

Unit 3 (All Exercises)

Exercise 3.1

(15)

QNo: 1 Write in set builder notation

- (i) $\{1, 4, 9, 16, 25, 36, \dots, 484\}$
 $= \{x | x = n^2, n \in \mathbb{N}, 1 \leq n \leq 22\}$
- (ii) $\{2, 4, 8, 16, \dots, 256\}$
 $= \{x | x = 2^n, n \in \mathbb{N}, 1 \leq n \leq 8\}$
- (iii) $\{0, \pm 1, \pm 2, \pm 3, \dots, \pm 1000\}$
 $= \{x | x \in \mathbb{Z}, -1000 \leq x \leq 1000\}$
- (iv) $\{6, 12, 18, \dots, 120\}$
 $= \{x | x = 6n, n \in \mathbb{N}, 1 \leq n \leq 20\}$
- (v) $\{100, 102, 104, \dots, 400\}$
 $= \{x | x = 100 + 2n, n \in \mathbb{W}, 0 \leq n \leq 150\}$
- (vi) $\{1, 3, 9, 27, 81, \dots\}$
 $= \{x | x = 3^n, n \in \mathbb{W}\}$
- (vii) $\{1, 2, 4, 5, 10, 20, 25, 50, 100\}$
 $= \{x | x \text{ is divisor of } 100\}$
- (viii) $\{5, 10, 15, \dots, 100\}$
 $= \{x | x = 5n, n \in \mathbb{N}, 1 \leq n \leq 20\}$

QNo: 2 Write in tabular form

- (i) $\{x | x \text{ is a multiple of } 3, x \leq 36\}$
 $= \{3, 6, 9, 12, \dots, 36\}$
- (ii) $\{x | x \in \mathbb{P}, x < 12\}$
 $= \{2, 3, 5, 7, 11\}$
- (iii) $\{x | x \in \mathbb{R}, 2x + 1 = 0\}$
 $= \{-\frac{1}{2}\}$
- (iv) $\{x | x \text{ is a divisor of } 128\}$
 $= \{1, 2, 4, 8, 16, 32, 64, 128\}$

Set of Natural = $\mathbb{N} = \{1, 2, 3, \dots\}$
 "Whole" = $\mathbb{W} = \{0, 1, 2, 3, \dots\}$
 "Integers" = $\mathbb{Z} = \{0, \pm 1, \pm 2, \pm 3, \dots\}$
 "Odd" = $\mathbb{O} = \{\pm 1, \pm 3, \pm 5, \dots\}$
 "Even" = $\mathbb{E} = \{0, \pm 2, \pm 4, \pm 6, \dots\}$
 "Prime" = $\mathbb{P} = \{2, 3, 5, 7, 11, \dots\}$
 "Rational" = $\mathbb{Q} = \{x | x = p/q, \text{ where } p, q \in \mathbb{Z}, q \neq 0\}$
 "Irrational" = $\mathbb{Q}' = \{x | x \neq p/q, \text{ where } p, q \in \mathbb{Z}, q \neq 0\}$
 "Set of all Real numbers" = $\mathbb{R} = \mathbb{Q} \cup \mathbb{Q}'$

- (v) $\{x | x = 2^n, n \in \mathbb{N}, n < 8\}$
 $= \{2, 4, 8, 16, 32, 64, 128\}$
- (vi) $\{x | x \in \mathbb{N}, x + 4 = 0\}$
 $= \{\}$
- (vii) $\{x | x \in \mathbb{N}, x = x\}$
 $= \{1, 2, 3, 4, \dots\}$
- (viii) $\{x | x \in \mathbb{Z}, 3x + 1 = 0\}$
 $= \{\}$

QNo: 3 Write two proper subset

- (i) $\{a, b, c\}$
 Two proper subset = $\{a\}, \{b\}$
- (ii) $\{0, 1\}$
 Two proper subset = $\{0\}, \{1\}$
- (iii) $\mathbb{N} = \{1, 2, 3, \dots\}$
 Two proper subset = $\{1\}, \{2\}$
- (iv) $\mathbb{Z} = \{0, \pm 1, \pm 2, \dots\}$
 Two proper subset = $\{0\}, \{+1\}$

(v) $Q = \{x | x = p/q, q \neq 0\}$

Two proper subset = $\{1\}, \{2\}$

(vi) $R = Q \cup Q'$

Two proper sub-set = $\{1\}, \{2\} \dots$

(vii) $\{x | x \in Q \wedge 0 < x \leq 2\}$

Two proper sub-set = $\{1\}, \{1/2\} \dots$

QNo: 4 کیا کوئی ایسا سیٹ ہے جس کا کوئی

واجبہ تحتہ نہیں ہے۔
Is there any set which has no proper subset

جی ہاں خالی سیٹ ایسا سیٹ ہے جس کا کوئی واجبہ

تحتی سیٹ نہیں ہے۔
Yes $\{\}$ or ϕ

QNo: 5 $\{a, b\}$ اور $\{a, b\}$ میں فرق کیا ہے

$\{a, b\} =$ ایک سیٹ ہے جس کے رکن a اور b ہیں

A set containing two elements a & b .

