MATHS

NCERT - NCERT MATHEMATICS (ENGLISH)

SETS

Miscellaneous Exercise

1. In a survey of 60 persons, it is found that 25 read newspaper H, 26 read T, 26 read I, 9 read

H and I, 11 and H and T,8 read T and I and 3 read all three newspaper. Find :

(a) No. of persons who read atleast one newspaper.

(b) No. of persons who read exactly one newspaper.

2. Find sets A, B and C such that $A \cap B$, $A \cap C$ and $B \cap C$ are non empty sets and $A \cap B \cap C = \varphi$.

3. In a survey of 600 students in a school, 150 students were found to be taking tea and 225 taking coffee, 100 were taking both tea and coffee. Find how many students were taking neither tea nor coffee?

4. Show that $A \cap B = A \cap C$ need not imply $B = C$.

5. Let A and B be sets. If $A \cap X = B \cap X = \varphi$ and $A \cup X = B \cup X$ for some set X, show that $A = B$.(Hints $A = A \cap (A \cup X), B = B \cap (B \cup X)$ and use Distributive law)

6. In a group of students, 100 students know Hindi, 50 know English and 25 know both. Each of the students knows either Hindi or English. How many students are there in the group?

7. Using properties of sets, show that(i) $A \cup (A \cap B) = A$ (ii) $A \cap (A \cup B) = A$.

8. Show that for any sets A and B,

$$A = (A \cap B) \cup (A - B) \text{and}$$

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

9. Decide, among the following sets, which sets are subsets of one and another:

$$A = \{x : x \in R \text{ and } x^2 - 8x + 12 = 0\}, \text{ `B =}$$

{ 2, 4, 6 }, C = { 2, 4, 6. 8 ......}

10. Let A, B and C be three sets such that $A \cup B = A \cup C$ and $A \cap B = A \cap C$. Show that B = C.

11. In each of the following, determine whether the statement is true or false. If it is true, prove it. If it is false, give an example.(i) $If x \in A and A \in B, then x \in B$ (ii) If $A \subset B$ and $B \in C$ then $A \in C$

12. Show that if $A \subset B$, then $C - B \subset C - A$

.

13. Show that the following four conditions are equivalent:(i)$A \subset B$ (ii) $AB = \varphi$ (iii) $A \cup B = B$ (iv) $A \cap B = A$

14. Is it true that for any sets A and B, $P(A) \cup P(B) = P(A \cup B)$? Justify your answer.

15. Assume that $P(A) = P(B)$. Show that $A = B$

16. In a survey it was found that 21 people liked product A, 26 liked product B and 29 liked product C. If 14 people liked products A and B, 12 people liked products C and A, 14 people liked products B and C and 8 liked all the three products. Find how many liked product C only.

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Solved Examples

1. For any sets A and B. show that $P(A \cap B) = P(A) \cap P(B).$

2. Show that $A \cap B = A \cup B$ implies $A = B$

3. Out of 500 car owners investigated, 400 owned car A and 200 owned car B, 50 owned

both A and B cars. Is this data correct?

4. A market research group conducted a survey of 2000 consumers and reported that 1720 consumers liked product P_1 and 1450 consumers like product P_2. What is the least number that must have liked both the products?

5. A college warded 38 medals in football, 15 in basketball and 20 in cricket. If these medals went to a total of 58 men and only three men got medals in all the three sports, how many received medals in exactly two of the three sports?

6. Write the solution set of the equation $x^2 + x - 2 = 0$ in roster form.

A. $\{-1, -2\}$

B. $\{1, 2\}$

C. $\{1, -2\}$

D. $\{-1, 2\}$

Answer: C

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7. Write the set

$$\left\{x : x\ is\ a\ positive\int e \geq r\ and\ x^2 < 40\right\} in \quad the$$

roster form.

