Section A

1. If x = a, then which of the following is not always true for an integer k.

(a) kx = ak

(b) x/k = a/k

(c) x - k = a – k

(d) x + k = a + k

Answer: (b) x/k = a/k

Given, x = a

We have to find the option which is not true for an integer k.

(i) Considering kx = ak

Cancelling out common term, we get

x = a

(ii) Considering x/k = a/k

Taking out (1/k) as common,

$\Rightarrow \left(\frac{1}{k}\right) x = \left(\frac{1}{k}\right) a$

Cancelling out common term,

x = a

When k is 0, x/0 = a/0 which is undefined.

(iii) Considering x - k = a - k

x = a - k + k

x = a

(iv) Considering x + k = a + k

x = a + k - k

x = a

Therefore, $\frac{x}{k} = \frac{a}{k}$ is not true.

2. x = -12 is the solution of the linear equation 5x -3(2x + 1) = 21+x. State whether the statement is true or false.

Answer: Given, x = -12 is the solution of the linear equation 5x -3(2x + 1) = 21+x.

We have to determine if the given statement is true or false.

On solving the equation for x,

5x - 3(2x + 1) = 21 + x

5x - 6x - 3 = 21 + x

x(5 - 6) - 3 = 21 + x

-x - 3 = 21 + x

-3 = 21 + x + x

-3 = 21 + 2x

2x = -3 - 21

2x = -24

x = -12

Therefore, the solution of the equation is -12.

3. Solve: $\frac{x}{2} + \frac{x}{4} + \frac{x}{5} + 1000 = x$

⇨ $\frac{x}{2} + \frac{x}{4} + \frac{x}{5} - x = 1000$

⇨ $\frac{10x + 4x + 5x - 20x}{20} = -10000$

⇨ $\frac{19x - 20x}{20} = -10000$

⇨ $\frac{-x}{20} = -10000$

⇨ x = 200000

4. The solution of which of the following equations is neither a fraction nor an integer

(a) 2x + 6 = 0 (b) 3x - 5 = 0

(c) 5x - 8 = x + 4 (d) 4x + 7 = x + 2

Answer: (d) 4x + 7 = x + 2

Let's solve each of the equations to find out the correct option.

(a) 2x + 6 = 0

2x = - 6

x = -3, which is an integer

(b) 3x - 5 = 0

3x = 5

x = 5/3, which is a fraction.

(c) 5x - 8 = x + 4

4x = 12

x = 3, which is an integer

(d) 4x + 7 = x + 2

3x = -5

x = $\frac{-5}{3}$, which is neither a fraction nor an integer

Hence out of the four options, the correct option is (d) 4x + 7 = x + 2, which is neither a fraction nor an integer.

5. If 8x - 3 = 25 +17x, then x is

(a) a fraction (b) an integer

(c) a rational number (d) cannot be solved

Answer: (c) a rational number

Given, the equation is 8x - 3 = 25 + 17x

We have to find the value of x.

On solving the equation for x,

8x - 3 = 25 + 17x

On grouping common terms,

8x - 17x = 25 + 3

x(8 - 17) = 28

-9x = 28

x = $\frac{-28}{9}$

Therefore, the solution is a rational number.

6. If $\frac{5x}{3} - 4 = \frac{2x}{5}$, then the numerical value of 2x – 7 is

(a) 19/13 (b) -13/19 (c) 0 (d) 13/19

Answer: (b) -13/19

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

$\frac{5x}{3} - \frac{2x}{5} = 4$ LCM of 3 and 5 is 15

⇨ $\frac{25x - 6x}{15} = 4$

⇨ 19x = 15 x 4

⇨ x = $\frac{60}{19}$

Substituting the value of 2x – 7

= 2 x $\frac{60}{19} - 7$

⇨ $\frac{120}{19} - 7$

⇨ $\frac{120-133}{19} = \frac{-13}{19}$

7. If a and b are positive integers, then the solution of the equation ax = b has to be always

(a) positive (b) negative (c) one (d) zero

Answer: (a) positive

Let a = 3 and b = 4

Then, ax = b

3x = 4

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

8. Linear equation in one variable has

(a) only one variable with any power. (b) only one term with a variable.

(c) only one variable with power 1. (d) only constant term.