$\{ \{a, b\} \} =$ ایک سیٹ ہے جس کا رکن $\{a, b\}$ ہے۔

A set containing one element $\{a, b\}$

QNo: 6 ان سیٹوں کے پاور سیٹ میں ارکان

کو تعداد کتنی ہو گئے؟
What is no of elements of power set of following

i) $\{\}$ $n=0$
پاور سیٹ کے ارکان کی تعداد $= 2^n = 2^0 = 1$

ii) $\{0, 1\}$ $n=2$
پاور سیٹ کے ارکان کی تعداد $= 2^n = 2^2 = 4$

iii) $\{1, 2, 3, 4, 5, 6, 7\}$ $n=7$
پاور سیٹ کے ارکان کی تعداد $= 2^n = 2^7 = 128$

iv) $\{0, 1, 2, 3, 4, 5, 6, 7\}$ $n=8$
پاور سیٹ کے ارکان کی تعداد $= 2^n = 2^8 = 256$

v) $\{a, \{b, c\}\}$ $n=2$
پاور سیٹ کے ارکان کی تعداد $= 2^n = 2^2 = 4$

vi) $\{\{a, b\}, \{b, c\}, \{d, e\}\}$ $n=3$
پاور سیٹ کے ارکان کی تعداد $= 2^n = 2^3 = 8$

QNo: 7 پاور سیٹ لکھیں

i) Let $A = \{9, 11\}$ $n=2$, تعداد $= 2^n = 2^2 = 4$

$P(A) = \{\phi, \{9\}, \{11\}, \{9, 11\}\}$

16

ii) Let $A = \{+, -, \times, \div\}$

$n=4$ تعداد $= 2^n = 2^4 = 16$

$P(A) = \{\phi, \{+\}, \{-\}, \{\times\}, \{\div\}, \{+, -\}, \{+, \times\}, \{+, \div\}, \{-, \times\}, \{-, \div\}, \{\times, \div\}, \{+, -, \times\}, \{+, -, \div\}, \{+, \times, \div\}, \{-, \times, \div\}, \{+, -, \times, \div\}\}$

iii) Let $A = \{\phi\}$ $n=1$ تعداد $= 2^n = 2^1 = 2$

$P(A) = \{\phi, \{\phi\}\}$

iv) Let $A = \{a, \{b, c\}\}$ $n=2$ تعداد $= 2^n = 2^2 = 4$

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

Exercise 3.2

QNo: 1 کے اضعاف

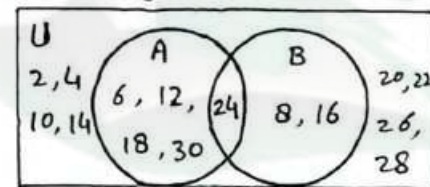
$U = \{x: x \text{ is multiple of } 2 \text{ \& } 0 < x \leq 30\}$
 $= \{2, 4, 6, \dots, 30\}$

i) $A = \{x: x \text{ is multiple of } 6\}$ کے اضعاف
 $= \{6, 12, 18, 24, 30\}$

$B = \{x: x \text{ is multiple of } 8\}$ کے اضعاف
 $= \{8, 16, 24\}$

ii) $A \cap B = \{6, 12, 18, 24, 30\} \cap \{8, 16, 24\}$
 $= \{24\}$

iii) Venn Diagram



QNo: 2 صحیح عدد

$U = \{x: x \text{ is an integer and } 0 < x \leq 150\}$
 $= \{1, 2, 3, \dots, 150\}$

$G = \{x: x = 2^m \text{ for integers \& } 0 \leq m \leq 12\}$
 $= \{1, 2, 4, 8, 16, 32, 64, 128\}$

$H = \{x: x \text{ is a square}\}$ x ایک مربع ہے
 $= \{1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144\}$

ii) $G \cup H = \{1, 2, 4, 8, 16, 32, 64, 128\} \cup \{1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144\}$
 $= \{1, 2, 4, 8, 9, 16, 25, 32, 36, 49, 64, 81, 100, 121, 128, 144\}$

$$(iii) G \cap H = \{1, 2, 4, 8, 16, 32, 64, 128\} \cap \{1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144\}$$

$$= \{1, 4, 16, 64\}$$

QNo: 3 مفرد و مرکب

$$P = \{x: x \text{ is a prime number } \& 0 < x \leq 20\}$$

$$= \{2, 3, 5, 7, 11, 13, 17, 19\}$$

$$Q = \{x: x \text{ is a divisor of } 210 \& 0 < x \leq 20\}$$

$$= \{1, 2, 3, 5, 6, 7, 10, 14, 15\}$$

$$i) P \cap Q = \{2, 3, 5, 7, 11, 13, 17, 19\} \cap \{1, 2, 3, 5, 6, 7, 10, 14, 15\}$$

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

$$ii) P \cup Q = \{2, 3, 5, 7, 11, 13, 17, 19\} \cup \{1, 2, 3, 5, 6, 7, 10, 14, 15\}$$

$$= \{1, 2, 3, 5, 6, 7, 10, 11, 13, 14, 15, 17, 19\}$$

QNo: 4 یونین اور تقاطع کی خاصیت مبادی کی تصدیق

Verify Commutative property of Union & intersection. $A \cup B = B \cup A$ & $A \cap B = B \cap A$

$$i) A = \{1, 2, 3, 4, 5\}, B = \{4, 6, 8, 10\}$$

$$A \cup B = \{1, 2, 3, 4, 5\} \cup \{4, 6, 8, 10\}$$

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

$$B \cup A = \{4, 6, 8, 10\} \cup \{1, 2, 3, 4, 5\}$$

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

Hence proved $A \cup B = B \cup A$ پس ثابت ہوا

$$A \cap B = \{1, 2, 3, 4, 5\} \cap \{4, 6, 8, 10\}$$

$$= \{4\}$$

$$B \cap A = \{4, 6, 8, 10\} \cap \{1, 2, 3, 4, 5\}$$

$$= \{4\}$$

Hence proved that $A \cap B = B \cap A$ پس ثابت ہوا

$$ii) N = \{1, 2, 3, 4, \dots\}$$

$$Z = \{0, \pm 1, \pm 2, \pm 3, \dots\}$$

$$N \cup Z = \{1, 2, 3, \dots\} \cup \{0, \pm 1, \pm 2, \dots\}$$

$$= \{0, \pm 1, \pm 2, \dots\}$$

$$Z \cup N = \{0, \pm 1, \pm 2, \dots\} \cup \{1, 2, 3, \dots\}$$

$$= \{0, \pm 1, \pm 2, \dots\}$$

Hence proved that $N \cup Z = Z \cup N$ پس ثابت ہوا

mn*Q 24/03/2025

17

$$(iii) A = \{x | x \in R, x \geq 0\}, B = R$$

$$= \{R \geq 0\}$$

$$ii) A \cup B = B \cup A$$

$$\{R \geq 0\} \cup R = R \cup \{R \geq 0\}$$

$$R = R \quad (\text{proved})$$

$$iii) A \cap B = B \cap A$$

$$\{R \geq 0\} \cap R = R \cap \{R \geq 0\}$$

$$R \geq 0 = R \geq 0$$

LHS = RHS
(Proved)

