Linear Equation In One Variable
Ex 9A

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.

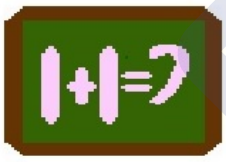
$x + 7 = 12$

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 $4(2) + 2 = 10$

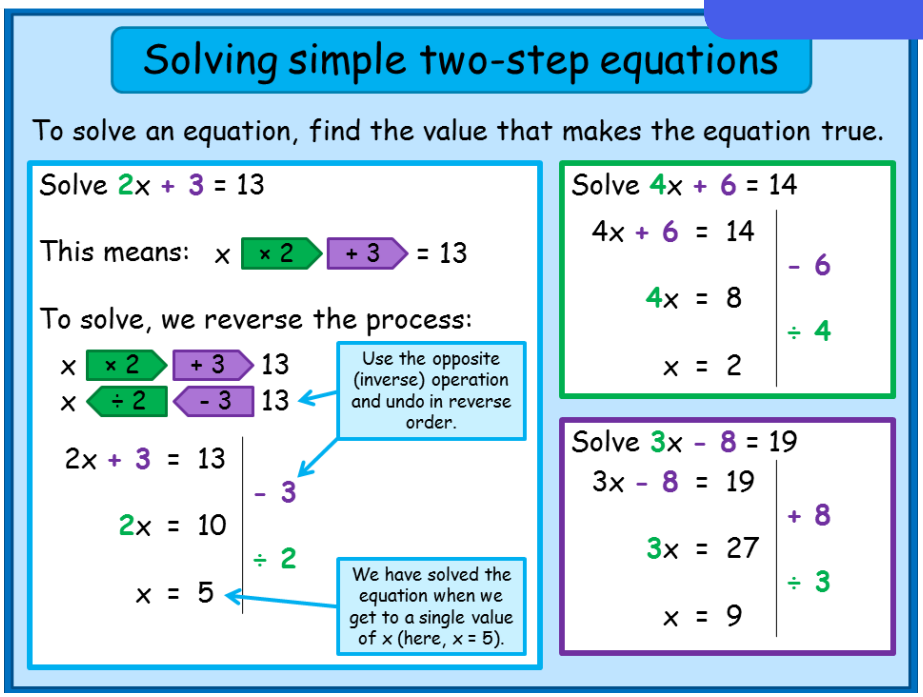
ONE STEP SUBTRACTION EXAMPLE

The Opposite of Subtraction is Addition

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

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!



Q1

Answer :

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

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

(iii) Let the required number be x.
So, when 25 exceeds the number, we get 25 — x.
∴ 25 — x = 7

(iv) Let the required number be x.
So, when the number exceeds 5, we get x — 5.
∴ x — 5 = 3

(v) Let the required number be x.
So, thrice the number will be 3x.
∴ 3x — 5 = 16

(vi) Let the required number be x.
So, 12 subtracted from the number will be x — 12.
∴ x — 12 = 24

(vii) Let the required number be x.
So, twice the number will be 2x.
∴ 19 — 2x = 11

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

(ix) Let the required number be x.
So, four times the number will be 4x.
∴ 4x — 3 = 17

(x) Let the required number be x.
So, 6 times the number will be 6x.
∴ 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

$\therefore y = 4$

(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

$\therefore x = 17$

(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

$\therefore x = 7$

(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

$\therefore y = 12$

(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

$\therefore x = 8$

(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:

$\Rightarrow x + 5 - 5 = 12 - 5$

$\Rightarrow x = 7$

Verification:

Substituting $x = 7$ in the L.H.S.:

$\Rightarrow 7 + 5 = 12$ = R.H.S.

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

Hence, verified.

Q2

Answer :

$x + 3 = -2$

Subtracting 3 from both the sides:

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

$\Rightarrow x = -5$

Verification:

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

$\Rightarrow -5 + 3 = -2$ = 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]

$\Rightarrow 3x = 18$

$\Rightarrow \frac{3x}{3} = \frac{18}{3}$ [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]

$\Rightarrow 4x = 8$

$\Rightarrow \frac{4x}{4} = \frac{8}{4}$ [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 :

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

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

$\Rightarrow x = 60$

Verification:

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

$\Rightarrow \frac{60}{5} = 12$ = 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.:

$3(2 + 6) = 3 \times 8 = 24$ = 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.:
$6(1 - 4 \times 3) + 7(2 + 5 \times 3)$
$\Rightarrow 6(1 - 12) + 7(2 + 15)$
$\Rightarrow 6(-11) + 7(17)$
$\Rightarrow -66 + 119 = 53 = R.H.S.$

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.:

$16(3 \times 5 - 5) - 10(4 \times 5 - 8)$
$\Rightarrow 16(15 - 5) - 10(20 - 8)$
$\Rightarrow 16(10) - 10(12)$
$\Rightarrow 160 - 120 = 40 = R.H.S.$

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

Q19

Answer :

3(x + 6) + 2(x + 3) = 64
⇒3 × x + 3 × 6 + 2 × x + 2 × 3 = 64 [On expanding the brackets]
⇒3x + 18 + 2x + 6 = 64
⇒5x + 24 = 64
⇒5x + 24 − 24 = 64 − 24 [Subtracting 24 from both the sides]
⇒5x = 40
$\Rightarrow \frac{5x}{5} = \frac{40}{5}$ [Dividing both the sides by 5]
⇒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 × 2 + 3 × (−5x) − 2 × 1 − 2 × (−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.:
$3(2 - 5 \times 1) - 2(1 - 6 \times 1)$
$\Rightarrow 3(2 - 5) - 2(1 - 6)$
$\Rightarrow 3(-3) - 2(-5)$
$\Rightarrow -9 + 10 = 1 = \text{R.H.S.}$
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:
$\frac{3\times60}{10} - 4$
$= \frac{180}{10} - 4 = 18 - 4 = 14 = R.H.S.$

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
Ex 9C

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.

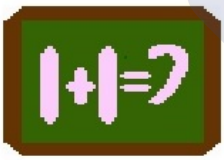
$x + 7 = 12$

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 $4(2) + 2 = 10$

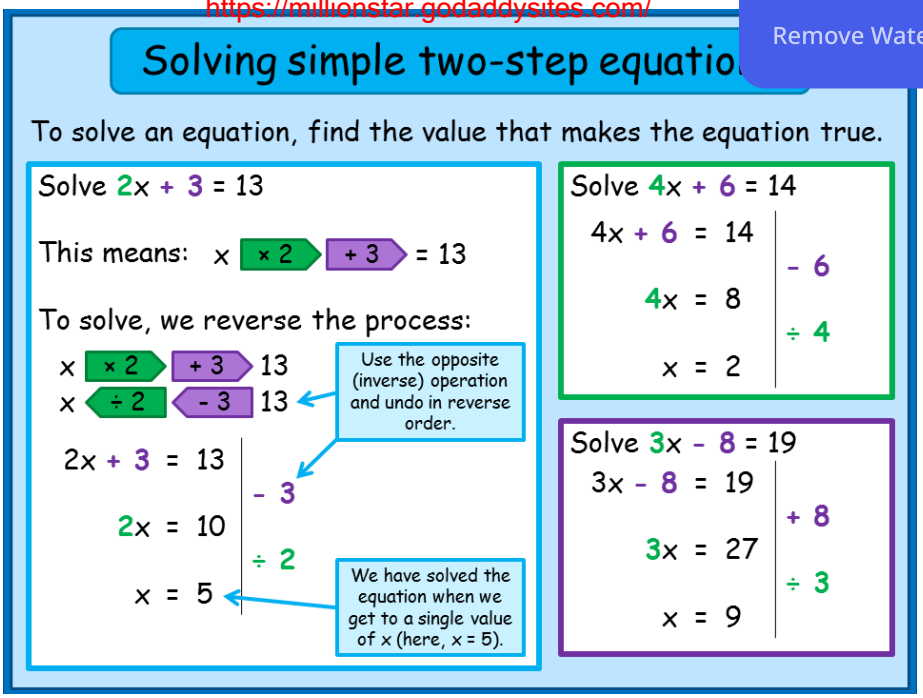
ONE STEP SUBTRACTION EXAMPLE

The Opposite of Subtraction is Addition

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

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!



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 3*x* metres.
Perimeter of the park = 2 (Length + Breadth) = 2 (3*x* + *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 = 3*x* = 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 (2*x* + 5) = 74
or, 2 ×2*x* + 2 ×5 = 74 [On expanding the brackets]
or, 4*x* + 10 = 74
or, 4*x* + 10 — 10 = 74 — 10 [Subtracting 10 from both the sides]
or, 4*x* = 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

∴ 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**