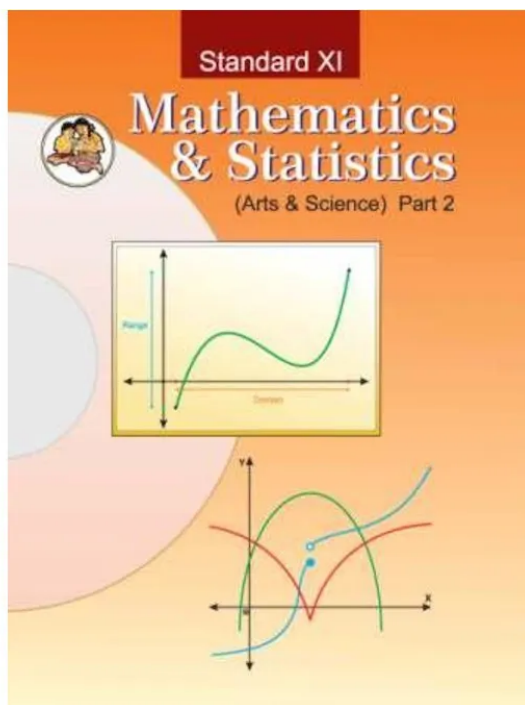


Maharashtra Board Solutions Class 11-Arts & Science Maths (Part 2): Chapter 5- Sets and Relations

Class 11 - Chapter 5 Sets and Relations



For any clarifications or questions you can write to info@indcareer.com

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Maharashtra Board Solutions Class 11-Arts & Science Maths (Part 2): Chapter 5- Sets and Relations

Class 11: Maths Chapter 5 solutions. Complete Class 11 Maths Chapter 5 Notes.

Maharashtra Board Solutions Class 11-Arts & Science Maths (Part 2): Chapter 5- Sets and Relations

Maharashtra Board 11th Maths Chapter 5, Class 11 Maths Chapter 5 solutions

Ex 5.1

Question 1.

Describe the following sets in Roster form:

(i) $A = \{x/x \text{ is a letter of the word 'MOVEMENT'}\}$

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(ii) $B = \{x/x \text{ is an integer, } -\frac{3}{2} < x < \frac{9}{2}\}$

(iii) $C = \{x/x = 2n + 1, n \in \mathbb{N}\}$

Solution:

(i) $A = \{M, O, V, E, N, T\}$

(ii) $B = \{-1, 0, 1, 2, 3, 4\}$

(iii) $C = \{3, 5, 7, 9, \dots\}$

Question 2.

Describe the following sets in Set-Builder form:

(i) $\{0\}$

(ii) $\{0, \pm 1, \pm 2, \pm 3\}$

(iii) $\left\{\frac{1}{2}, \frac{2}{5}, \frac{3}{10}, \frac{4}{17}, \frac{5}{26}, \frac{6}{37}, \frac{7}{50}\right\}$

(iv) $\{0, -1, 2, -3, 4, -5, 6, \dots\}$

Solution:

(i) Let $A = \{0\}$

0 is a whole number but it is not a natural number.

$$\therefore A = \{x / x \in \mathbb{W}, x \notin \mathbb{N}\}$$

(ii) Let $B = \{0, \pm 1, \pm 2, \pm 3\}$

B is the set of elements which belongs to $\mathbb{Z}$ from -3 to 3.

$$\therefore B = \{x / x \in \mathbb{Z} \mid -3 < x < 3\}$$

(iii) Let $C = \left\{ \frac{1}{2}, \frac{2}{5}, \frac{3}{10}, \frac{4}{17}, \frac{5}{26}, \frac{6}{37}, \frac{7}{50} \right\}$
 $\therefore C = \{x / x = \frac{n}{n^2+1}, n \in \mathbb{N}, n \leq 7\}$

(iv) Let $D = \{0, -1, 2, -3, 4, -5, 6, \dots\}$
 $\therefore D = \{x / x = (-1)^{n-1} \times (n-1), n \in \mathbb{N}\}$

Question 3.

If $A = \{x / 6x^2 + x - 15 = 0\}$, $B = \{x / 2x^2 - 5x - 3 = 0\}$, $C = \{x / 2x^2 - x - 3 = 0\}$, then find

(i) $(A \cup B \cup C)$

(ii) $(A \cap B \cap C)$

Solution:

$$A = \{x / 6x^2 + x - 15 = 0\}$$

$$6x^2 + x - 15 = 0$$

$$6x^2 + 10x - 9x - 15 = 0$$

$$2x(3x + 5) - 3(3x + 5) = 0$$

$$(3x + 5)(2x - 3) = 0$$

$$3x + 5 = 0 \text{ or } 2x - 3 = 0$$

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

$$A = \left\{ \frac{-5}{3}, \frac{3}{2} \right\}$$

$$B = \{x/2x^2 - 5x - 3 = 0\}$$

$$2x^2 - 5x - 3 = 0$$

$$2x^2 - 6x + x - 3 = 0$$

$$2x(x - 3) + 1(x - 3) = 0$$

$$(x - 3)(2x + 1) = 0$$

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

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

$$B = \left(-\frac{1}{2}, 3\right)$$

$$C = \{x/2x^2 - x - 3 = 0\}$$

$$2x^2 - x - 3 = 0$$

$$2x^2 - 3x + 2x - 3 = 0$$

$$x(2x - 3) + 1(2x - 3) = 0$$

$$(2x - 3)(x + 1) = 0$$

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

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

$$C = \left\{-1, \frac{3}{2}\right\}$$

$$(i) A \cup B \cup C = \left\{-\frac{5}{3}, \frac{3}{2}\right\} \cup \left\{-\frac{1}{2}, 3\right\} \cup \left\{-1, \frac{3}{2}\right\} = \left\{-\frac{5}{3}, -1, -\frac{1}{2}, \frac{3}{2}, 3\right\}$$

$$(ii) A \cap B \cap C = \{\}$$

Question 4.

If A, B, C are the sets for the letters in the words 'college', 'marriage' and 'luggage' respectively, then verify that $[A - (B \cup C)] = [(A - B) \cap (A - C)]$.

Solution:

$$A = \{c, o, l, g, e\}$$

$$B = \{m, a, r, i, g, e\}$$

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$$C = \{l, u, g, a, e\}$$

$$B \cup C = \{m, a, r, i, g, e, l, u\}$$

$$A - (B \cup C) = \{c, o\}$$

$$A - B = \{c, o, l\}$$

$$A - C = \{c, o\}$$

$$\therefore [(A - B) \cap (A - C)] = \{c, o\} = A - (B \cup C)$$

$$\therefore [A - (B \cup C)] = [(A - B) \cap (A - C)]$$

Question 5.