QNo: 5 دی مارجن کے قوانین کے پڑا ل کر

$$U = \{a, b, c, d, e, f, g, h, i, j\}$$

$$A = \{a, b, c, d, g, h\}, B = \{c, d, e, f, j\}$$

De Morgan's laws

$$i) (A \cup B)' = A' \cap B' \quad ii) (A \cap B)' = A' \cup B'$$

$$A \cup B = \{a, b, c, d, g, h\} \cup \{c, d, e, f, j\}$$

$$= \{a, b, c, d, e, f, g, h, j\}$$

$$(A \cup B)' = U - (A \cup B)$$

$$= \{a, b, c, d, e, f, g, h, j\} - \{a, b, c, d, e, f, g, h, j\}$$

$$= \{i\} \longrightarrow i)$$

$$A' = U - A = \{a, b, c, d, e, f, g, h, i, j\} - \{a, b, c, d, g, h\}$$

$$= \{e, f, i, j\}$$

$$B' = U - B = \{a, b, c, d, e, f, g, h, i, j\} - \{c, d, e, f, j\}$$

$$= \{a, b, g, h, i\}$$

$$A' \cap B' = \{e, f, i, j\} \cap \{a, b, g, h, i\}$$

$$= \{i\} \longrightarrow ii)$$

From (i) & (ii)

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

$$A \cap B = \{a, b, c, d, g, h\} \cap \{c, d, e, f, j\}$$

$$= \{c, d\}$$

$$(A \cap B)' = U - (A \cap B)$$

$$= \{a, b, c, d, e, f, g, h, i, j\} - \{c, d\}$$

$$= \{a, b, e, f, g, h, i, j\} \longrightarrow iii)$$

$$A' = U - A = \{a, b, c, d, e, f, g, h, i, j\} - \{a, b, c, d, g, h\}$$

$$= \{e, f, i, j\}$$

$$B' = U - B = \{a, b, c, d, e, f, g, h, i, j\} - \{c, d, e, f, j\}$$

$$= \{a, b, g, h, i\}$$

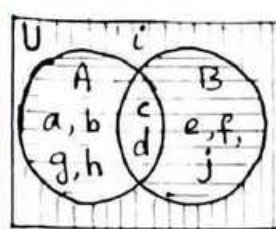
$$A' \cup B' = \{e, f, i, j\} \cup \{a, b, g, h, i\}$$

$$= \{a, b, e, f, g, h, i, j\} \longrightarrow iv)$$

From (iii) & (iv)

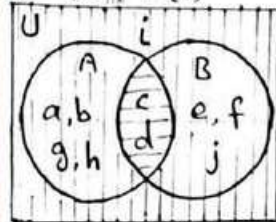
$$(A \cap B)' = A' \cup B'$$

500 ایمپلائرز کے گروپ میں 250 اردو، 150 انگریز اور 50 پنجابی بول سکتے ہیں۔ 40 ایمپلائرز دونوں اردو اور انگریز، 30 انگریز اور پنجابی اور 10 اردو اور پنجابی بول سکتے ہیں۔ بتائیں کتنے تینوں زبانیں بول سکتے ہیں۔



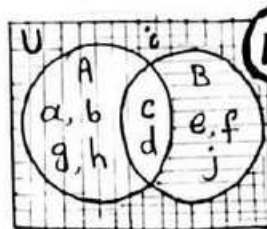
$$A \cup B = \{a, b, c, d, e, f, g, h, j\}$$

$$(A \cup B)' = \{i\}$$



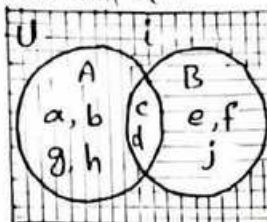
$$A \cap B = \{c, d\}$$

$$(A \cap B)' = \{a, b, c, d, e, f, g, h, j, i\}$$



$$A' = \{e, f, i, j, z\} \quad B' = \{a, b, g, h\}$$

$$A' \cap B' = \{i\}$$



$$A = \{a, b, c, d, e, f, g, h, j, z\} \quad B = \{a, b, g, h\}$$

$$A \cup B = \{a, b, c, d, e, f, g, h, j, z\}$$

$$n(U) = 500 \quad (\text{Speaking Urdu})$$

$$n(E) = 150 \quad (\text{English})$$

$$n(P) = 50 \quad (\text{Punjabi})$$

$$n(U \cap E) = 40 \quad (\text{Urdu \& Eng})$$

$$n(E \cap P) = 30 \quad (\text{Eng \& Punj})$$

$$n(U \cap P) = 10 \quad (\text{Urdu \& Punj})$$

$$n(U \cup E \cup P) = 500$$

$$n(U \cap E \cap P) = ?$$

$$n(U \cup E \cup P) = n(U) + n(E) + n(P) - n(U \cap E) - n(E \cap P) - n(U \cap P) + n(U \cap E \cap P)$$

$$500 = 250 + 150 + 50 - 40 - 30 - 10 + n(U \cap E \cap P)$$

$$500 = 450 - 80 + n(U \cap E \cap P)$$

$$500 = 370 + n(U \cap E \cap P)$$

$$n(U \cap E \cap P) = 500 - 370$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