Answer: (c) only one variable with power 1.

A linear equation is a type of equation in which the degree of each variable is exactly equal to one.

Linear equations in one variable are those equations in which there is only one variable present, and there is only one solution of the equation.

Example: consider the equation x + 4 = 10

On solving the equation for x,

x = 10 - 4

x = 6

We observe that x + 4 = 10 is a linear equation with one variable x and has only one solution 6.

Therefore, a linear

9. $\frac{-4}{3}$ **y =** $\frac{-3}{4}$

Answer:

$\frac{-4}{3}$ y = $\frac{-3}{4}$

$y = \frac{-3}{4} \times \frac{-3}{4}$

$y = \frac{9}{16}$

$y = \frac{3\ x\ 3}{4\ x\ 4}$

$y = \left(\frac{3}{4}\right)^2$

10. The digit in the tens place of a two-digit number is 3 more than the digit in the units place. Let the digit at unit place be b. Then the number is

(a)11b + 30 (b) 10b + 30

(c) 11b + 3 (d) 10b + 3

Answer: (a)11b + 30

Given, the digit in the tens place of a two-digit number is 3 more than the digit in the units place.

The digit at the unit place is b.

We have to find the number.

According to the question,

Unit's digit = b

Ten's digit = 3 + b

Number = tens digit + unit's digit

= 10(3 + b) + b

= 10(3) + 10(b) + b

= 30 + 10b + b

= 30 + 11b

11. The sum of three consecutive multiples of 7 is 357. Find the smallest multiple.

(a) 112 (b) 126 (c) 119 (d) 116

Answer:

Given, the sum of three consecutive multiples of 7 is 357.

We have to find the first multiple.

Let the three consecutive multiples of 7 be 7x, (7x + 7) and (7x + 14).

According to the question,

7x + 7x + 7 + 7x + 14 = 357

On grouping of common terms,

7x + 7x + 7x = 357 - 7 - 14

21x = 357 - 21

21x = 336

x = $\frac{336}{21}$

x = 16

Now, 7x = 7(16) = 112

Therefore, the first multiple is 112.

12. The solution of the equation 2y = $\frac{5y-18}{5}$ is _____. Fill in the blanks to make the statement true.

Answer:

Given, the expression is 2y = $\frac{5y-18}{5}$

On solving the equation for y,

2y = $\frac{5y-18}{5}$ On grouping of common terms,

5y - 2y = $\frac{18}{5}$

3y = $\frac{18}{5}$

y = $\frac{18}{5\ x\ 3}$

$y = \frac{6}{5}$

Therefore, the value of x is $\frac{6}{5}$.

13. Three consecutive numbers whose sum is 12 are _____, _____ and _____. Fill in the blanks to make the statement true.

Answer:

Given, three consecutive numbers whose sum is 12 are _____, _____ and _____.

Let the three consecutive numbers be x, x + 1 and x + 2.

According to the question,

x + x + 1 + x + 2 = 12

On grouping of common terms,

x + x + x = 12 - 1 - 2

3x = 12 - 3

3x = 9

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

x = 3

Now, x + 1 = 3 + 1 = 4

x + 2 = 3 + 2 = 5

Therefore, the three consecutive numbers are 3, 4 and 5.

14. The solution of the equation $\frac{x}{2} - \frac{1}{5} = \frac{x}{3} + \frac{1}{4}$

(a) 2.7 (b) 1.8 (c) 2.9 (d) 1.7

Answer:

$\frac{x}{2} - \frac{1}{5} = \frac{x}{3} + \frac{1}{4}$

$\Rightarrow \frac{x}{2} - \frac{x}{3} = \frac{1}{4} + \frac{1}{5}$

$\Rightarrow \frac{1}{6}\ x = \frac{5+4}{20}$

$\Rightarrow \frac{1}{6}\ x = \frac{9}{20}$

⇨ $x = \frac{9}{20} \times \frac{6}{1} = \frac{27}{10} = 2.7$

15. If we subtract 1/2 from a number and multiply the result by 1/2, we get 1/8, then the number is

(a) $\frac{1}{2}$ (b) $\frac{3}{4}$ (c) $\frac{1}{4}$ (d) none of these

Answer:

Let the number be x

⇨ $\left[x - \frac{1}{2}\right]\frac{1}{2} = \frac{1}{8}$

➔ $x - \frac{1}{2} = \frac{1}{8} \times \frac{2}{1}$

➔ $x - \frac{1}{2} = \frac{1}{4}$

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

Therefore **x =** $\frac{3}{4}$

16. If the perimeter of a rectangle is 13 cm and its width is $2\frac{3}{4}$ cm, then its length is

(a) $2\frac{3}{4}$ (b) $3\frac{3}{4}$ (c) $4\frac{3}{4}$ (d) $5\frac{3}{4}$

Answer: (b) $\mathbf{3\frac{3}{4}}$

Perimeter of rectangle = 13 cm

Width = $2\frac{3}{4} = \frac{11}{4}$ cm

Let the length = x cm

$\therefore$ Perimeter $= 2$ (Length + Breadth)

➔ $13 = 2\left(x + \frac{11}{4}\right)$

$\Rightarrow \frac{13}{2} = x + \frac{11}{4}$

$\Rightarrow x = \frac{13}{2} - \frac{11}{4} = \frac{26-11}{4} = \frac{15}{4}$

$\therefore \text{Length} = \frac{15}{4} = 3\frac{3}{4}$ cm

17. What should be added to twice the rational number $\frac{-7}{3}$ to get $\frac{3}{7}$?

(a) $\frac{58}{21}$ (b) $\frac{29}{21}$ (c) $\frac{89}{21}$ (d) $\frac{107}{21}$

Answer: (d) $\mathbf{\frac{107}{21}}$

Let x be added

According to the question

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

$\Rightarrow \frac{-14}{3} + \text{x} = \frac{3}{7}$

$\Rightarrow \text{x} = \frac{3}{7} + \frac{14}{3}$

$\therefore \text{x} = \frac{9+98}{21} = \frac{107}{21}$

18. The sum of digits of a two-digit number is 8. If the number obtained by reversing the digits is 18 more than the original number, then the original number is

(a) 35 (b) 53 (c) 26 (d) 62

Answer: (a) 35

The sum of digits of a two-digit number = 8

Let unit digit = x

Then tens digit = 8 – x

$\therefore$ Number $= x + 10(8 - x) = x + 80 - 10x = 80 - 9x$

By reversing the digits,

Unit digit $= 8 - x$

And tens digit $= x$

$\therefore$ Number $= 8 - x + 10x = 8 + 9x$

$\therefore 8 + 9x = 80 + 18 - 8$

$\Rightarrow 18x = 90$

$\Rightarrow X = \frac{90}{18} = 5$

$\therefore$ Number $= 80 - 9x = 80 - 9 \times 5$

$= 80 - 45$

$= 35$

19. Arjun is twice as old as Shriya. If five years ago his age was three times Shriya's age, then Arjun's present age is

(a) 10 years (b) 15 years (c) 20 years (d) 25 years

Answer: (c) 20 years

Let Shriya's age = x years

Then Arjun]s age = 2x

5 years ago,

Age of Shriya = (x – 5) years

and age of Arjun = (2x – 5) years

$\therefore$ (2x – 5) = 3(x – 5)

➔ 2x – 5 = 3x = 15

➔ 3x - 2x = 15 – 5

➔ x = 10

So, Shriya's present age = x = 10 years.

Therefore, Arjun's present age = 2x = 2(10) = 20 years.

Section B

20. $\frac{3x}{4} - \frac{1}{4}(x - 20) = \frac{x}{4} + 32$

Answer:

⇨ $\frac{3x}{4} - \frac{1}{4}x + \frac{1}{4} \times 20 = \frac{x}{4} + 32$

⇨ $\frac{3x}{4} - \frac{x}{4} - \frac{1}{4} = 32 - 5$

⇨ $\frac{3x - x - x}{4} = 27$

⇨ $\frac{x}{4} = 27$

⇨ $x = 27 \times 4 = 108$

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

➔ $\frac{x}{3} - \frac{5}{2} = \frac{4x}{9} - \frac{2x}{3}$

Since LCM of denominators 3,2,9 and 3 = 18

➔ $\frac{x}{3} \times 18 - \frac{5}{2} \times 18 = \frac{4x}{9} \times 18 - \frac{2x}{3} \times 18$ [multiplying each term by 18]

