1 Choose the correct answer from those given

1. $\{(-5,5)\}$
2. $\{(3,1)\}$
3. The origin point
4. $\{(3,4)\}$
5. zero
6. Parallel
7. Coincident
8. $a = 3$
9. $k \neq 4$
10. $k = 3$
11. Infinite numbers
12. $k = 3$
13. 9 and 4
14. $x + 8$
15. $x - 4$
16. $x + 10y$
17. ϕ
18. zero
19. $\{2, 3\}$
20. ϕ
21. Intersect X-axis in one point
22. 4
23. 1
24. zero
25. 4 and 5
26. 2
27. 4
28. $\{(3,3), (-3,-3)\}$
29. $(4, 2)$
30. $\{0\}$
31. $\mathbb{R}$
32. $\{0, 1\}$
33. 8
34. -50
35. 5
36. $\mathbb{R}$
37. $\mathbb{R} - \{4, -4\}$
38. $\mathbb{R}$
39. Undefined
40. $>$
41. $\{-3\}$
42. $\mathbb{R} - \{0, 1, -1\}$
43. 3
44. 7
45. $2x - 1$
46. 1
47. $\frac{1-x}{x+3}$
48. $\mathbb{R} - \{7\}$
49. $\mathbb{R} - \{2, -5\}$
50. $\mathbb{R} - \{0\}$
51. x
52. $\mathbb{R} - \{4, 7\}$
53. Undefined
54. 8

2 Find algebraically in $\mathbb{R} \times \mathbb{R}$ the solution set of each pair of the following equations

1 $2x - y = 3$ ① $\qquad x + 2y = 4$ ②

Multiply the two sides of equation ① by 2

We get : $4x - 2y = 6$ ③

adding ③ + ② $\qquad 4x - \cancel{2y} = 6$ ③

$x + \cancel{2y} = 4$ ②

$\therefore 5x = 10 \qquad \therefore x = 2$

By substituting in ② $\qquad \therefore 2 + 2y = 4$

$\therefore 2y = 4 - 2 = 2 \qquad \therefore y = 1$

$\therefore$ S.S $= \{(2, 1)\}$

2 $3x + 4y = 24$ ① $\qquad x - 2y = -2$ ②

Multiply the two sides of equation ② by 2

We get : $2x - 4y = -4$ ③

adding ③ + ① $\qquad 2x - \cancel{4y} = -4$ ③

$3x + \cancel{4y} = 24$ ①

$\therefore 5x = 20 \qquad \therefore x = 4$

By substituting in ① $\qquad \therefore 3 \times 4 + 4y = 24$

$\therefore 4y + 12 = 24 \qquad \therefore 4y = 24 - 12 = 12$

$\therefore y = 3 \qquad \therefore$ S.S $= \{(4, 3)\}$

3 $3x + 2y = 11$ ① $\qquad 2x + 3y = 14$ ②

Multiply the two sides of equation ① by 3

We get : $9x + 6y = 33$ ③

Multiply the two sides of equation ② by -2

We get : $-4x - 6y = -28$ ④

adding ③ + ④ $\qquad 9x + \cancel{6y} = 33$ ③

$-4x - \cancel{6y} = -28$ ④

$\therefore 5x = 5 \qquad \therefore x = 1$

By substituting in ① $\qquad \therefore 3 + 2y = 11$

$\therefore 2y = 11 - 3 = 8 \qquad \therefore y = 4$

$\therefore$ S.S $= \{(1, 4)\}$

4 $\frac{x}{6} + \frac{y}{3} = \frac{1}{3}$ ① $\qquad \frac{x}{2} + \frac{2y}{3} = 1$ ②