$$= 130$$

QNo: 6

Verify

تصدیق کریں

$$U = \{1, 2, 3, \dots, 20\}, \quad A = \{1, 3, 5, \dots, 19\}$$

$$i) A \cup A' = U \quad ii) A \cap U = A \quad iii) A \cap A' = \emptyset$$

$$A' = U - A = \{1, 2, 3, \dots, 20\} - \{1, 3, 5, \dots, 19\}$$

$$= \{2, 4, 6, \dots, 20\}$$

$$A \cup A' = \{1, 3, 5, \dots, 19\} \cup \{2, 4, 6, \dots, 20\}$$

$$= \{1, 2, 3, 4, 5, 6, \dots, 20\}$$

$$= U \quad (\text{proved}) \quad LHS = RHS$$

$$ii) A \cap U = \{1, 3, 5, \dots, 19\} \cap \{1, 2, 3, \dots, 20\}$$

$$= \{1, 3, 5, \dots, 19\}$$

$$= A \quad (\text{proved}) \quad LHS = RHS$$

$$iii) A' = U - A = \{1, 2, 3, \dots, 20\} - \{1, 3, 5, \dots, 19\}$$

$$= \{2, 4, 6, \dots, 20\}$$

$$A \cap A' = \{1, 3, 5, \dots, 19\} \cap \{2, 4, 6, \dots, 20\}$$

$$= \{\} = \emptyset \quad (\text{proved})$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

$$LHS = RHS$$

QNo: 7

55 طلباء کے کلاس میں 34 طالب علم کرکٹ کھیلتے ہیں۔ 30 طلباء ہاکی کھیلتے ہیں۔ 9 طلباء دونوں کھیل کھیلتے ہیں۔

Let playing (let playing) = n(C) = 34

cricket) = n(C) = 34

Playing hockey) = n(H) = 30

Total students) = n(CUH) = 55

Playing both games) = n(CNH) = ?

n(CUH) = n(C) + n(H) - n(CNH)

55 = 34 + 30 - n(CNH)

n(CNH) = 64 - 55

n(CNH) = 64 - 55

n(CNH) = 64 - 55

n(CNH) = 64 - 55

n(CNH) = 64 - 55

n(CNH) = 64 - 55

n(CNH) = 64 - 55

QNo: 9

کھیلوں کے مقابلے میں 19 لوگ نیلی شرٹس پہنتے ہیں۔ 15 سبز قمیضیں پہنتے ہیں۔ 3 نیلی اور سبز قمیضیں 4 نیلی اور سبز قمیضیں پہنتے ہیں اور 2 نیلی اور سبز قمیضیں پہنتے ہیں۔ نیلی یا سبز قمیض پہننے والے لوگوں کی کل تعداد 34 ہے۔ کتنے لوگ نیلی پہنتے ہیں؟

Blue shirt) = n(B) = 19

Green shirt) = n(G) = 15

Blue and Green) = n(BG) = 3

Blue and Green) = n(CNB) = 4

Blue and Green) = n(CNG) = 2

Blue and Green) = n(BUGUC) = 34

Blue and Green) = n(C) = ?

n(BUGUC) = n(B) + n(G) + n(C) - n(BG) - n(CNB) - n(CNG)

34 = 19 + 15 - 3 - 4 - 2 + n(C)

34 = 34 - 9 + n(C)

34 = 25 + n(C)

34 - 25 = n(C)

n(C) = 9

n(C) = 9

n(C) = 9

n(C) = 9

n(C) = 9

n(C) = 9

n(C) = 9

n(C) = 9

n(C) = 9

n(C) = 9

n(C) = 9

QNo:3 $g(x) = 3x + 2$ & $h(x) = x^2 + 1$

i) $g(x) = 3x + 2$
 $g(0) = 3(0) + 2$
 $= 0 + 2$
 $= 2$

ii) $g(x) = 3x + 2$
 $g(-3) = 3(-3) + 2$
 $= -9 + 2$
 $= -7$

iii) $g(x) = 3x + 2$
 $g(\frac{2}{3}) = 3(\frac{2}{3}) + 2$
 $= 2 + 2$
 $= 4$

iv) $h(x) = x^2 + 1$
 $h(1) = (1)^2 + 1$
 $= 1 + 1$
 $= 2$

v) $h(x) = x^2 + 1$
 $h(-4) = (-4)^2 + 1$
 $= 16 + 1$
 $= 17$

vi) $h(x) = x^2 + 1$
 $h(-\frac{1}{2}) = (-\frac{1}{2})^2 + 1$
 $= \frac{1}{4} + \frac{1}{1} = \frac{1+4}{4}$
 $= \frac{5}{4}$

QNo:4 $f(x) = ax + b + 1$ & $f(3) = 8$
 $f(6) = 14$

$f(3) = a(3) + b + 1$ & $f(6) = a(6) + b + 1$
 $8 = 3a + b + 1$ | $14 = 6a + b + 1$

$8 - 1 = 3a + b$ | $14 - 1 = 6a + b$

$3a + b = 7 \rightarrow$ (i) | $6a + b = 13 \rightarrow$ (ii)

Subtracting (i) from (ii) $\rightarrow$ (iii) $\rightarrow$ $3a = 6$

$6a + b = 13$

$3a + b = 7$

$3a = 6$

$a = \frac{6}{3}$

$a = 2$

کی قیمت مساوات (i) میں درج کرنے سے
 Putting value of a in eq (i)

$3a + b = 7$

$3(2) + b = 7$

$6 + b = 7$

$b = 7 - 6 = 1$

$b = 1$

QNo:5 $g(x) = ax + b + 5$ & $g(-1) = 0$
 $g(2) = 10$

$g(-1) = a(-1) + b + 5$

$0 = -a + b + 5$

$a - b = 5 \rightarrow$ (i)

$g(2) = a(2) + b + 5$

$10 = 2a + b + 5$

$10 - 5 = 2a + b$

$2a + b = 5 \rightarrow$ (ii)