8. Write the set $A = \{1, 4, 9, 16, 25, :\}$ in setbuilder form.

9. Write the set $\{\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}, \frac{6}{7}\}$ in the setbuilder form.

10. Match each of the set on the left described in the roster form with the same set on the light described in the setbuilder form :(i) $\{P, R, I, N, C, A, L\}$(a) { x : x is a positive integer and is a divisor of 18}(ii) `{ 0

11. If $A \times B = \{(p, q), (p, r), (m, q), (m, r)\}$, Find A and B

12. Find the pairs of equal sets, if any, give reasons:$A = \{0\}$,

$B = \{x : x > 15 and x < 5\}$,

$C = \{x : x5 = 0\}, D = \{x : x^2 = 25\}$, `E = {x :

$x\ i\ s\ a\ n\ i\ n\ t\ egr\ a\ l\ pos\ i\ t\ i\ v\ e$

13. Which of the following pairs of sets are equal? Justify your answer.(i)X, the set of

letters in "ALLOY" and B, the set of letters in "LOYAL".(ii)A = {n : n∈ Z and n2≤ 4} and B = {x : x∈ R and x2 – 3x + 2 = 0}

14. Consider the sets $\varphi, A = \{1, 3\}$, $B = \{1, 5, 9\}, C = \{1, 3, 5, 7, 9\}$Insert the symbol $\subset$ or between each of the following pair of sets : (i) $\varphi \vdots B$ (ii) `A dot dot dot

15. Let $A = \{a, e, i, o, u\}$ and $B = \{a, i, u\}$.

Show that $A \cup B = A$

16. Let $A = \{2, 4, 6, 8\}$ and $B = \{6, 8, 10, 12\}$.

Find $A \cup B$.

17. Let A, B and C be three sets. If $A \in B$ and $B \subset C$. is it true that $A \subset C$? If not give an example.

18. Let $A = \{a, e, i, o, u\}$ and $B = \{a, b, c, d\}$. Is A a subset of B? No.(Why?). Is B a subset of A? No. (Why?)

19. let $f(x) = \sqrt{x}$ and $g(x) = x$ be function defined over the set of non negative real numbers . find $(f+g)(x)$, $(f-g)(x)$, $(fg)(x)$ and $(f/g)(x)$.

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20. Consider the sets X and Y of Example 14.

Find $X \cap Y$

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21. Consider the sets A and B of Example 12. Find $A \cap B$.

22. Let X = {Rani, Geeta, Akbar} be the set of students of Class XI who are in school hockey team. Let Y = {Geeta, David, Ashok} be the set of students from Class XI who are in the school football team. Find X ∪ Y and interpret the set

23. Let $V = \{a, e, i, o, u\}$ and $B = \{a, i, k, u\}$. Find $V - B$ and $B - V$

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24. Let $A = \{1, 2, 3, 4, 5, 6\}$, $B = \{2, 4, 6, 8\}$. Find $A - B$ and $B - A$.

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25. Show that the set of letters needed to spell "CATARACT" and the set of letters needed to spell "TRACT" are equal.

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26. List all the subsets of the set $\{1, 0, 1\}$.

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27. In a survey of 400 students in a school, 100 were listed as taking apple juice, 150 as taking

orange juice and 75 were listed as taking both apple as well as orange juice. Find how many students were taking neither apple juice nor orange juice.

28. There are 200 individuals with a skin disorder, 120 had been exposed to the chemical C_1? 50 to chemical C_2, and 30 to both the chemicals C_1 and C_2. Find the

number of individuals exposed to(i) Chemical C_1but not chemical C_2

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29. In a school there are 20 teachers who teach mathematics or physics. Of these, 12 teach mathematics and 4 teach both physics and mathematics. How many teach physics?

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30. In a class of 35 students, 24 like to play cricket and 16 like to play football. Also, each student likes to play at least one of the two games. How many students like to play both cricket and football?

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31. Let $U = \{1, 2, 3, 4, 5, 6\}$, $A = \{2, 3\}$and $B = \{3, 4, 5\}$Find A', B', $A' \cap B'$, $A \cup B$ and hence show that $(A \cup B)' = A' \cap B'$..

32. If X and Y are two sets such that X ∪ Y has 50 elements, X has 28 elements and Y has 32 elements, how many elements does X ∩ Y have?

33. Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ and $A = \{1, 3, 5, 7, 9\}$. Find A'.

34. Let u be universal set of all the students of Class XI of a coeducational school and A be the set of all girls in Class XI. Find A'.