Multiply the two sides of equation ① by 10

We get : $2x + 4y = 4$ ③

Multiply the two sides of equation ② by -6

We get : $-3x - 4y = -12$ ④

adding ③ + ④ $\qquad 2x + \cancel{4y} = 4$ ③

$-3x - \cancel{4y} = -6$ ④

$\therefore -x = -2 \qquad \therefore x = 2$

By substituting in ③ $\qquad \therefore 4 + 4y = 4$

$\therefore 4y = 4 - 4 = 0 \qquad \therefore y = 0$

$\therefore$ S.S $= \{(2, 0)\}$

5 $x - y = 1$ ① $\qquad x^2 + y^2 = 25$ ②

From eq ① $x - y = 1$ We get $x = 1 + y$ ③

By substituting in ② $\therefore (1+y)^2 + y^2 = 25$

$\therefore 1 + 2y + y^2 + y^2 = 25$

$\therefore 2y^2 + 2y + 1 - 25 = 0$

$\therefore 2y^2 + 2y - 24 = 0$ divide both sides by 2

$\therefore y^2 + y - 12 = 0 \quad \therefore (y-3)(y+4) = 0$

$\therefore y = 3$ or $y = -4$

By substituting in ③

At : $y = 3 \quad \therefore x = 1 + 3 = 4$

At : $y = -4 \quad \therefore x = 1 + (-4) = -3$

$\therefore$ S.S $= \{(-3, -4), (4, 3)\}$

6 $x + y = 7$ ① $\qquad y^2 - x^2 = 7$ ②

From eq ① $x + y = 7$ We get $y = 7 - x$ ③

By substituting in ② $\therefore (7-x)^2 - x^2 = 7$

$\therefore 49 - 14x + x^2 - x^2 = 7$

$\therefore -14x + 49 - 7 = 0$

$\therefore -14x + 42 = 0 \quad \therefore -14x = -42$

$\therefore x = 3$

By substituting in ③

At : $x = 3 \quad \therefore y = 7 - 3 = 4$

$\therefore$ S.S $= \{(3, 4)\}$

7 $y - x = 3$ ① $\qquad x^2 + y^2 - xy = 13$ ②

From eq ① $y - x = 3$ We get $y = 3 + x$ ③

By substituting in ②

$\therefore x^2 + (3+x)^2 - x(3+x) = 13$

$\therefore x^2 + 9 + 6x + x^2 - 3x - x^2 - 13 = 0$

$\therefore x^2 + 3x - 4 = 0 \quad \therefore (x-1)(x+4) = 0$

$\therefore x = 1$ or $x = -4$

By substituting in ③

At : $x = 1 \quad \therefore y = 3 + 1 = 4$

At : $x = -4 \quad \therefore y = 1 + (-4) = -1$

$\therefore$ S.S $= \{(-4, -1), (1, 4)\}$

8 $x + y = 2$ ① $\qquad \frac{1}{x} + \frac{1}{y} = 2$ ②

Multiply the two sides of equation ② by xy

We get : $y + x = 2xy$ ③

From eq ① $y + x = 2$ We get $y = 2 - x$ ③

By substituting in ③

$\therefore 2 - x + x = 2x(2-x) \quad \therefore 2 = 4x - 2x^2$

$\therefore 2x^2 - 4x + 2 = 0$ divide both sides by 2

$\therefore x^2 - 2x + 1 = 0 \quad \therefore (x-1)^2 = 0$

$\therefore x = 1$

By substituting in ①

At : $x = 1 \quad \therefore y = 2 - 1 = 1$

3 Find in $\mathbb{R}$ the solution set of each of the following equations using the general formula

1 $2x^2 - 4x + 1 = 0$

$a = 2, b = -4$ and $c = 1$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{4 \pm \sqrt{16 - 4 \times 2 \times 1}}{2 \times 2}$$

$$= \frac{4 \pm \sqrt{8}}{4} \qquad \therefore x = \frac{4 + \sqrt{8}}{4} = 1.707$$

or $x = \frac{4 - \sqrt{8}}{4} = 0.293$

$\therefore$ S.S $= \{1.707, 0.293\}$

2 $x(x-1) = 4 \quad \therefore x^2 - x - 4 = 0$

$a = 1, b = -1$ and $c = -4$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{1 \pm \sqrt{1 - 4 \times 1 \times -4}}{2 \times 1}$$

$$= \frac{1 \pm \sqrt{17}}{2} \qquad \therefore x = \frac{1 + \sqrt{17}}{2} = 2.562$$

or $x = \frac{1 - \sqrt{17}}{2} = -1.562$

$\therefore$ S.S $= \{-1.562, 2.562\}$

3 $x - \frac{4}{x} = 4$ Multiply both sides by x

$\therefore x^2 - 4 = 4x \quad \therefore x^2 - 4x - 4 = 0$

$a = 1, b = -4$ and $c = -4$

Complete by yourself

4 $\frac{8}{x^2} - \frac{1}{x} = 1$ Multiply both sides by x^2

$\therefore 8 - x = x^2 \quad \therefore x^2 + x - 8 = 0$

$a = 1, b = 1$ and $c = -8$

Complete by yourself

5 $(x-3)^2 - 5x = 0 \quad \therefore x^2 - 6x + 9 - 5x = 0 \quad \therefore x^2 - 11x + 9 = 0$