مساوات (ii) میں (i) سے

$2a + b = 5$

$a - b = 5$

$3a = 10$

$a = \frac{10}{3}$

21

کی قیمت مساوات (i) میں درج کرنے سے

$a - b = 5$

$\frac{10}{3} - b = 5$

$\frac{10}{3} - 5 = b$

$b = \frac{10-15}{3}$

$b = -\frac{5}{3}$

QNo:6 $f(x) = 5x + 1$. $f(x) = 31, x = ?$

$31 = 5x + 1$

$31 - 1 = 5x$

$5x = 30$

$x = 30/5 = 6$

QNo:7 $f(x) = cx^2 + d$ & $f(1) = 6$
 $f(-2) = 10$

$f(1) = c(1)^2 + d$

$6 = c(1) + d$

$c + d = 6 \rightarrow$ (i)

$f(-2) = c(-2)^2 + d$

$10 = c(4) + d$

$4c + d = 10 \rightarrow$ (ii)

مساوات (ii) کو (i) میں سے ٹولین کرنے سے

$4c + d = 10$

$\pm c + d = \pm 6$

$3c = 4$

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

$c + d = 6$

$\frac{4}{3} + d = 6$

$d = 6 - \frac{4}{3}$

$d = \frac{18-4}{3}$

$d = \frac{14}{3}$

R. Exercise 3 اعادہ مشق

QNo:2 Set builder Notation میں لکھیں

i) $\{x | x = 2n, n \in \mathbb{N}\}$

$= \{2, 4, 6, 8, \dots\}$

$n = \mathbb{N} = 1, 2, 3, \dots$

$2n = 2, 4, 6, 8, \dots$

ii) $\{x | x = 2m + 1, m \in \mathbb{N}\}$

$= \{3, 5, 7, 9, 11, \dots\}$

$m = \mathbb{N} = 1, 2, 3, \dots$

$2m + 1 = 2 + 1 = 3$

$4 + 1 = 5$

$6 + 1 = 7, \dots$

iii) $\{x | x = 11n, n \in \mathbb{W}, n < 11\}$

$= \{0, 11, 22, 33, \dots, 110\}$

$n = 0, 1, 2, 3, \dots, 10$

$11n = 0, 11, 22, 33, \dots, 110$

iv) $\{x | x \in \mathbb{E}, 4 < x < 6\}$

$= \{\} \text{ or } \emptyset$

4 اور 6 کے درمیان کوئی جفت (Even) عدد نہیں ہے

v) $\{x | x \in \mathbb{O}, 5 \leq x < 7\}$

$= \{5\}$

5 یا 5 سے بڑے اور 7 سے چھوٹے طاق اعداد

vi) $\{x | x \in \mathbb{Q}, x^2 = 2\}$

$= \{\} = \emptyset$

ایسا ناطق عدد (Rational) جس کا مربع 2 ہو

vii) $\{x | x \in \mathbb{R}, x \notin \mathbb{Q}\}$

$= \mathbb{Q}$

Real no. حقیقی اعداد میں $\mathbb{Q}$ اور $\mathbb{Q}$ کا برعکس برعکس

viii) $\{x | x \in \mathbb{Q}, x = -x\}$

$= \{0\}$

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

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

i) $A' = U - A$

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

$$= \{1, 3, 5, 7, 9\}$$

ii) $B' = U - B$

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

$$= \{6, 7, 8, 9, 10\}$$

iii) $A \cup B = \{2, 4, 6, 8, 10\} \cup \{1, 2, 3, 4, 5\}$

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

iv) $A - B = \{2, 4, 6, 8, 10\} - \{1, 2, 3, 4, 5\}$

$$= \{6, 8, 10\}$$

v) $A \cap C = \{2, 4, 6, 8, 10\} \cap \{1, 3, 5, 7, 9\}$

$$= \{\}$$

vi) $A' \cap C' = ?$

$$A' = U - A = \{1, 2, 3, \dots, 10\} - \{2, 4, 6, 8, 10\}$$

$$= \{1, 3, 5, 7, 9\}$$

$$C' = U - C = \{1, 2, 3, \dots, 10\} - \{1, 3, 5, 7, 9\}$$

$$= \{2, 4, 6, 8, 10\}$$

$$A' \cap C' = \{1, 3, 5, 7, 9\} \cap \{2, 4, 6, 8, 10\}$$

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

vii) $A' \cup C = ?$

$$A' = U - A = \{1, 2, 3, \dots, 10\} - \{2, 4, 6, 8, 10\}$$

$$= \{1, 3, 5, 7, 9\}$$

$$A' \cup C = \{1, 3, 5, 7, 9\} \cup \{1, 3, 5, 7, 9\}$$

$$= \{1, 3, 5, 7, 9\}$$

viii) $U' = U - U$

$$= \{1, 2, 3, \dots, 10\} - \{1, 2, 3, \dots, 10\}$$

$$= \{\} = \phi$$

QNo:6 (a) $A = \{1, 2, 3, 4\}$, $B = \{3, 4, 5, 6, 7, 8\}$

$$C = \{5, 6, 7, 9, 10\}$$

Verify i) Associativity of union

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

$$\text{LHS} = A \cup (B \cap C)$$

$$= \{1, 2, 3, 4\} \cup (\{3, 4, 5, 6, 7, 8\} \cap \{5, 6, 7, 9, 10\})$$

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

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

22

$$\text{RHS} = (A \cup B) \cap C$$

$$= (\{1, 2, 3, 4\} \cup \{3, 4, 5, 6, 7, 8\}) \cap \{5, 6, 7, 9, 10\}$$

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

$$= \{5, 6, 7\}$$

$$\text{LHS} = \text{RHS}$$

ii) Associativity of intersection

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

$$\text{LHS} = A \cap (B \cap C)$$

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

$$= \{1, 2, 3, 4\} \cap \{5, 6, 7\}$$

$$= \{\}$$

$$\text{RHS} = (A \cap B) \cap C$$

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

$$= \{3, 4\} \cap \{5, 6, 7, 9, 10\}$$

$$= \{\}$$

$$\text{LHS} = \text{RHS}$$

iii) Distributivity of union over intersection

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

$$\text{LHS} = A \cup (B \cap C)$$

$$= \{1, 2, 3, 4\} \cup (\{3, 4, 5, 6, 7, 8\} \cap \{5, 6, 7, 9, 10\})$$

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

$$= \{1, 2, 3, 4, 5, 6, 7\}$$

$$\text{RHS} = (A \cup B) \cap (A \cup C)$$

$$= (\{1, 2, 3, 4\} \cup \{3, 4, 5, 6, 7, 8\}) \cap (\{1, 2, 3, 4\} \cup \{5, 6, 7, 9, 10\})$$

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

$$= \{1, 2, 3, 4, 5, 6, 7\}$$

$$\text{LHS} = \text{RHS}$$

iv) Distributivity of intersections over union.