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Exercise 1 3

1. Given the sets $A = \{1, 3, 5\}$, $B = \{2, 4, 6\}$ and $C = \{0, 2, 4, 6, 8\}$, which of the following

may be considered as universal set (s) for all the three sets A, B and C (i) $\{0, 1, 2, 3, 4, 5, 6\}$

(ii) ϕ (iii) {0,1,2,3,4,5,6,7,8,9,10} (iv) {1,2,3,4,5,6,7,8}`

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2. What universal set(s) would you propose for each of the following :(i) The set of right triangles. (ii) The set of isosceles triangles.

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3. Make correct statements by filling m the symbols ⊂ or ⊄ in the blank spaces :

(i) $\{2, 3, 4\}$. . . $\{1, 2, 3, 4, 5\}$

(ii) $\{a, b, c\}$. . . $\{b, c, d\}$

(iii) {x: x is a student of Class XI of your school}. . . {x : x student of your school}

(iv) {x : x is a circle in the plane} . . .{x : x is a circle in the same plane with radius 1 unit}

(v) {x : x is a triangle in a plane} . . . {x : x is a rectangle in the plane}

(vi) { x : x is an equilateral triangle in a plane} . . . { x : x is a triangle in the same plane}

(vii) {x : x is an even natural number} . . . {x : x is an integer}

4. Let $A = \{1, 2, \{3, 4\}, 5\}$. Which of the following statements are incorrect and why?(i) $\{3, 4\} \subset A$ (ii) $\{3, 4\} \in A$ (iii) $\{\{3, 4\}\} \subset A$ (iv) $1 \in A$ (v) $1 \subset A$ (vi)$\{1, 2, 5\} \subset A$ (vii) $\{1, 2, 5\} \in A$ (viii) $\{1, 2, 3\} \subset A$ (ix) $\varphi \in A$ (x) $\varphi \subset A$ (xi) $\{\varphi\} \subset A$

5. Examine whether the following statements are true or false:

(i) { a, b } ⊄ { b , c, a }

(ii) { a , e } ⊂ { x : x is a vowel in the English alphabet}

(iii) { 1, 2, 3 } ⊂ { 1, 3, 5 }

(iv) { a }⊂ { a, b, c }

(v) { a }∈ { a , b, c }

(vi) { x : x is an even natural number less than 6} ⊂ { x : x is a natural number which divides 36}

6. When $A = \phi$, the number of elements in $P(A)$ is . . . .

7. Write down all the subsets of the following sets (i) $\{a\}$ (ii) $\{a, b\}$ (iii) $\{1, 2, 3\}$ (iv) φ

8. Write the following intervals in set builder form:(i) $(3, 0)$ (ii) $[6, 12]$ (iii) $(6, 12]$ (iv) $[23, 5)$

9. Write the following as intervals : (i) $\{x : x \in R, 4 < x \leq 6\}$(ii) $\{x : x \in R, 10 < x < 12\}$(iii) $\{x : x \in R, 0 \leq x < 7\}$ (iv) $\{x : x \in R, 3 \leq x \leq 4\}$

1. Match each of the set on the left in the roster form with the same set on the right described in set builder form:

(i) $\{1, 2, 3, 6\}$ (a) {x : x is a prime number and a divisor of 6}

(ii) $\{2, 3\}$ (b) {x : x is an odd natural number less than 10}

(iii) {M,A,T,H,E,I,C,S} (c) {x : x is natural number and divisor of 6}

(iv) {1, 3, 5, 7, 9} (d) {x : x is a letter of the word

MATHEMATICS}.

2. List all the elements of the following sets :

(i) A = {x : x is an odd natural number}

(ii) B = {x : x is an integer, x lies b/w -1/2 and 9/2

}

(iii) C{x :x is an integer, $x^2 \leq 4$}

(iv) D={x: x is a letter in the word loyal}

(v) E= {x: x is a month of a year not having 31

days}

(vi) F = {x : x is a consonant in the English alphabet which precedes k }.