If $A = \{1, 2, 3, 4\}$, $B = \{3, 4, 5, 6\}$, $C = \{4, 5, 6, 7, 8\}$ and universal set $X = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, then verify the following:

(i) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

(ii) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

(iii) $(A \cup B)' = A' \cap B'$

(iv) $(A \cap B)' = A' \cup B'$

(v) $A = (A \cap B) \cup (A \cap B')$

(vi) $B = (A \cap B) \cup (A' \cap B)$

(vii) $(A \cup B) = (A - B) \cup (A \cap B) \cup (B - A)$

(viii) $A \cap (B \Delta C) = (A \cap B) \Delta (A \cap C)$

(ix) $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

(x) $n(B) = n(A' \cap B) + n(A \cap B)$

Solution:

$$A = \{1, 2, 3, 4\}, B = \{3, 4, 5, 6\}, C = \{4, 5, 6, 7, 8\},$$

$$X = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

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$$(i) B \cap C = \{4, 5, 6\}$$

$$\therefore A \cup (B \cap C) = \{1, 2, 3, 4, 5, 6\} \dots\dots(i)$$

$$A \cup B = \{1, 2, 3, 4, 5, 6\}$$

$$A \cup C = \{1, 2, 3, 4, 5, 6, 7, 8\}$$

$$\therefore (A \cup B) \cap (A \cup C) = \{1, 2, 3, 4, 5, 6\} \dots\dots(ii)$$

From (i) and (ii), we get

$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$$

$$(ii) B \cup C = \{3, 4, 5, 6, 7, 8\}$$

$$\therefore A \cap (B \cup C) = \{3, 4\} \dots\dots\dots(i)$$

$$A \cap B = \{3, 4\}$$

$$A \cap C = \{4\}$$

$$\therefore (A \cap B) \cup (A \cap C) = \{3, 4\} \dots\dots\dots(ii)$$

From (i) and (ii), we get

$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$

$$(iii) A \cup B = \{1, 2, 3, 4, 5, 6\}$$

$$\therefore (A \cup B)' = \{7, 8, 9, 10\} \dots\dots\dots(i)$$

$$A' = \{5, 6, 7, 8, 9, 10\},$$

$$B' = \{1, 2, 7, 8, 9, 10\}$$

$$\therefore A' \cap B' = \{7, 8, 9, 10\} \dots\dots\dots(ii)$$

From (i) and (ii), we get

$$(A \cup B)' = A' \cap B'$$

$$(iv) A \cap B = \{3, 4\}$$

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$$(A \cap B)' = \{1, 2, 5, 6, 7, 8, 9, 10\} \dots\dots(i)$$

$$A' = \{5, 6, 7, 8, 9, 10\}$$

$$B' = \{1, 2, 7, 8, 9, 10\}$$

$$\therefore A' \cup B' = \{1, 2, 5, 6, 7, 8, 9, 10\} \dots\dots(ii)$$

From (i) and (ii), we get

$$(A \cap B)' = A' \cup B'$$

$$(v) A = \{1, 2, 3, 4\} \dots\dots(i)$$

$$A \cap B = \{3, 4\}$$

$$B' = \{1, 2, 7, 8, 9, 10\}$$

$$A \cap B' = \{1, 2\}$$

$$\therefore (A \cap B) \cup (A \cap B') = \{1, 2, 3, 4\} \dots\dots(ii)$$

From (i) and (ii), we get

$$A = (A \cap B) \cup (A \cap B')$$

$$(vi) B = \{3, 4, 5, 6\} \dots\dots(i)$$

$$A \cap B = \{3, 4\}$$

$$A' = \{5, 6, 7, 8, 9, 10\}$$

$$A' \cap B = \{5, 6\}$$

$$\therefore (A \cap B) \cup (A' \cap B) = \{3, 4, 5, 6\} \dots\dots(ii)$$

From (i) and (ii), we get

$$B = (A \cap B) \cup (A' \cap B)$$

$$(vii) A \cup B = \{1, 2, 3, 4, 5, 6\} \dots\dots(i)$$

$$A - B = \{1, 2\}$$

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$$A \cap B = \{3, 4\}$$

$$B - A = \{5, 6\}$$

$$\therefore (A - B) \cup (A \cap B) \cup (B - A) = \{1, 2, 3, 4, 5, 6\} \dots\dots(ii)$$

From (i) and (ii), we get

$$A \cup B = (A - B) \cup (A \cap B) \cup (B - A)$$

$$(viii) B - C = \{3\}$$

$$C - B = \{7, 8\}$$

$$B \Delta C = (B - C) \cup (C - B) = \{3, 7, 8\}$$

$$\therefore A \cap (B \Delta C) = \{3\} \dots\dots(i)$$

$$A \cap B = \{3, 4\}$$

$$A \cap C = \{4\}$$

$$\therefore (A \cap B) \Delta (A \cap C) = [(A \cap B) - (A \cap C)] \cup [(A \cap C) - (A \cap B)] = \{3\} \dots\dots(ii)$$

From (i) and (ii), we get

$$A \cap (B \Delta C) = (A \cap B) \Delta (A \cap C)$$

$$(ix) A = \{1, 2, 3, 4\}, B = \{3, 4, 5, 6\}$$

$$A \cap B = \{3, 4\}, A \cup B = \{1, 2, 3, 4, 5, 6\}$$

$$\therefore n(A) = 4, n(B) = 4,$$

$$n(A \cap B) = 2, n(A \cup B) = 6 \dots\dots(i)$$

$$\therefore n(A) + n(B) - n(A \cap B) = 4 + 4 - 2$$

$$\therefore n(A) + n(B) - n(A \cap B) = 6 \dots\dots(ii)$$

From (i) and (ii), we get

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

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$$(x) B = \{3, 4, 5, 6\}$$

$$\therefore n(B) = 4 \dots\dots(i)$$

$$A' = \{5, 6, 7, 8, 9, 10\}$$

$$A' \cap B = \{5, 6\}$$

$$\therefore n(A' \cap B) = 2$$

$$A \cap B = \{3, 4\}$$

$$\therefore n(A \cap B) = 2$$

$$\therefore n(A' \cap B) + n(A \cap B) = 2 + 2 = 4 \dots\dots(ii)$$

From (i) and (ii), we get

$$n(B) = n(A' \cap B) + n(A \cap B)$$

Question 6.

