 45
or, $\frac{3x}{3} = \frac{45}{3}$ [Dividing both the sides by 3]
or, x = 15
Thus, the required number is 15.

Q7

Answer :

Let one of the number be x.
∴ The other number = (x + 18)
According to the question:
x + (x + 18) = 92
or, 2x + 18 − 18 = 92 − 18   [Subtracting 18 from both the sides]
or, 2x =74
or, $\frac{2x}{2} = \frac{74}{2}$ [Dividing both the sides by 2]
or, x = 37
Required numbers are:
x = **37**
or, x + 18 = 37 + 18 = **55**

Q8

Answer :

Let one of the number be 'x'
∴ Second number = 3x
According to the question:
x + 3x = 124
or, 4x = 124
or, $\frac{4x}{4} = \frac{124}{4}$ [Dividing both the sides by 4]
or, x = 31
Thus, the required number is x = **31** and 3x = 3×31 = **93**.

Q9

Answer :

Let one of the number be x.
∴ Second number = 5x
According to the question:
5x − x = 132
or, 4x = 132
or, $\frac{4x}{4} = \frac{132}{4}$ [Dividing both the sides by 4]
or, x = 33
Thus, the required numbers are x = **33** and 5x = 5×33 = **165**.

Q10

Answer :

Let one of the even number be x.
Then, the other consecutive even number is (x + 2).
According to the question:
x + (x + 2) = 74
or, 2x + 2 = 74
or, 2x + 2 − 2 = 74 − 2   [Subtracting 2 from both the sides]
or, 2x = 72
or, $\frac{2x}{2} = \frac{72}{2}$ [Dividing both the sides by 2]
or, x = 36
Thus, the required numbers are x = **36** and x+ 2 = **38**.

Q11

Answer :

Let the first odd number be x.
Then, the next consecutive odd numbers will be (x + 2) and (x + 4).
According to the question:
x + (x + 2) + (x + 4) = 21
or, 3x + 6 = 21
or, 3x + 6 − 6 = 21 − 6   [Subtracting 6 from both the sides]
or, 3x = 15
or, $\frac{3x}{3} = \frac{15}{3}$ [Dividing both the sides by 3]
or, x = 5
∴ Required numbers are:
x = **5**
x + 2 = 5 + 2 = **7**
x + 4 = 5 + 4 = **9**

Q12

Answer :

Let the present age of Ajay be x years.
Since Reena is 6 years older than Ajay, the present age of Reena will be (x+ 6) years.
According to the question:
x + (x + 6) = 28
or, 2x + 6 = 28
or, 2x + 6 − 6 = 28 − 6   [Subtracting 6 from both the sides]
or, 2x = 22
or, $\frac{2x}{2} = \frac{22}{2}$ [Dividing both the sides by 2]
or, x = 11
∴ Present age of Ajay = **11 years**
Present age of Reena = x +6 = 11 + 6
                                    = **17 years**

Q13

Answer :

Let the present age of Vikas be x years.
Since Deepak is twice as old as Vikas, the present age of Deepak will be 2x years.
According to the question:
2x − x = 11
x = 11
∴ Present age of Vikas = **11 years**
Present age of Deepak = 2x = 2×11
                                    = **22 years**

Q14

Answer :

Let the present age of Rekha be x years.
As Mrs. Goel is 27 years older than Rekha, the present age of Mrs. Goel will be (x + 27) years.
After 8 years:
Rekha's age = (x + 8) years
Mrs. Goel's age = (x + 27 + 8)
= (x + 35) years

According to the question:
(x + 35) = 2(x + 8)
or, x + 35 = 2×x + 2×8   [On expanding the brackets]
or, x + 35 = 2x + 16
or, 35 − 16 = 2x − x   [Transposing 16 to the L.H.S. and x to the R.H.S.]
or, x = 19
∴ Present age of Rekha = **19 years**
Present age of Mrs. Goel = x + 27
= 19 + 27
= **46 years**

Q15

Answer :

Let the present age of the son be x years.
As the man is 4 times as old as his son, the present age of the man will be (4x) years.
After 16 years:
Son's age = (x + 16) years
Man's age = (4x + 16) years

According to the question:
(4x + 16) = 2(x + 16)
or, 4x + 16 = 2×x + 2×16   [On expanding the brackets]
or, 4x + 16 = 2x + 32
or, 4x − 2x = 32 − 16   [Transposing 16 to the R.H.S. and 2x to the L.H.S.]
or, 2x = 16
or, $\frac{2x}{2} = \frac{16}{2}$ [Dividing both the sides by 2]
or, x = 8
∴ Present age of the son = **8 years**
Present age of the man = 4x = 4×8

Q16

Answer :

Let the present age of the son be x years.
As the man is 3 times as old as his son, the present age of the man will be (3x) years.