3. Write the following sets m the setbuilder form:(i) $(3, 6, 9, 12\}$ (ii) $\{2, 4, 8, 16, 32\}$ (iii) $\{5, 25, 125, 625\}$ (iv) $\{2, 4, 6, ...\}$ (v) $\{1, 4, 9, ..., 100\}$

4. Write the following sets in roster form:

(i) A = {x : x is an integer and $3 < x < 7$}

(ii) B = {x : x is a natural number less than 6}

(iii) C = {x: x is a two digit natural number such that the sum of its digits is 1

(iv) D = {x : x is a prime number which is divisor of 60}

(v) E = The set of all letters in the word TRIGONOMETRY

(vi) F = The set of all letters in the word BETTER

5. Let $A = \{1, 2, 3, 4, 5, 6\}$. Insert the appropriate symbol $\in$ or $\notin$ in the blank spaces:(i) $5...\dot{A}$ (ii) $8...A$ (iii) $0...\dot{A}$(iv) $4..\dot{A}$ (v) $2...\dot{A}$ (vi) `10... A

6. Which of the following are sets? Justify your answer.

(i) The collection of all the months of a year beginning with the letter J.

(ii) The collection of ten most talented writers of India.

(iii) A team of elevens best–cricket batsmen of the world.

(iv) The collection of all boys in your class.

(v) The collection of all natural numbers less than 100.

(vi) A collection of novels written by the writer Munshi Prem Chand.

(vii) The collection of all even integers.

(viii) The collection of questions in this chapter.

(ix) A collection of most dangerous animals of the world.

Exercise 1 6

1. If X and Y are two sets such that has 18 elements, X has 8 elements and Y has 15 elements; how many elements does $X \cap Y$ have?

2. In a group of 400 people, 250 can speak Hindi and 200 can speak English. How many people can speak both Hindi and English?

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3. If X and Y are two sets such that $n(X) = 17$, $n(Y) = 23$ and $n(X \cup Y) = 38$, find $n(X \cap Y)$.

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4. In a group of 70 people, 37 like coffee, 52 like tea and each person likes at least one of the two drinks. How many people like both coffee and tea?

5. In a group of 65 people, 40 like cricket, 10 like both cricket and tennis. How many like tennis only and not cricket? How many like tennis?

6. If S and T are two sets such that S has 21 elements, T has 32 elements and $S \cap T$ has 11 elements , how many elements does $S \cup T$ have ?

7. If X and Y are two sets such that X has 40 elements, $X \cup Y$ has 60 elements and $X \cap Y$

has 10 elements, how many elements does Y have ?

8. In a committee, 50 people speak French, 20 speak Spanish and 10 speak both Spanish and French. How many speak at least one of these two languages?

1. Find the union of each of the following pairs

of sets :(i) $X = \{1, 3, 5\}\ Y = \{1, 2, 3\}$

(ii) $A = [a, e, i, o, u\}\ B = [a, b, c\}$

(iii) $A =$ {x : x is a natural number and

multiple of 3} $B =$ {x : x is a natural number

less than 6}

(iv) $A =$ {x : x is a natural number and

$1 < x \leq 6$ } $B =$ {x : x is a natural number

and $6 < x < 10$ }

(v)$A = \{1, 2, 3\},\ B = \varphi$

2. Let $A = \{a, b\}, B = \{a, b, c\}$. Is $A \subset B$?

What is $A \cup B$?

3. If A and B are two sets such that $A \subset B$, then what is $A \cup B$?

4. If $A = \{1, 2, 3, 4\}$, $B = \{3, 4, 5, 6\}$, $C = \{5, 6, 7, 8\}$ and $D = \{7, 8, 9, 10\}$: find (i) $A \cup B$ (ii) $A \cup C$ (iii) $B \cup C$ (iv) $B \cup D$ (v) $A \cup B \cup C$ (vi) $A \cup B \cup D$ (vii) $B \cup C \cup D$

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5. Find the intersection of each pair of sets of question 1 above.

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6. If $A = \{3, 5, 7, 9, 11\}$, $B = \{7, 9, 11, 13\}$, $C = \{11, 13, 15\}$ and $D = \{15, 17\}$; find(i) $A \cap B$ (ii) $B \cap C$ (iii) $A \cap C \cap D$(iv) $A \cap C$ (v) $B \cap D$ (vi) $A \cap (B \cup C)$(vii) $A \cap D$

7. If A= {x : x is a natural number}, B = {x : x is an even natural number}C = {x : x is an odd natural number} and D = {x : x is a prime

number }, find(i) $A \cap B$ (ii) $A \cap C$ (iii) $A \cap D$
(iv) $B \cap C$ (v) $B \cap D$ (vi) $C \cap D$