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

$$\text{LHS} = A \cap (B \cup C)$$

$$= \{1, 2, 3, 4\} \cap (\{3, 4, 5, 6, 7, 8\} \cup \{5, 6, 7, 9, 10\})$$

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

$$= \{3, 4\}$$

$$\text{RHS} = (A \cap B) \cup (A \cap C)$$

$$= (\{1, 2, 3, 4\} \cap \{3, 4, 5, 6, 7, 8\}) \cup (\{1, 2, 3, 4\} \cap \{5, 6, 7, 9, 10\})$$

$$= \{3, 4\} \cup \{\}$$

$$= \{3, 4\}$$

$$\text{LHS} = \text{RHS}$$

$A = \phi, B = \{0\}, C = \{0, 1, 2\}$

i) Associativity of Union

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

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

$= \phi \cup (\{0\} \cap \{0, 1, 2\})$

$= \phi \cup \{0\}$

$= \{0, 1, 2\}$

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

$= (\phi \cup \{0\}) \cap \{0, 1, 2\}$

$= \{0\} \cap \{0, 1, 2\}$

$= \{0, 1, 2\}$

LHS = RHS

ii) Associativity of intersection

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

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

$= \phi \cap (\{0\} \cup \{0, 1, 2\})$

$= \phi \cap \{0\}$

$= \phi$

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

$= (\phi \cap \{0\}) \cup \{0, 1, 2\}$

$= \phi \cap \{0, 1, 2\}$

$= \phi$

LHS = RHS

iii) Distributivity of union over intersection

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

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

$= \phi \cup (\{0\} \cap \{0, 1, 2\})$

$= \phi \cup \{0\}$

$= \{0\}$

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

$= (\phi \cup \{0\}) \cap (\phi \cup \{0, 1, 2\})$

$= \{0\} \cap \{0, 1, 2\}$

$= \{0\}$

LHS = RHS

iv) Distributivity of intersection over Union

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

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

$= \phi \cap (\{0\} \cup \{0, 1, 2\})$

$= \phi \cap \{0, 1, 2\}$

$= \phi$

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

$= (\phi \cap \{0\}) \cup (\phi \cap \{0, 1, 2\})$

$= \phi \cup \phi$

$= \phi$

LHS = RHS

c) $A = N = \{1, 2, 3, \dots\}, B = Z = \{0, \pm 1, \pm 2, \pm 3, \dots\}$

$C = Q = \{x | x = \frac{p}{q}\}$

i) Associativity of Union

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

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

$= \{1, 2, 3, \dots\} \cup (\{0, \pm 1, \pm 2, \dots\} \cap Q)$

$= \{1, 2, 3, \dots\} \cup Q$

$= Q$

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

$= (N \cup Z) \cap Q$

$= N \cup Q$

$= Q$

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

$= (\{1, 2, 3, \dots\} \cup \{0, \pm 1, \pm 2, \dots\}) \cap Q$

$= \{0, \pm 1, \pm 2, \dots\} \cap Q$

$= Q$

LHS = RHS

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

$= (N \cup Z) \cap Q$

$= Z \cup Q$

$= Q$

23

ii) Associativity of intersection

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

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

$= N \cap (\{0\} \cup Q)$

$= N \cap Z$

$= N$

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

$= (N \cap \{0\}) \cap Q$

$= N \cap Q$

$= N$

LHS = RHS

iii) Distributivity of union over intersection

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

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

$= N \cup (\{0\} \cap Q)$

$= N \cup Z$

$= Z$

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

$= (N \cup \{0\}) \cap (N \cup Q)$

$= Z \cap Q$

$= Z$

LHS = RHS

iv) Distributivity of intersection over union

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

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

$= N \cap (\{0\} \cup Q)$

$= N \cap Q$

$= N$

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

$= (N \cap \{0\}) \cup (N \cap Q)$

$= N \cup N$

$= N$

LHS = RHS

QNo: 7 verify De Morgan's law

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

a) $A \cup B = \{2, 4, 6, \dots\} \cup \{1, 3, 5, \dots\} = \{1, 2, 3, \dots, 20\}$

$A = \{2, 4, 6, 8, \dots, 20\}$

$B = \{1, 3, 5, \dots, 19\}$

$(A \cup B)' = U - (A \cup B)$

$= \{1, 2, 3, \dots, 20\} - \{1, 2, 3, \dots, 20\}$

$= \{ \}$ $\rightarrow$ (i)

$A' = U - A = \{1, 2, 3, \dots, 20\} - \{2, 4, 6, \dots, 20\}$

$= \{1, 3, 5, \dots, 19\}$

$B' = U - B = \{1, 2, 3, \dots, 20\} - \{1, 3, 5, \dots, 19\}$

$= \{2, 4, 6, \dots, 20\}$

$A' \cap B' = \{1, 3, 5, \dots, 19\} \cap \{2, 4, 6, \dots, 20\}$

$= \{ \}$ $\rightarrow$ (ii)