➔ $6x - 45 = 8x - 12x$

➔ $6x + 12x - 8x = 45$

➔ $18x - 8x = 45$

➔ $10x = 45$

⇨ $x = \frac{45}{10} = 4.5$

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

➔ $\frac{1(x-2)+2(x-1)}{(x-1)\,(x-2)} = \frac{3}{x-3}$

⇨ $\frac{x-2+2x-2}{x^2-2x+x+2} = \frac{3}{x-3}$

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

⇨ (x -3) (3x - 4) = 3 ($x^2 - 3x + 2$)

⇨ x (3x - 4) -3(3x - 4) = $3x^2$ – 9x + 6

⇨ $3x^2$ - 4x – 9x + 12 = $3x^2$ – 9x + 6

⇨ $3x^2$ – 13x - $3x^2$ + 9x = 6 – 12

⇨ -4x = -6

⇨ x = $\frac{-6}{-4} = \frac{3}{2} = 1\frac{1}{2}$

23. Fifteen less than 4 times a number is 9. Find the number.

Answer:

Let the required number be x

4 times the number = 4x

15 less than 4 times the number = 4x – 15

According to the statement

⇨ 4x – 15 = 9

⇨ 4x = 9 + 15

⇨ 4x = 24

⇨ x = $\frac{24}{4}$ = 6

24. Six more than one-fourth of a number is two-fifths of the number. Find the number.

Answer:

Let the required number be x

One-fourth of a number = $\frac{x}{4}$

Two-fifths of the number = $\frac{2x}{5}$

According to the statement:

➔ $\frac{2x}{5} = 6 + \frac{x}{4}$

➔ $\frac{2x}{5} - \frac{x}{4} = \frac{6}{1}$ LCM of 5,4 and 1 = 20

➔ $\frac{2x}{5} \times 20 - \frac{x}{4} \times 20 = \frac{6}{20}$

➔ 8x – 5x = 120

➔ 3x = 120

➔ x = $\frac{120}{3}$ = 40

The required number is 40.

25. Separate 178 into two parts so that the first part is 8 less than twice the second part.

Answer:

Let the first part = x

Second part = 178 - x

According to the problem:

First part = 8 less than twice the second part.

x = 2(178 – x) – 8

⇨ x = 356 – 2x – 8

⇨ x + 2x = 356 – 8

⇨ 3x = 348

⇨ x = $\frac{348}{3}$ = 116

First part = 116

Second part = 178 – x = 178 – 116 = 62

26. The difference between two numbers is 3 and the difference of their squares is 69. Find the numbers.

Answer:

Let one number = x

Second number = x + 3 (The difference of the two numbers is 3)

According to the statement:

$(x + 3)^2 – (x)^2 = 69$

⇨ $(x)^2 + (3)^2 + 2 \times x \times 3 – x^2 = 69$

⇨ $x^2 + 9 + 6x - x^2 = 69$

⇨ $6x = 69 – 9$

⇨ $6x = 60$

⇨ $x = \frac{60}{6} = 10$

One number = 10

Second number = x + 3 = 10 + 3 = 13

Section C

27. A rectangle's length is 5 cm less than twice its width. If the length is decreased by 5 cm and width is increased by 2 cm; the perimeter of the resulting rectangle will be 74 cm. Find the length and the width of the original rectangle.

Answer:

Let the width of the original rectangle = x cm

Length of original rectangle = (2x – 5)cm

Now, the new length of a rectangle = 2x – 5 – 5 = (2x -10) cm

New width of rectangle = (x + 2)cm

New Perimeter = 2[Length + Width] = 2[2x -10 + x + 2] = 2[3x – 8] = (6x – 16) cm

Given, new perimeter = 74 cm

➔ 6x – 16 = 74

➔ 6x = 74 + 16

➔ 6x = 90 cm

➔ x = $\frac{90}{6}$ = 15

The length of the original rectangle = 2x -5 = 2 x 15 – 5 = 30 – 5 = 25 cm

The width of the original rectangle = x = 15cm

28. Distance between two stations A and B is 690 km. Two cars start simultaneously from A and B towards each other, and the distance between them after 6 hours is 30 km. If the speed of one car is less than the other by 10 km/hr, find the speed of each car.