If A and B are subsets of the universal set X and $n(X) = 50$, $n(A) = 35$, $n(B) = 20$, $n(A' \cap B') = 5$, find

(i) $n(A \cup B)$

(ii) $n(A \cap B)$

(iii) $n(A' \cap B)$

(iv) $n(A \cap B')$

Solution:

$$n(X) = 50, n(A) = 35, n(B) = 20, n(A' \cap B') = 5$$

$$(i) n(A \cup B) = n(X) - [n(A' \cap B')]$$

$$= n(X) - n(A' \cap B')$$

$$= 50 - 5$$

$$= 45$$

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$$(ii) n(A \cap B) = n(A) + n(B) - n(A \cup B)$$

$$= 35 + 20 - 45$$

$$= 10$$

$$(iii) n(A' \cap B) = n(B) - n(A \cap B)$$

$$= 20 - 10$$

$$= 10$$

$$(iv) n(A \cap B') = n(A) - n(A \cap B)$$

$$= 35 - 10$$

$$= 25$$

Question 7.

In a class of 200 students who appeared in certain examinations, 35 students failed in CET, 40 in NEET and 40 in JEE, 20 failed in CET and NEET, 17 in NEET and JEE, 15 in CET and JEE and 5 failed in all three examinations. Find how many students

(i) did not fail in any examination.

(ii) failed in NEET or JEE entrance.

Solution:

Let A = set of students who failed in CET

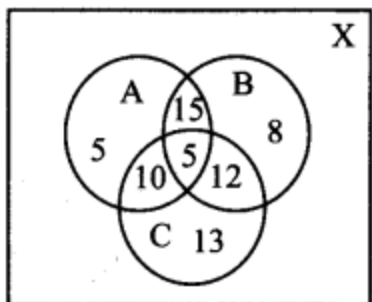
B = set of students who failed in NEET

C = set of students who failed in JEE

X = set of all students

$\therefore n(X) = 200, n(A) = 35, n(B) = 40, n(C) = 40, n(A \cap B) = 20, n(B \cap C) = 17, n(A \cap C) = 15, n(A \cap B \cap C) = 5$

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$$(i) n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$$

$$= 35 + 40 + 40 - 20 - 17 - 15 + 5$$

$$= 68$$

$$\therefore \text{No. of students who did not fail in any exam} = n(X) - n(A \cup B \cup C)$$

$$= 200 - 68$$

$$= 132$$

$$(ii) \text{No. of students who failed in NEET or JEE entrance} = n(B \cup C)$$

$$= n(B) + n(C) - n(B \cap C)$$

$$= 40 + 40 - 17$$

$$= 63$$

Question 8.

From amongst 2000 Uterate individuals of a town, 70% read Marathi newspapers, 50% read English newspapers and 32.5% read both Marathi and English newspapers. Find the number of individuals who read

(i) at least one of the newspapers.

(ii) neither Marathi nor English newspaper.

(iii) only one of the newspapers.

Solution:

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Let M = set of individuals who read Marathi newspapers

E = set of individuals who read English newspapers

X = set of all literate individuals

$$\therefore n(X) = 2000,$$

$$n(M) = \frac{70}{100} \times 2000 = 1400$$

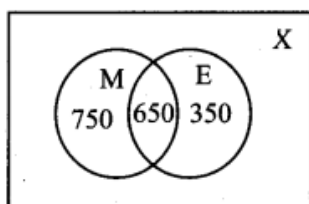
$$n(E) = \frac{50}{100} \times 2000 = 1000$$

$$n(M \cap E) = \frac{32.5}{100} \times 2000 = 650$$

$$(i) n(M \cup E) = n(M) + n(E) - n(M \cap E)$$

$$= 1400 + 1000 - 650$$

$$= 1750$$



No. of individuals who read at least one of the newspapers = $n(M \cup E) = 1750$.

(ii) No. of individuals who read neither Marathi nor English newspaper = $n(M' \cap E')$

$$= n(M \cup E)'$$

$$= n(X) - n(M \cup E)$$

$$= 2000 - 1750$$

$$= 250$$

(iii) No. of individuals who read only one of the newspapers = $n(M \cap E') + n(M' \cap E)$

$$= n(M \cup E) - n(M \cap E)$$

$$= 1750 - 650$$

$$= 1100$$

Question 9.

In a hostel, 25 students take tea, 20 students take coffee, 15 students take milk, 10 students take both tea and coffee, 8 students take both milk and coffee. None of them take tea and milk both and everyone takes atleast one beverage, find the total number of students in the hostel.

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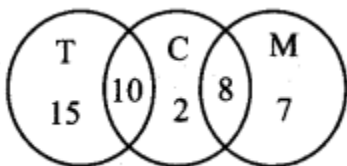
Solution:

Let T = set of students who take tea

C = set of students who take coffee

M = set of students who take milk

$$\therefore n(T) = 25, n(C) = 20, n(M) = 15, n(T \cap C) = 10, n(M \cap C) = 8, n(T \cap M) = 0, n(T \cap M \cap C) = 0$$



$$\therefore \text{Total number of students in the hostel} = n(T \cup C \cup M)$$

$$= n(T) + n(C) + n(M) - n(T \cap C) - n(M \cap C) - n(T \cap M) + n(T \cap M \cap C)$$

$$= 25 + 20 + 15 - 10 - 8 - 0 + 0$$

$$= 42$$

Question 10.

There are 260 persons with skin disorders. If 150 had been exposed to the chemical A, 74 to the chemical B, and 36 to both chemicals A and B, find the number of persons exposed to

- (i) Chemical A but not Chemical B
- (ii) Chemical B but not Chemical A
- (iii) Chemical A or Chemical B

Solution:

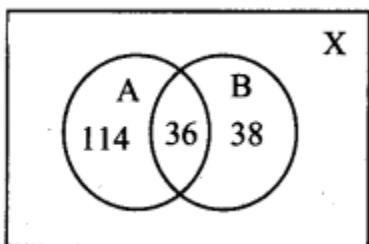
Let A = set of persons exposed to chemical A

B = set of persons exposed to chemical B

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X = set of all persons

$$\therefore n(X) = 260, n(A) = 150, n(B) = 74, n(A \cap B) = 36$$



(i) No. of persons exposed to chemical A but not to chemical B = $n(A \cap B')$

$$= n(A) - n(A \cap B)$$

$$= 150 - 36$$

$$= 114$$

(ii) No. of persons exposed to chemical B but not to chemical A = $n(A' \cap B)$

$$= n(B) - n(A \cap B)$$

$$= 74 - 36$$

$$= 38$$

(iii) No. of persons exposed to chemical A or chemical B = $n(A \cup B)$

$$= n(A) + n(B) - n(A \cap B)$$

$$= 150 + 74 - 36$$

$$= 188$$

Question 11.