From (i) & (ii) $(A \cup B)' = A' \cap B'$

b) $A \cap B = \{2, 4, 6, \dots, 20\} \cap \{1, 3, 5, \dots, 19\}$

$= \{ \}$

$(A \cap B)' = U - (A \cap B) = \{1, 2, 3, \dots, 20\} - \{ \}$

$= \{1, 2, 3, \dots, 20\}$ $\rightarrow$ (iii)

$A' = U - A = \{1, 2, 3, \dots, 20\} - \{2, 4, 6, \dots, 20\}$

$= \{1, 3, 5, \dots, 19\}$

$B' = U - B = \{1, 2, 3, \dots, 20\} - \{1, 3, 5, \dots, 19\}$

$= \{2, 4, 6, \dots, 20\}$

$A' \cup B' = \{1, 3, 5, \dots, 19\} \cup \{2, 4, 6, \dots, 20\}$

$= \{1, 2, 3, 4, \dots, 20\}$ $\rightarrow$ (iv)

From (iii) & (iv) $(A \cap B)' = A' \cup B'$

05/04/2025

QNo: 8 $P = \{x | x = 5m, m \in \mathbb{N}\}$ Final PnQ
 $= \{5, 10, 15, \dots\}$

$Q = \{x | x = 2m, m \in \mathbb{N}\} = \{2, 4, 6, \dots\}$

$P \cap Q = \{5, 10, 15, 20, 25, 30, \dots\} \cap \{2, 4, 6, 8, 10, 12, 14, 16, 18, 20, \dots\}$
 $= \{10, 20, 30, \dots\}$ (آخر میں) صفحہ 25 پر

QNo: 10 $g(x) = 7x - 2$ & $S(x) = 8x^2 - 3$

i) $g(x) = 7x - 2$
 $g(0) = 7(0) - 2$
 $= 0 - 2$
 $= -2$

ii) $g(x) = 7x - 2$
 $g(-1) = 7(-1) - 2$
 $= -7 - 2$
 $= -9$

iii) $g(x) = 7x - 2$
 $g(-\frac{5}{3}) = 7(-\frac{5}{3}) - 2$
 $= -\frac{35}{3} - \frac{2}{1}$
 $= -\frac{35-6}{3}$
 $= -\frac{41}{3}$

iv) $S(x) = 8x^2 - 3$
 $S(1) = 8(1)^2 - 3$
 $= 8(1) - 3$
 $= 8 - 3$
 $= 5$

v) $S(x) = 8x^2 - 3$
 $S(-9) = 8(-9)^2 - 3$
 $= 8(81) - 3$
 $= 648 - 3$
 $= 645$

vi) $S(x) = 8x^2 - 3$
 $S(\frac{7}{2}) = 8(\frac{7}{2})^2 - 3$
 $= 8(\frac{49}{4}) - 3$
 $= 98 - 3$
 $= 95$

QNo: 11 $f(x) = ax + b$; $f(-2) = 3$ & $f(4) = 10$

$f(x) = ax + b$
 $f(-2) = a(-2) + b$
 $3 = -2a + b$
 $-2a + b = 3 \rightarrow (i)$

$f(x) = ax + b$
 $f(4) = a(4) + b$
 $10 = 4a + b$
 $4a + b = 10 \rightarrow (ii)$

$4a + b = 10$
 $-2a + b = 3$
 $6a = 7$

$a = \frac{7}{6}$

$-2a + b = 3$
 $-2(\frac{7}{6}) + b = 3$
 $-\frac{7}{3} + b = 3$

$b = 3 + \frac{7}{3}$
 $= \frac{9+7}{3} = \frac{16}{3}$

$b = \frac{16}{3}$

QNo: 12 $K(x) = 7x - 5$ if $K(x) = 100$ $x = ?$

$K(x) = 7x - 5$
 $100 = 7x - 5$
 $100 + 5 = 7x$
 $105 = 7x$

$x = \frac{105}{7}$

$x = 15$

24 QNo: 13

$g(x) = mx^2 + n$ $m = ?$ $n = ?$

$g(x) = mx^2 + n$

$g(4) = 20$ & $g(0) = 5$

$g(4) = m(4)^2 + n$

$g(x) = mx^2 + n$

$g(0) = m(0)^2 + n$

$20 = m(16) + n$

$5 = 0 + n$

$16m + n = 20 \rightarrow (i)$

$n = 5$

ن کی قیمت مساوات (i) میں درج کرنے سے

$16m + n = 20$

$16m = 15$

$16m + 5 = 20$

$m = \frac{15}{16}$

QNo: 14

ایک شاپنگ مال میں 100 پروڈکٹس ہیں جو 1 سے 100 تک لیبل کیے گئے ہیں۔ ان میں سے 30 Electronics ہیں، 55 Clothes ہیں، 25 Beauty Products ہیں۔
 30 Electronics میں سے 10 Electronics اور 20 Clothes ہیں۔
 25 Beauty Products میں سے 10 Beauty Products اور 15 Clothes ہیں۔
 10 Electronics اور 10 Beauty Products اور 10 Clothes ہیں۔

Universal set = $U = \{1, 2, 3, \dots, 100\}$

Electronics = $A = \{1, 2, 3, \dots, 30\}$

Clothes = $B = \{31, 32, 33, \dots, 55\}$

Beauty Products = $C = \{76, 77, 78, \dots, 100\}$

$A \cup B \cup C = ?$

$A \cup B \cup C = \{1, 2, 3, \dots, 30\} \cup \{31, 32, 33, \dots, 55\} \cup \{76, 77, 78, \dots, 100\}$