Answer:

Given, the distance between two stations A and B is 690 km.

Two cars start simultaneously from A and B towards each other.

The distance between the two cars after 6 hours is 30 km.

The speed of one car is less than the other by 10 km/hr.

We have to find the speed of each car.

Let the speed of the faster car be x km/hr.

The speed of other car = (x - 10) km/hr

Let the first car start from point A and the other from point B

Let M and N be the position of the cars after 6 hours.

We know, distance = speed × time

Distance AM = x × 6 = 6x km

Distance BN = (x-10) × 6 = 6x - 60 km

According to the question,

6x + 6x - 60 + 30 = 690

12x = 690 + 30

12x = 720

x = 720/12

x = 60 km/hr

Now, (x - 10) = 60 - 10 = 50 km/hr

Therefore, the speed of the cars are 60 km/hr and 50 km/hr.

29. (x + 2) (x + 3) + (x – 3) (x -2) – 2x (x+1) = 0

Answer:

➔ $[x^2 + (2 + 3)\, x + 2 \times 3] + [x^2 + (-3 -2\,)x + (-3)(-2)] – 2x^2 – 2x = 0$

⇨ $x^2 + 5x + 6 + x^2 – 5x + 6 -2x^2 – 2x = 0$

⇨ $x^2 + x^2 -2x^2 + 5x – 5x + 6 - 2x^2 – 2x = 0$

⇨ $- 2x + 12 = 0$

Subtracting 12 from both sides,

$= - 2x + 12 – 12 = 0 – 12$

⇨ $- 2x = - 12$

Dividing by -2

⇨ $\frac{-2x}{-2} = \frac{-12}{-2}$ ➔ x = 6

Verification

LHS = (x + 2) (x + 3) + (x – 3) (x – 2) – 2x(x+1)

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

= 8 x 9 + 3 x 4 – 12 x 7

= 72 + 12 – 84

= 84 – 84 = 0

30. $\frac{x+2}{6} - \left[\frac{11-x}{3} - \frac{1}{4}\right] = \frac{3x-4}{12}$

Answer:

⇨ $\frac{x+2}{6} - \left[\frac{4(11-x)-1\,x\,3}{12}\right] = \frac{3x-4}{12}$

⇨ $\frac{x+2}{6} - \frac{44+4\,x+\,3}{12} = \frac{3x-4}{12}$

⇨ $\frac{2(x+2)-41+4x}{12} = \frac{3x-4}{12}$

⇨ $\frac{2x+4-41+4x}{12} = \frac{3x-4}{12}$

⇨ $\frac{6x-37}{12} = \frac{3x-4}{12}$

⇨ $12(6x - 37) = 12\,(3x - 4)$

⇨ 72x – 444 = 36x – 48

⇨ 72x - 36x = – 48 + 444

⇨ 36x = 396

⇨ $x = \frac{396}{36} = 11$

31. The ages of A and B are in the ratio 7 : 5. Ten years hence, the ratio of their ages will be 9 : 7. Find their present ages.

Answers:

Ratio in the present ages of A and B = 7 : 5

Let the age of A = 7x years

Let the age of B = 5x years

10 years hence,

Then age of A = 7x + 10 years

And the age of age B = 5x + 10 years

According to the condition,

⇨ $\frac{7x + 10}{5x + 10} = \frac{9}{7}$

By crossing multiplication

⇨ $7(7x + 10) = 9(5x + 10)$

⇨ $49x + 70 = 45x + 90$

⇨ $49x - 45x = 90 - 70$

⇨ $4x = 20$

⇨ $x = \frac{20}{4} = 5$

Present age of A = 7x = 7 x 5 = 35 years

And present age of B = 5x = 5 x 5 = 25 years

32. Find the number whose double is 45 greater than its half.

Answers:

Let the required number = x

Double of it = 2x

And half of it = $\frac{x}{2}$

According to the condition:

⇨ $2x - \frac{x}{2} = 45$

⇨ $\frac{4x - x}{2} = 45$

⇨ $\frac{3x}{2} = 45$

⇨ $3x = 45 \times 2$

⇨ $x = \frac{45 \times 2}{3} = 15 \times 2 = 30$

Required number = 30