Write down the power set of $A = \{1, 2, 3\}$.

Solution:

$$A = \{1, 2, 3\}$$

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The power set of A is given by

$$P(A) = \{\{\Phi\}, \{2\}, \{3\}, \{1, 2\}, \{2, 3\}, \{1, 3\}, \{1, 2, 3\}\}$$

Question 12.

Write the following intervals in Set-Builder form:

(i) $(-3, 0)$

(ii) $[6, 12]$

(iii) $(6, \infty)$

(iv) $(-\infty, 5]$

(v) $(2, 5]$

(vi) $[-3, 4)$

Solution:

(i) $(-3, 0) = \{x / x \in \mathbb{R}, -3 < x < 0\}$

(ii) $[6, 12] = \{x / x \in \mathbb{R}, 6 \leq x \leq 12\}$

(iii) $(6, \infty) = \{x / x \in \mathbb{R}, x > 6\}$

(iv) $(-\infty, 5] = \{x / x \in \mathbb{R}, x \leq 5\}$

(v) $(2, 5] = \{x / x \in \mathbb{R}, 2 < x \leq 5\}$

(vi) $[-3, 4) = \{x / x \in \mathbb{R}, -3 \leq x < 4\}$

Question 13.

A college awarded 38 medals in volleyball, 15 in football, and 20 in basketball. The medals were awarded to a total of 58 players and only 3 players got medals in all three sports. How many received medals in exactly two of the three sports?

Solution:

Let A = Set of students who received medals in volleyball

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B = Set of students who received medals in football

C = Set of students who received medals in basketball

$$n(A) = 38, n(B) = 15, n(C) = 20, n(A \cup B \cup C) = 58, n(A \cap B \cap C) = 3$$

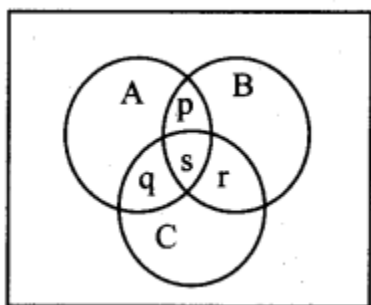
$$n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$$

$$58 = 38 + 15 + 20 - n(A \cap B) - n(B \cap C) - n(A \cap C) + 3$$

$$\therefore n(A \cap B) + n(B \cap C) + n(A \cap C) = 18 \dots\dots(i)$$

Number of players who got exactly two medals = $p + q + r$

$$\text{Here, } s = n(A \cap B \cap C) = 3$$



$$n(A \cap B) + n(B \cap C) + n(A \cap C) = 18 \dots\dots[\text{From (i)}]$$

$$\therefore p + s + s + r + q + s = 18$$

$$\therefore p + q + r + 3s = 18$$

$$\therefore p + q + r + 3(3) = 18$$

$$\therefore p + q + r = 18 - 9 = 9$$

$\therefore$ Number of players who received exactly two medals = 9.

Question 14.

Solve the following inequalities and write the solution set using interval notation.

(i) $-9 < 2x + 7 \leq 19$

(ii) $x^2 - x > 20$

(iii) $\frac{2x}{x-4} \leq 5$

(iv) $6x^2 + 1 \leq 5x$

Solution:

(i) $-9 < 2x + 7 \leq 19$

$$\therefore -16 < 2x \leq 12$$

$$\therefore -8 < x \leq 6$$

$$\therefore x \in (-8, 6]$$

(ii) $x^2 - x > 20$

$$\therefore x^2 - x - 20 > 0$$

$$\therefore x^2 - 5x + 4x - 20 > 0$$

$$\therefore (x - 5)(x + 4) > 0$$

$$\therefore \text{either } x - 5 > 0 \text{ and } x + 4 > 0 \text{ or } x - 5 < 0 \text{ and } x + 4 < 0$$

Case I: $x - 5 > 0$ and $x + 4 > 0$

$$\therefore x > 5 \text{ and } x > -4$$

$$\therefore x > 5 \dots(i)$$

Case II:

$$x - 5 < 0 \text{ and } x + 4 < 0$$

$$\therefore x < -4 \dots\dots(ii)$$

From (i) and (ii), we get

$$x \in (-\infty, -4) \cup (5, \infty)$$

$$(iii) \frac{2x}{x-4} \leq 5$$

$$\therefore \frac{2x}{x-4} - 5 \leq 0$$

$$\therefore \frac{2x-5x+20}{x-4} \leq 0$$

$$\therefore \frac{20-3x}{x-4} \leq 0$$

$$\text{When } \frac{a}{b} \leq 0,$$

$$a \geq 0 \text{ and } b < 0 \text{ or } a \leq 0 \text{ and } b > 0$$

$$\therefore \text{either } 20 - 3x \geq 0 \text{ and } x - 4 < 0 \text{ or } 20 - 3x \leq 0 \text{ and } x - 4 > 0$$

Case I:

$$20 - 3x \geq 0 \text{ and } x - 4 < 0$$

$$\therefore x \leq \frac{20}{3} \text{ and } x < 4$$

$$\therefore x < 4 \dots\dots(I)$$

$$\text{Case II: } 20 - 3x \leq 0 \text{ and } x - 4 > 0$$

$$\therefore x \geq \frac{20}{3} \text{ and } x > 4$$

$$\therefore x \geq \frac{20}{3} \dots\dots(ii)$$

From (i) and (ii), we get

$$x \in (-\infty, 4) \cup \left[\frac{20}{3}, \infty\right)$$

$$(iv) 6x^2 + 1 \leq 5x$$

$$6x^2 - 5x + 1 \leq 0$$

$$6x^2 - 3x - 2x + 1 \leq 0$$

$$(3x - 1)(2x - 1) \leq 0$$

either $3x - 1 \leq 0$ and $2x - 1 \geq 0$ or $3x - 1 \geq 0$ and $2x - 1 \leq 0$

Case I:

$$3x - 1 \leq 0 \text{ and } 2x - 1 \geq 0$$

$\therefore x \leq \frac{1}{3}$ and $x \geq \frac{1}{2}$, which is not possible.

Case II:

$$3x - 1 \geq 0 \text{ and } 2x - 1 \leq 0$$

$$\therefore x \geq \frac{1}{3} \text{ and } x \leq \frac{1}{2}$$

$$\therefore x \in \left[\frac{1}{3}, \frac{1}{2}\right]$$

Question 15.