5 years ago:
Son's age = (x − 5) years
Man's age = (3x − 5) years

According to the question:
(3x − 5) = 4(x − 5)
or, 3x − 5 = 4×x − 4×5   [On expanding the brackets]
or, 3x − 5 = 4x − 20
or, 20 − 5 = 4x − 3x   [Transposing 3x to the R.H.S. and 20 to the L.H.S.]
or, x = 15
∴ Present age of the son = **15 years**
Present age of the man = 3x = 3×15
                                = **45 years**

Q17

Answer :

Let the present age of Fatima be x years.

After 16 years:
Fatima's age = (x + 16) years

According to the question:
x + 16 = 3(x)
or, 16 = 3x − x   [Transposing x to the R.H.S.]
or, 16 = 2x
or, $\frac{2x}{2}$ = $\frac{16}{2}$ [Dividing both the sides by 2]
or, x = 8
∴ Present age of Fatima = 8 years

Q18

Answer :

Let the present age of Rahim be x years.
After 32 years:
Rahim's age = (x + 32) years
8 years ago:
Rahim's age = (x − 8) years
According to the question:
x + 32 = 5(x − 8)
or, x + 32 = 5x − 5×8
or, x + 32 = 5x − 40
or, 40 + 32 = 5x − x   [Transposing 'x' to the R.H.S. and 40 to the L.H.S.]
or, 72 = 4x
or, $\frac{4x}{4}$ = $\frac{72}{4}$ [Dividing both the sides by 4]
or, x = 18
Thus, the present age of Rahim is 18 years.

Q19

Answer :

Let the number of 50 paisa coins be x.
Then, the number of 25 paisa coins will be 4x.
According to the question:
0.50(x) + 0.25(4x) = 30
or, 0.5x + x = 30
or, 1.5x = 30
or, $\frac{1.5x}{1.5}$ = $\frac{30}{1.5}$ [Dividing both the sides by 1.5]
or, x = 20
Thus, the number of 50 paisa coins is 20.
Number of 25 paisa coins = 4x = 4×20 = 80

Q20

Answer :

Let the price of one pen be Rs x.
According to the question:
5x = 3x + 17
or, 5x — 3x = 17   [Transposing 3x to the L.H.S.]
or, 2x = 17
or, $\frac{2x}{2} = \frac{17}{2}$ [Dividing both the sides by 2]
or, x = 8.50
∴ Price of one pen = Rs 8.50

Q21
Answer :

Let the number of girls in the school be x.
Then, the number of boys in the school will be (x + 334).
Total strength of the school = 572

∴ x + (x + 334) = 572
or, 2x + 334 = 572
or, 2x + 334 — 334 = 572 — 334   {Subtracting 334 from both the sides]
or, 2x = 238
or, $\frac{2x}{2} = \frac{238}{2}$ [Dividing both the sides by 2]
or, x = 119
∴ Number of girls in the school = 119

Q22
Answer :

Let the breadth of the park be x metres.
Then, the length of the park will be 3x metres.
Perimeter of the park = 2 (Length + Breadth) = 2 (3x + x) m
Given perimeter = 168 m

∴ 2(3x + x) = 168
or, 2 (4x) = 168
or, 8x = 168   [On expanding the brackets]
or, $\frac{8x}{8} = \frac{168}{8}$ [Dividing both the sides by 8]
or, x = 21 m
∴ Breadth of the park = x = **21 m**
Length of the park = 3x = 3×21 = **63 m**

Q23
Answer :

Let the breadth of the hall be x metres.
Then, the length of the hall will be (x + 5) metres.
Perimeter of the hall = 2(Length + Breadth) = 2(x + 5 + x) metres
Given perimeter of the rectangular hall = 74 metres

∴ 2(x + 5 + x) = 74
or, 2 (2x + 5) = 74
or, 2 ×2x + 2 ×5 = 74   [On expanding the brackets]
or, 4x + 10 = 74
or, 4x + 10 — 10 = 74 — 10   [Subtracting 10 from both the sides]
or, 4x = 64
or, $\frac{4x}{4} = \frac{64}{4}$ [Dividing both the sides by 4]
or, x = 16 metres
∴ Breadth of the park = x
                  = **16 metres**
Length of the park = x + 5 = 16 + 5
                  = **21 metres**

Q24

Answer :

Let the breadth of the rectangle be x cm.

Then, the length of the rectangle will be (x + 7) cm.

Perimeter of the rectangle = 2(Length + Breadth) = 2(x + 7 + x) cm

Given perimeter of the rectangle = Length of the wire = 86 cm

$\therefore$ 2(x + 7 + x) = 86

or, 2 (2x + 7) = 86

or, 2 ×2x + 2 × 7 = 86   [On expanding the brackets]

or, 4x + 14 = 86

or, 4x + 14 - 14 = 86 - 14   [Subtracting 14 from both the sides]

or, 4x = 72

or, $\frac{4x}{4} = \frac{72}{4}$ [Dividing by 4 on both the sides]

or, x = 18 metres

Breadth of the hall = x

                       = **18 metres**

Length of the hall = x + 7

                     = 18 + 7

                     = **25 metres**