$= \{1, 2, 3, \dots, 55, 76, 77, 78, \dots, 100\}$

$= \{1, 2, 3, \dots, 55, 76, 77, 78, \dots, 100\}$

$= \{1, 2, 3, \dots, 55, 76, 77, 78, \dots, 100\}$

QNo: 15

180 طلباء ہیں۔ 120 طالب علم میٹھ کر بیٹھیں گے۔ 90 طلباء ہیں۔ 50 طالب علم ہیں۔

نے دونوں میٹھ کر اور سائنس کے میٹھ کر پاس کیے۔

a) کتنے طالب علموں نے میٹھ کر سائنس کے میٹھ کر پاس کیے؟

b) کتنے طالب علموں نے دونوں میں سے کوئی بھی پاس نہیں کیا؟

c) کتنے طلباء نے سائنس میٹھ کر پاس کیا لیکن میٹھ کر پاس نہیں کیا؟

d) کتنے طلباء سائنس کے میٹھ کر پاس نہیں کیے؟

Total Stud. $n(U) = 180$

میٹھ کر میں پاس $n(M) = 120$

سائنس میں پاس $n(S) = 90$

میٹھ کر اور سائنس دونوں میں پاس $n(M \cap S) = 60$

میٹھ کر اور سائنس دونوں میں پاس $n(M \cup S) = ?$

$n(M \cup S) = ?$

$$n(MUS) = n(M) + n(S) - n(M \cap S)$$

$$= 120 + 90 - 60$$

$$= 150$$

b) $n(MUS) =$ جنہوں نے زبانوں میں سے کوئی بھی پاس نہیں کیا

$$n(MUS)' = n(U) - n(MUS)$$

$$= 180 - 150$$

c) $= 30$ جنہوں نے سائنس ٹیسٹ پاس کیا، جنہوں نے نہیں کیا؟

$$= n(S) - n(M \cap S)$$

$$= 90 - 60$$

$$= 30$$

d) $n(U) - n(S)$ سائنس میں فیل ہوئے

$$= 180 - 90$$

$$= 90$$

QNo: 16 ایک شہر کے سو فٹ وینٹر ہاؤس میں 300 لوگ رہتے ہیں۔ زیادہ تر زبانوں کی خبریں۔

$$n(U) = 300$$

$$Python = n(P) = 150$$

$$Java = n(J) = 130$$

$$PHP = n(PHP) = 120$$

$$Java, Python = n(P \cap J) = 70$$

$$PHP, Python = n(P \cap PHP) = 60$$

$$PHP, Java = n(J \cap PHP) = 50$$

$$Java, Python, PHP = n(J \cap P \cap PHP) = 40$$

a) $n(P \cup J \cup PHP) =$ جنہوں نے کم از کم ان میں سے ایک language پسند کیا

$$n(P \cup J \cup PHP) = n(P) + n(J) + n(PHP) -$$

$$n(P \cap J) - n(P \cap PHP) - n(J \cap PHP) + n(P \cap J \cap PHP)$$

$$= 150 + 130 + 120 - 70 - 60 - 50 + 40$$

$$= 440 - 180$$

$$= 260$$

b) $= ?$ جنہوں نے صرف ایک ہی زبان استعمال کی

$$n(P) - n(P \cap J) - n(P \cap PHP) + n(P \cap J \cap PHP)$$

$$= 150 - 70 - 60 + 40$$

$$= 190 - 130 = 60$$

$$n(J) - n(P \cap J) - n(J \cap PHP) + n(P \cap J \cap PHP)$$

$$= 130 - 70 - 50 + 40$$

$$= 170 - 120 = 50$$

$$n(PHP) - n(P \cap PHP) - n(J \cap PHP) + n(P \cap J \cap PHP)$$

$$= 120 - 50 - 60 + 40$$

$$= 160 - 110 = 50$$

Language استعمال کرنے والے = $60 + 50 + 50$

$$= 160$$

c) $n(P \cup J \cup PHP)$ جنہوں نے ان میں سے کوئی بھی زبان استعمال نہیں کیا

$$n(P \cup J \cup PHP)' = n(U) - n(P \cup J \cup PHP)$$

$$= 300 - 260$$

$$= 40$$

d) $= ?$ صرف PHP استعمال کرنے والے

$$= n(PHP) - n(P \cap PHP) - n(J \cap PHP) + n(P \cap J \cap PHP)$$

$$= 120 - 50 - 60 + 40$$

$$= 160 - 110 = 50$$

QNo: 9 i) $A \cap (A \cup B) = A \cup (A \cap B)$

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

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

$$= RHS$$

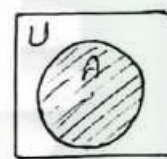
$$ii) A \cup (A \cap B) = A \cap (A \cup B)$$

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

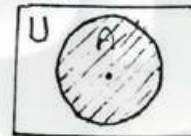
$$= A \cap (A \cup B) \because A \cup A = A$$

$$= RHS$$

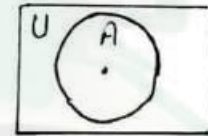
QNo: 4



$$(i) A' = \text{shaded region outside A} \quad (ii) A \cap U = A \quad (iii) A \cup U = U$$

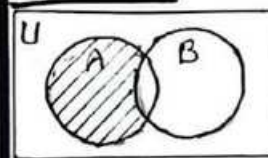


$$(iv) A \cup \phi$$

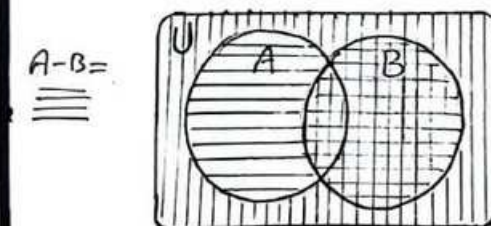
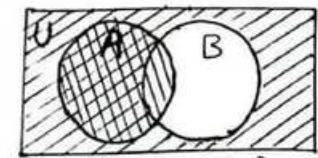


$$\phi \cap \phi$$

QNo: 5



$$i) A - B \quad (A - B \neq A \cap B') \quad B' = \text{shaded region outside B} \quad A \cup B' = \text{shaded region outside B}$$



$$(A - B)' = \text{shaded region outside A-B} \quad (A - B)' \cap B = \text{shaded region outside A-B} = B$$

m*
05/04/25