$a = 1, b = -11$ and $c = 9$

Complete by yourself

4 in each of the following Find $\mathrm{n}(x)$ in the simplest form showing the domain of each of them

1 $\mathrm{n}(x)=\dfrac{x^2-25}{x^2-3x-10}=\dfrac{(x-5)(x+5)}{(x-5)(x+2)}$

$\therefore$ Domain $=\mathbb{R}-\{5,-2\}$

$,\ \mathrm{n}(x)=\dfrac{(\cancel{x-5})(x+5)}{(\cancel{x-5})(x+2)}=\dfrac{(x+5)}{(x+2)}$

2 $\mathrm{n}(x)=\dfrac{x^3-4x}{x^3-5x^2+6x}=\dfrac{x(x-2)(x+2)}{x(x-3)(x-2)}$

$\therefore$ Domain $=\mathbb{R}-\{0,3,2\}$

$,\ \mathrm{n}(x)==\dfrac{\cancel{x}(\cancel{x-2})(x+2)}{\cancel{x}(x-3)(\cancel{x-2})}=\dfrac{(x+2)}{(x-3)}$

3 $\mathrm{n}(x)=\dfrac{x}{x-4}+\dfrac{x+4}{x^2-16}$

$=\dfrac{x}{x-4}+\dfrac{x+4}{(x-4)(x+4)}$

$\therefore$ Domain $=\mathbb{R}-\{4,-4\}$

$,\ \mathrm{n}(x)=\dfrac{x}{x-4}+\dfrac{\cancel{x+4}}{(x-4)(\cancel{x+4})}$

$=\dfrac{x}{x-4}+\dfrac{1}{x-4}=\dfrac{(x-1)}{(x-4)}$

4 $\mathrm{n}(x)=\dfrac{x-6}{2x^2-15x+18}+\dfrac{x-5}{15-13x+2x^2}$

$=\dfrac{x-6}{(2x-3)(x-6)}+\dfrac{x-5}{(2x-3)(x-5)}$

$\therefore$ Domain $=\mathbb{R}-\{6,5,\frac{3}{2}\}$

$,\ \mathrm{n}(x)=\dfrac{\cancel{x-6}}{(2x-3)(\cancel{x-6})}+\dfrac{\cancel{x-5}}{(2x-3)(\cancel{x-5})}$

$=\dfrac{1}{2x-3}+\dfrac{1}{2x-3}=\dfrac{2}{2x-3}$

5 $\mathrm{n}(x)=\dfrac{x^2+2x+4}{x^3-8}-\dfrac{9-x^2}{x^2+x-6}$

$=\dfrac{x^2+2x+4}{(x-2)(x^2+2x+4)}+\dfrac{x^2-9}{(2x-3)(x-5)}$

$=\dfrac{\cancel{x^2+2x+4}}{(x-2)(\cancel{x^2+2x+4})}+\dfrac{(x-3)(\cancel{x+3})}{(\cancel{x+3})(x-2)}$

$\therefore$ Domain $=\mathbb{R}-\{2,-3\}$

$,\ \mathrm{n}(x)=\dfrac{1}{x-2}+\dfrac{x-3}{x-2}=\dfrac{x-2}{x-2}=1$

6 $\mathrm{n}(x)=\dfrac{x^2-3x+2}{1-x^2}\div\dfrac{3x-15}{x^2-6x+5}$

$=\dfrac{(x-1)(x-2)}{-(x^2-1)}\div\dfrac{3(x-5)}{(x-5)(x-1)}$

$=\dfrac{(\cancel{x-1})(x-2)}{-(\cancel{x-1})(x+1)}\times\dfrac{(\cancel{x-5})(x-1)}{3(\cancel{x-5})}$

$\therefore$ Domain $=\mathbb{R}-\{1,-1,5\}$

$,\ \mathrm{n}(x)=\dfrac{x-2}{x+1}+\dfrac{x-1}{3}=\dfrac{(x-1)(x-2)}{3(x+1)}$

7 $\mathrm{n}(x)=\dfrac{x^2-5x}{x^2-8x+15}-\dfrac{x^2+3x+9}{x^3-27}$

$=\dfrac{x(\cancel{x-5})}{(x-3)(\cancel{x-5})}-\dfrac{\cancel{x^2+3x+9}}{(x-3)(\cancel{x^2+3x+9})}$