If $A = (-7, 3]$, $B = [2, 6]$ and $C = [4, 9]$, then find

(i) $A \cup B$

(ii) $B \cup C$

(iii) $A \cup C$

(iv) $A \cap B$

(v) $B \cap C$

(vi) $A \cap C$

(vii) $A' \cap B$

(viii) $B' \cap C'$

(ix) $B - C$

(x) $A - B$

Solution:

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$$A = (-7, 3], B = [2, 6], C = [4, 9]$$

$$(i) A \cup B = (-7, 6]$$

$$(ii) B \cup C = [2, 9]$$

$$(iii) A \cup C = (-7, 3] \cup [4, 9]$$

$$(iv) A \cap B = [2, 3]$$

$$(v) B \cap C = [4, 6]$$

$$(vi) A \cap C = \{ \}$$

$$(vii) A' = (-\infty, -7] \cup (3, \infty)$$

$$\therefore A' \cap B = (3, 6]$$

$$(viii) B' = (-\infty, 2) \cup (6, \infty)$$

$$C' = (-\infty, 4) \cup (9, \infty)$$

$$\therefore B' \cap C' = (-\infty, 2) \cup (9, \infty)$$

$$(ix) B - C = [2, 4)$$

$$(x) A - B = (-7, 2)$$

Ex 5.2

Question 1.

If $(x - 1, y + 4) = (1, 2)$, find the values of x and y .

Solution:

$$(x - 1, y + 4) = (1, 2)$$

By the definition of equality of ordered pairs, we have

$$x - 1 = 1 \text{ and } y + 4 = 2$$

$$\therefore x = 2 \text{ and } y = -2$$

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Question 2.

If $(x + \frac{1}{3}, \frac{y}{3} - 1) = (\frac{1}{2}, \frac{3}{2})$, find x and y.

Solution:

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

By the definition of equality of ordered pairs, we have

$$x + \frac{1}{3} = \frac{1}{2} \text{ and } \frac{y}{3} - 1 = \frac{3}{2}$$

$$\therefore x = \frac{1}{2} - \frac{1}{3} \text{ and } \frac{y}{3} = \frac{3}{2} + 1$$

$$\therefore x = \frac{1}{6} \text{ and } y = \frac{15}{2}$$

Question 3.

If $A = \{a, b, c\}$, $B = \{x, y\}$, find $A \times B$, $B \times A$, $A \times A$, $B \times B$.

Solution:

$$A = \{a, b, c\}, B = \{x, y\}$$

$$A \times B = \{(a, x), (a, y), (b, x), (b, y), (c, x), (c, y)\}$$

$$B \times A = \{(x, a), (x, b), (x, c), (y, a), (y, b), (y, c)\}$$

$$A \times A = \{(a, a), (a, b), (a, c), (b, a), (b, b), (b, c), (c, a), (c, b), (c, c)\}$$

$$B \times B = \{(x, x), (x, y), (y, x), (y, y)\}$$

Question 4.

If $P = \{1, 2, 3\}$ and $Q = \{1, 4\}$, find sets $P \times Q$ and $Q \times P$.

Solution:

$$P = \{1, 2, 3\}, Q = \{1, 4\}$$

$$\therefore P \times Q = \{(1, 1), (1, 4), (2, 1), (2, 4), (3, 1), (3, 4)\}$$

$$\text{and } Q \times P = \{(1, 1), (1, 2), (1, 3), (4, 1), (4, 2), (4, 3)\}$$

Question 5.

Let $A = \{1, 2, 3, 4\}$, $B = \{4, 5, 6\}$, $C = \{5, 6\}$. Verify,

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$$(i) A \times (B \cap C) = (A \times B) \cap (A \times C)$$

$$(ii) A \times (B \cup C) = (A \times B) \cup (A \times C)$$

Solution:

$$A = \{1, 2, 3, 4\}, B = \{4, 5, 6\}, C = \{5, 6\}$$

$$(i) B \cap C = \{5, 6\}$$

$$A \times (B \cap C) = \{(1, 5), (1, 6), (2, 5), (2, 6), (3, 5), (3, 6), (4, 5), (4, 6)\}$$

$$A \times B = \{(1, 4), (1, 5), (1, 6), (2, 4), (2, 5), (2, 6), (3, 4), (3, 5), (3, 6), (4, 4), (4, 5), (4, 6)\}$$

$$A \times C = \{(1, 5), (1, 6), (2, 5), (2, 6), (3, 5), (3, 6), (4, 5), (4, 6)\}$$

$$\therefore (A \times B) \cap (A \times C) = \{(1, 5), (1, 6), (2, 5), (2, 6), (3, 5), (3, 6), (4, 5), (4, 6)\}$$

$$\therefore A \times (B \cap C) = (A \times B) \cap (A \times C)$$

$$(ii) B \cup C = \{4, 5, 6\}$$

$$A \times (B \cup C) = \{(1, 4), (1, 5), (1, 6), (2, 4), (2, 5), (2, 6), (3, 4), (3, 5), (3, 6), (4, 4), (4, 5), (4, 6)\}$$

$$A \times B = \{(1, 4), (1, 5), (1, 6), (2, 4), (2, 5), (2, 6), (3, 4), (3, 5), (3, 6), (4, 4), (4, 5), (4, 6)\}$$

$$A \times C = \{(1, 5), (1, 6), (2, 5), (2, 6), (3, 5), (3, 6), (4, 5), (4, 6)\}$$

$$\therefore (A \times B) \cup (A \times C) = \{(1, 4), (1, 5), (1, 6), (2, 4), (2, 5), (2, 6), (3, 4), (3, 5), (3, 6), (4, 4), (4, 5), (4, 6)\}$$

$$\therefore A \times (B \cup C) = (A \times B) \cup (A \times C)$$

Question 6.

Express $\{(x, y) / x^2 + y^2 = 100, \text{ where } x, y \in W\}$ as a set of ordered pairs.

Solution:

$$\{(x, y) / x^2 + y^2 = 100, \text{ where } x, y \in W\}$$

$$\text{We have, } x^2 + y^2 = 100$$

$$\text{When } x = 0 \text{ and } y = 10,$$

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$$x^2 + y^2 = 0^2 + 10^2 = 100$$

When $x = 6$ and $y = 8$,

$$x^2 + y^2 = 6^2 + 8^2 = 100$$

When $x = 8$ and $y = 6$,

$$x^2 + y^2 = 8^2 + 6^2 = 100$$

When $x = 10$ and $y = 0$,

$$x^2 + y^2 = 10^2 + 0^2 = 100$$

$\therefore$ Set of ordered pairs = $\{(0, 10), (6, 8), (8, 6), (10, 0)\}$

Question 7.

Let $A = \{6, 8\}$ and $B = \{1, 3, 5\}$. Show that $R_1 = \{(a, b) / a \in A, b \in B, a - b \text{ is an even number}\}$ is a null relation, $R_2 = \{(a, b) / a \in A, b \in B, a + b \text{ is an odd number}\}$ is a universal relation.

Solution:

$$A = \{6, 8\}, B = \{1, 3, 5\}$$

$$R_1 = \{(a, b) / a \in A, b \in B, a - b \text{ is an even number}\}$$

$$a \in A$$

$$\therefore a = 6, 8$$

$$b \in B$$

$$\therefore b = 1, 3, 5$$

When $a = 6$ and $b = 1$, $a - b = 5$, which is odd

When $a = 6$ and $b = 3$, $a - b = 3$, which is odd

When $a = 6$ and $b = 5$, $a - b = 1$, which is odd

When $a = 8$ and $b = 1$, $a - b = 7$, which is odd

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When $a = 8$ and $b = 3$, $a - b = 5$, which is odd

When $a = 8$ and $b = 5$, $a - b = 3$, which is odd

Thus, no set of values of a and b gives $a - b$ as even.

$\therefore R_1$ has a null relation from A to B .

$$A \times B = \{(6, 1), (6, 3), (6, 5), (8, 1), (8, 3), (8, 5)\}$$

When $a = 6$ and $b = 1$, $a + b = 7$, which is odd

When $a = 6$ and $b = 3$, $a + b = 9$, which is odd

When $a = 6$ and $b = 5$, $a + b = 11$, which is odd

When $a = 8$ and $b = 1$, $a + b = 9$, which is odd

When $a = 8$ and $b = 3$, $a + b = 11$, which is odd

When $a = 8$ and $b = 5$, $a + b = 13$, which is odd

$$\therefore R_2 = \{(6, 1), (6, 3), (6, 5), (8, 1), (8, 3), (8, 5)\}$$

Here, $R_2 = A \times B$

$\therefore R_2$ has a universal relation from A to B .

Question 8.

Write the relation in the Roster form. State its domain and range.

(i) $R_1 = \{(a, a^2) / a \text{ is a prime number less than } 15\}$

(ii) $R_2 = \{(a, 1a) / 0 < a \leq 5, a \in \mathbb{N}\}$

(iii) $R_3 = \{(x, y) / y = 3x, y \in \{3, 6, 9, 12\}, x \in \{1, 2, 3\}\}$

(iv) $R_4 = \{(x, y) / y > x + 1, x = 1, 2 \text{ and } y = 2, 4, 6\}$

(v) $R_5 = \{(x, y) / x + y = 3, x, y \in \{0, 1, 2, 3\}\}$

(vi) $R_6 = \{(a, b) / a \in \mathbb{N}, a < 6 \text{ and } b = 4\}$

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$$(vii) R_7 = \{(a, b) / a, b \in \mathbb{N}, a + b = 6\}$$

$$(viii) R_8 = \{(a, b) / b = a + 2, a \in \mathbb{Z}, 0 < a < 5\}$$

Solution:

$$(i) R_1 = \{(a, a^2) / a \text{ is a prime number less than } 15\}$$

$$\therefore a = 2, 3, 5, 7, 11, 13$$

$$\therefore a^2 = 4, 9, 25, 49, 121, 169$$

$$\therefore R_1 = \{(2, 4), (3, 9), (5, 25), (7, 49), (11, 121), (13, 169)\}$$

$$\therefore \text{Domain } (R_1) = \{a / a \text{ is a prime number less than } 15\}$$

$$= \{2, 3, 5, 7, 11, 13\}$$

$$\text{Range } (R_1) = \{a^2 / a \text{ is a prime number less than } 15\}$$

$$= \{4, 9, 25, 49, 121, 169\}$$

$$ii. \quad R_2 = \left\{ \left(a, \frac{1}{a} \right) / 0 < a \leq 5, a \in \mathbb{N} \right\}$$

$$\therefore a = 1, 2, 3, 4, 5$$

$$\therefore \frac{1}{a} = 1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}$$

$$\therefore R_2 = \left\{ (1, 1), \left(2, \frac{1}{2} \right), \left(3, \frac{1}{3} \right), \left(4, \frac{1}{4} \right), \left(5, \frac{1}{5} \right) \right\}$$

$$\therefore \text{Domain } (R_2) = \{a / 0 < a \leq 5, a \in \mathbb{N}\}$$

$$= \{1, 2, 3, 4, 5\}$$

$$\text{Range } (R_2) = \left\{ \frac{1}{a} / 0 < a \leq 5, a \in \mathbb{N} \right\}$$

$$= \left\{ 1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5} \right\}$$

$$(iii) R_3 = \{(x, y) / y = 3x, x \in \{1, 2, 3\}, y \in \{3, 6, 9, 12\}\}$$

$$\text{Here } y = 3x$$

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When $x = 1$, $y = 3(1) = 3$