$\therefore$ Domain $=\mathbb{R}-\{3,5\}$

$,\ \mathrm{n}(x)=\dfrac{x}{x-3}+\dfrac{1}{x-3}=\dfrac{x+1}{x-3}$

$\because 1\in$ Domain $\quad\therefore \mathrm{n}(1)=\dfrac{1+1}{1-3}=-2$

$\because 5\notin$ Domain $\quad\therefore \mathrm{n}(5)$ undefined

Complete by yourself

5 Answer the following question

1 $\because$ domain $=\mathbb{R}-\{3\}$ $\quad\therefore x^2+ax+9=0$ at $x=3$ substituting by 3 in the denominator

$\therefore 9+3a+9=0$ $\quad\therefore 3a=-18$ $\quad\therefore a=-6$

2 $\because$ domain $=\mathbb{R}-\{2,3\}$

$\therefore x^2+ax+b=0$ at $x=2$ and 3

substituting by 2 in the denominator $\quad\therefore 4+2a+b=0$ $\quad\therefore 2a+b=-4$ ①

substituting by 3 in the denominator $\quad\therefore 9+3a+b=0$ $\quad\therefore 3a+b=-9$ ②

Multiply the two sides of equation ① by -1 We get : $-2a-b=4$ ③

adding ③ + ② We get : $a=-5$ By substituting in ① $\therefore b=6$

3 $\because \mathrm{n}_1(x)=\dfrac{x^2-x}{x^3-2x^2}=\dfrac{x(x-1)}{x^2(x-2)}=\dfrac{(x-1)}{x(x-2)}$ and its domain $=\mathbb{R}-\{0,2\}$ ①

$, n_1(x) = \frac{x^2 - 3x + 2}{x^3 - 4x^2 + 4x} = \frac{(x-1)(x-2)}{x(x-2)(x-2)} = \frac{(x-1)}{x(x-2)}$ and its domain $= \mathbb{R} - \{0, 2\}$ ②

From ① and ② $\therefore n_1 = n_2$

4 $\because z(f) = \{3, 5\}$

$\therefore f(3) = 0$ $\therefore 9a + 3b + 15 = 0$ $\therefore 9a + 3b = -15$ ①

$, f(5) = 0$ $\therefore 25a + 5b + 15 = 0$ $\therefore 25a + 5b = -15$ ②

Multiply the two sides of equation ① by -5 We get : $-45a - 15b = 75$ ③

Multiply the two sides of equation ② by 3 We get : $75a + 15b = -45$ ④

adding ③ + ④ We get : $30a = 30$ $\therefore a = 1$

By substituting in ① $\therefore b = -8$

5 $\because$ let length $= x$ and width $= y$

A length of a rectangle is 3 cm. more than its width means : $x - y = 3$ ①

area is 28 cm^2. means : $xy = 28$ ②

solve the two equations together by yourself $x = 7$ and $y = 3$

6 $\because$ let the lengths of the two sides of the right-angle are x and y

the length of the hypotenuse = 13 cm. $\Longrightarrow x^2 + y^2 = 169$ ①

perimeter = 30 cm. $\Longrightarrow x + y + 13 = 30$ $\Longrightarrow x + y = 17$ ②

solve the two equations together by yourself $x = 12$ and $y = 5$

7 **try yourself**

8 $\because$ let the digit of ones is x and the digit of tens is y then : the number is $x + 10y$

the sum of its digits is 11 $\Longrightarrow x + y = 11$ ①

if the two digits reversed $(y + 10x)$, then the resulted number is 27 more than the original number

$(y + 10x) - (x + 10y) = 27$ $\Longrightarrow 9x - 9y = 27$ divide both sides by 9 $\Longrightarrow x - y = 3$ ②

solve the two equations together by yourself $x = 7$ and $y = 4$

9 $\because$ let the measures of the two angles are x and y

Two acute angles in a right-angled triangle $\Longrightarrow x + y = 90$ ①

the difference between their measures $= 50^\circ$ $\Longrightarrow x - y = 50$ ②

solve the two equations together by yourself $x = 70$ and $y = 20$

10 $\because (3, -1)$ is the solution set of the equation : $ax + by = 5$ $\therefore 3a - b = 5$ ①

$\because (3, -1)$ is the solution set of the equation : $3ax + by = 17$ $\therefore 9a - b = 17$ ②

Multiply the two sides of equation ① by -1 We get : $-3a + b = -5$ ③

adding ③ + ② We get : $6a = 12$ $\therefore a = 2$

By substituting in ① $\therefore b = 1$

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