When $x = 2$, $y = 3(2) = 6$

When $x = 3$, $y = 3(3) = 9$

$\therefore R_3 = \{(1, 3), (2, 6), (3, 9)\}$

$\therefore \text{Domain } (R_3) = \{1, 2, 3\}$

$\therefore \text{Range } (R_3) = \{3, 6, 9\}$

(iv) $R_4 = \{(x, y) / y > x + 1, x = 1, 2 \text{ and } y = 2, 4, 6\}$

Here, $y > x + 1$

When $x = 1$ and $y = 2$, $2 \not> 1 + 1$

When $x = 1$ and $y = 4$, $4 > 1 + 1$

When $x = 1$ and $y = 6$, $6 > 1 + 1$

When $x = 2$ and $y = 2$, $2 \not> 2 + 1$

When $x = 2$ and $y = 4$, $4 > 2 + 1$

When $x = 2$ and $y = 6$, $6 > 2 + 1$

$\therefore R_4 = \{(1, 4), (1, 6), (2, 4), (2, 6)\}$

$\text{Domain } (R_4) = \{1, 2\}$

$\text{Range } (R_4) = \{4, 6\}$

(v) $R_5 = \{(x, y) / x + y = 3, x, y \in (0, 1, 2, 3)\}$

Here, $x + y = 3$

When $x = 0$, $y = 3$

When $x = 1$, $y = 2$

When $x = 2$, $y = 1$

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When $x = 3, y = 0$

$$\therefore R_5 = \{(0, 3), (1, 2), (2, 1), (3, 0)\}$$

$$\text{Domain } (R_5) = \{0, 1, 2, 3\}$$

$$\text{Range } (R_5) = \{3, 2, 1, 0\}$$

$$(vi) R_6 = \{(a, b) / a \in N, a < 6 \text{ and } b = 4\}$$

$$a \in N \text{ and } a < 6$$

$$\therefore a = 1, 2, 3, 4, 5 \text{ and } b = 4$$

$$R_6 = \{(1, 4), (2, 4), (3, 4), (4, 4), (5, 4)\}$$

$$\text{Domain } (R_6) = \{1, 2, 3, 4, 5\}$$

$$\text{Range } (R_6) = \{4\}$$

$$(vii) R_7 = \{(a, b) / a, b \in N, a + b = 6\}$$

$$\text{Here, } a + b = 6$$

$$\text{When } a = 1, b = 5$$

$$\text{When } a = 2, b = 4$$

$$\text{When } a = 3, b = 3$$

$$\text{When } a = 4, b = 2$$

$$\text{When } a = 5, b = 1$$

$$\therefore R_7 = \{(1, 5), (2, 4), (3, 3), (4, 2), (5, 1)\}$$

$$\text{Domain } (R_7) = \{1, 2, 3, 4, 5\}$$

$$\text{Range } (R_7) = \{5, 4, 3, 2, 1\}$$

$$(viii) R_8 = \{(a, b) / b = a + 2, a \in Z, 0 < a < 5\}$$

$$\text{Here, } b = a + 2$$

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When $a = 1, b = 3$

When $a = 2, b = 4$

When $a = 3, b = 5$

When $a = 4, b = 6$

$\therefore R_8 = \{(1, 3), (2, 4), (3, 5), (4, 6)\}$

Domain $(R_8) = \{1, 2, 3, 4\}$

Range $(R_8) = \{3, 4, 5, 6\}$

Question 9.

Identify which of the following relations are reflexive, symmetric, and transitive.

Relation	Reflexive	Symmetric	Transitive
$R = \{(a, b) : a, b \in \mathbb{Z}, a - b \text{ is an integer}\}$			
$R = \{(a, b) : a, b \in \mathbb{N}, a + b \text{ is even}\}$	✓	✓	✗
$R = \{(a, b) : a, b \in \mathbb{N}, a \text{ divides } b\}$			
$R = \{(a, b) : a, b \in \mathbb{N}, a^2 - 4ab + 3b^2 = 0\}$			
$R = \{(a, b) : a \text{ is sister of } b \text{ and } a, b \in G = \text{Set of girls}\}$			
$R = \{(a, b) : \text{Line } a \text{ is perpendicular to line } b \text{ in a plane}\}$			
$R = \{(a, b) : a, b \in \mathbb{R}, a < b\}$			
$R = \{(a, b) : a, b \in \mathbb{R}, a \leq b^3\}$			

Solution:

	Relation	Reflexive	Symmetric	Transitive
i.	$R = \{(a, b) : a, b \in \mathbb{Z}, a - b \text{ is an integer}\}$	✓	✓	✓
ii.	$R = \{(a, b) : a, b \in \mathbb{N}, a + b \text{ is even}\}$	✓	✓	✓
iii.	$R = \{(a, b) : a, b \in \mathbb{N}, a \text{ divides } b\}$	✓	✗	✓
iv.	$R = \{(a, b) : a, b \in \mathbb{N}, a^2 - 4ab + 3b^2 = 0\}$	✓	✗	✗
v.	$R = \{(a, b) : a \text{ is sister of } b \text{ and } a, b \in G = \text{Set of girls}\}$	✗	✓	✓
vi.	$R = \{(a, b) : \text{Line } a \text{ is perpendicular to line } b \text{ in a plane}\}$	✗	✓	✗
vii.	$R = \{(a, b) : a, b \in \mathbb{R}, a < b\}$	✗	✗	✓
viii.	$R = \{(a, b) : a, b \in \mathbb{R}, a \leq b^3\}$	✗	✗	✗

(i) Given, $R = \{(a, b) : a, b \in \mathbb{Z}, a - b \text{ is an integer}\}$

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Let $a \in \mathbb{Z}$, then $a - a \in \mathbb{Z}$

$\therefore (a, a) \in R$

$\therefore R$ is reflexive.

Let $(a, b) \in R$

$\therefore a - b \in \mathbb{Z}$

$\therefore -(a - b) \in \mathbb{Z}$, i.e., $b - a \in \mathbb{Z}$

$\therefore (b, a) \in R$

$\therefore R$ is symmetric.

Let (a, b) and $(b, c) \in R$

$\therefore a - b \in \mathbb{Z}$ and $b - c \in \mathbb{Z}$

$\therefore (a - b) + (b - c) \in \mathbb{Z}$

$\therefore a - c \in \mathbb{Z}$

$\therefore (a, c) \in R$

$\therefore R$ is transitive.

(ii) Given, $R = \{(a, b) : a, b \in \mathbb{N}, a + b \text{ is even}\}$

Let $a \in \mathbb{N}$, then $a + a = 2a$, which is even.

$\therefore (a, a) \in R$

$\therefore R$ is reflexive.

Let $(a, b) \in R$

$\therefore a + b$ is even

$\therefore b + a$ is even

$\therefore (b, a) \in R$

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$\therefore R$ is symmetric.

Let (a, b) and $(b, c) \in R$

$\therefore a + b$ and $b + c$ is even

Let $a + b = 2x$ and $b + c = 2y$ for $x, y \in \mathbb{N}$

$\therefore (a + b) + (b + c) = 2x + 2y$

$\therefore a + 2b + c = 2(x + y)$

$\therefore a + c = 2(x + y) - 2b = 2(x + y - b)$

$\therefore a + c$ is even[$\because x, y, b \in \mathbb{N}, x + y - b \in \mathbb{N}$]

$\therefore (a, c) \in R$

$\therefore R$ is transitive.

(iii) Given, $R = \{(a, b) : a, b \in \mathbb{N}, a \text{ divides } b\}$

Let $a \in \mathbb{N}$, then a divides a .

$\therefore (a, a) \in R$

$\therefore R$ is reflexive.

Let $a = 2$ and $b = 8$, then 2 divides 8

$\therefore (a, b) \in R$

But 8 does not divide 2.

$\therefore (b, a) \notin R$

$\therefore R$ is not symmetric.

Let (a, b) and $(b, c) \in R$

$\therefore a$ divides b and b divides c .

Let $b = ax$ and $c = by$ for $x, y \in \mathbb{N}$.

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$$\therefore c = (ax) y = a(xy)$$

i.e., a divides c .

$$\therefore (a, c) \in R$$

$\therefore R$ is transitive.

$$(iv) \text{ Given, } R = \{(a, b) : a, b \in \mathbb{N}, a^2 - 4ab + 3b^2 = 0\}$$

$$\text{Let } a \in \mathbb{N}, \text{ then } a^2 - 4aa + 3a^2 = a^2 - 4a^2 + 3a^2 = 0$$

$$\therefore (a, a) \in R$$

$\therefore R$ is reflexive.

$$\text{Let } a = 3 \text{ and } b = 1,$$

$$\text{then } a^2 - 4ab + 3b^2 = 9 - 12 + 3 = 0$$

$$\therefore (a, b) \in R$$

$$\text{Consider, } b^2 - 4ba + 3a^2 = 1 - 12 + 9 = -2 \neq 0$$

$$\therefore (b, a) \notin R$$

$\therefore R$ is not symmetric.

$$\text{Let } a = 3, b = 1 \text{ and } c = 13,$$

$$\text{then } a^2 - 4ab + 3b^2 = 9 - 12 + 3 = 0 \text{ and}$$

$$b^2 - 4bc + 3c^2 = 1 - 43 + 13 = 1 - 1 = 0$$

$$\therefore \text{ we get } (a, b) \text{ and } (b, c) \in R.$$

$$\text{Consider, } a^2 - 4ac + 3c^2 = 9 - 4 + 13 = 163 \neq 0$$

$$\therefore (a, c) \notin R$$

$\therefore R$ is not transitive.

$$(v) \text{ Given, } R = \{(a, b) : a \text{ is sister of } b \text{ and } a, b \in G = \text{Set of girls}\}$$

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Let $a \in G$, then 'a' cannot be a sister of herself.

$\therefore (a, a) \notin R$

$\therefore R$ is not reflexive.

Let $(a, b) \in R$

$\therefore$ 'a' is a sister of 'b'.

$\therefore$ 'b' is a sister of 'a'.

$\therefore (b, c) \in R$

$\therefore R$ is symmetric.

Let (a, b) and $(b, c) \in R$

$\therefore$ 'a' is a sister of 'b' and 'b' is a sister of 'c'

$\therefore$ 'a' is a sister of 'c'.

$\therefore (a, c) \in R$

$\therefore R$ is transitive.

(vi) Given, $R = \{(a, b) : \text{Line } a \text{ is perpendicular to line } b \text{ in a plane}\}$

Let a be any line in the plane, then a cannot be perpendicular to itself.

$\therefore (a, a) \notin R$

$\therefore R$ is not reflexive.

Let $(a, b) \in R$

$\therefore a$ is perpendicular to b .

$\therefore b$ is perpendicular to a .

$\therefore (b, a) \in R$.

$\therefore R$ is symmetric.

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Let (a, b) and $(b, c) \in R$.

$\therefore a$ is perpendicular to b and b is perpendicular to c .

$\therefore a$ is parallel to c .

$\therefore (a, c) \notin R$

$\therefore R$ is not transitive.

(vii) Given, $R = \{(a, b) : a, b \in R, a < b\}$

Let $a \in R$, then $a \not< a$.

$\therefore (a, a) \notin R$

$\therefore R$ is not reflexive.

Let $a = 1$ and $b = 2$, then $1 < 2$

$\therefore (a, b) \in R$

But $2 \not< 1$

$\therefore (b, a) \notin R$

$\therefore R$ is not symmetric.

Let (a, b) and $(b, c) \in R$

$\therefore a < b$ and $b < c$

$\therefore a < c$

$\therefore (a, c) \in R$

$\therefore R$ is transitive.

(viii) Given, $R = \{(a, b) : a, b \in R, a \leq b^3\}$

Let $a = -3$, then $a^3 = -27$.

Here, $a \not\leq a$

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$\therefore (a, a) \notin R$

$\therefore R$ is not reflexive.

Let $a = 2$ and $b = 9$, then $b^3 = 729$

Here, $a < b^3$

$\therefore (a, b) \in R$

Consider, $a^3 = 8$

Here, $b \not< a^3$

$\therefore (b, a) \notin R$

$\therefore R$ is not symmetric.

Let $a = 10$, $b = 3$, $c = 2$,

then $b^3 = 27$ and $c^3 = 8$

Here, $a < b^3$ and $b < c^3$.

$\therefore (a, b)$ and $(b, c) \in R$

But $a \not< c^3$

$\therefore (a, c) \notin R$.

$\therefore R$ is not transitive.



Maharashtra Board Solutions

Class 11 Arts & Science Maths

(Part 2)

- Chapter 1- Complex Numbers
- Chapter 2- Sequences and Series
- Chapter 3- Permutations and Combination
- Chapter 4- Methods of Induction and Binomial Theorem
- Chapter 5- Sets and Relations
- Chapter 6- Functions
- Chapter 7- Limits
- Chapter 8- Continuity
- Chapter 9- Differentiation

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About About Maharashtra State Board (MSBSHSE)

The Maharashtra State Board of Secondary and Higher Secondary Education or MSBSHSE (Marathi: महाराष्ट्र राज्य माध्यमिक आणि उच्च माध्यमिक शिक्षण मंडळ), is an **autonomous and statutory body established in 1965**. The board was amended in the year 1977 under the provisions of the Maharashtra Act No. 41 of 1965.

The Maharashtra State Board of Secondary & Higher Secondary Education (MSBSHSE), Pune is an independent body of the Maharashtra Government. There are more than 1.4 million students that appear in the examination every year. The Maha State Board conducts the board examination twice a year. This board conducts the examination for SSC and HSC.

The Maharashtra government established the Maharashtra State Bureau of Textbook Production and Curriculum Research, also commonly referred to as Ebalbharati, in 1967 to take up the responsibility of providing quality textbooks to students from all classes studying under the Maharashtra State Board. MSBHSE prepares and updates the curriculum to provide holistic development for students. It is designed to tackle the difficulty in understanding the concepts with simple language with simple illustrations. Every year around 10 lakh students are enrolled in schools that are affiliated with the Maharashtra State Board.

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FAQs

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As of now, the MSCERT and Balbharti are responsible for the syllabus and textbooks of Classes 1 to 8, while Classes 9 and 10 are under the Maharashtra State Board of Secondary and Higher Secondary Education (MSBSHSE).

How many state boards are there in Maharashtra?

The Maharashtra State Board of Secondary & Higher Secondary Education, conducts the HSC and SSC Examinations in the state of Maharashtra through its nine Divisional Boards located at Pune, Mumbai, Aurangabad, Nasik, Kolhapur, Amravati, Latur, Nagpur and Ratnagiri.

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