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8. Which of the following pairs of sets are disjoint(i) $\{1, 2, 3, 4\}$and $\{x : x$ is a natural number and $4 \le x \le 6\}$(ii) $\{a, e, i, o, u\}$and $\{c, d, e, f\}$(iii) $\{x : x$ is an even integer $\}$ and $\{x : x$ is an odd integer}

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9. If $A = \{3, 6, 9, 12, 15, 18, 21\}$,

$B = \{4, 8, 12, 16, 20\}$,

$C = \{2, 4, 6, 8, 10, 12, 14, 16\}$,

$D = \{5, 10, 15, 20\}$; find(i) $A - B$ (ii) $A - C$

(iii) $A - D$

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10. State whether each of the following statement is true or false. Justify your answer.

(i) $\{2, 3, 4, 5\}$ and $\{3, 6\}$ are disjoint sets,

(ii) $\{a, e, i, o, u\}$ and $\{a, b, c, d\}$ are disjoint

sets,

(iii) $\{2, 6, 10, 14\}$ and $\{3, 7, 11, 15\}$ are

disjoint sets.

$(iv)\{2, 6, 10\}$ and $\{3, 7, 11\}$ are disjoint sets.

11. If R is the set of real numbers and Q is the

set of rational numbers, then what is $R - Q$?

A. Set of rational numbers

B. Set of irrational numbers

C. Set of irrational numbers including 0

D. None

Answer: B

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12. If $X = \{a, b, c, d\}$ and $Y = \{f, b, d, g\}$, find (i) $X - Y$ (ii) $Y - X$ (iii) $X \cap Y$

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1. From the sets given below, select equal sets :

$A = \{2, 4, 8, 12\},$ $B = \{1, 2, 3, 4\},$

$C = \{4, 8. 12, 14\},$ $D = \{3, 1, 4, 2\}$

$E = \{-1, 1\}, \quad F = \{0, a\}, \quad G = \{1, -1\},$

$H = \{0, 1\}$

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2. In the following, state whether $A = B$ or not:(i) $A = \{a, b, c, d\}$ $B = \{d, c, b, a\}$(ii)

$A = \{4, 8, 12, 16\}$ $B = \{8, 4, 16, 18\}$(iii)

$A = \{2, 4, 6, 8, 10\}$ B = {x: x is positive even integer and x≤10} (iv) A = {x : x is a multiple of 10} B={10,15,20,25,30,...}

3. Are the following pair of sets equal? Give reasons.(i) $A = \{2, 3\}$, B = {x: x is solution of $x^2 + 5x + 6 = 0$}(ii) A = { x : x is a letter in the word FOLLOW} B = { y : y is a letter in the word WOLF}

4. Which of the following sets are finite or infinite(i) The set of months of a year(ii) $\{1, 2, 3, ...\}$(iii) $\{1, 2, 3, ...99, 100\}$(iv) The set of positive integers greater than 100(v) The set of prime numbers less than 99

5. State whether each of the following set is finite or infinite:(i) The set of lines which are

parallel to the x–axis(ii) The set of letters in the English alphabet(iii) The set of numbers which are multiple of 5(iv) The set of animals living on the earth(v) The set of circles passing through the origin (0, 0)

6. Which of the following are examples of the null set(i) Set of odd natural numbers divisible by 2(ii) Set of even prime numbers(iii) {x: x is a

natural numbers, $x < 5$ and $x > 7$}(iv) {y: y is a point common to any two parallel lines}

Exercise 1 5

1. Taking the set of natural numbers as the universal set, write down the complements of the following sets:

(i) {x : x is an even natural number} (ii) { x : x is an odd natural number }

(iii) {x : x is a positive multiple of 3} (iv) { x : x is a prime number }

(v) {x : x is a natural number divisible by 3 and 5}

(vi) { x : x is a perfect square } (vii) { x : x is a perfect cube}

(viii) { x : x + 5 = 8 }(ix) { x : 2x + 5 = 9}

(x) { x : x ≥ 7 }(xi) { x : x $\in$ N and 2x + 1 > 10 }

2. If $U = \{a, b, c, d, e, f, g, h\}$, find the complements of the following sets :(i) $A = \{a, b, c\}$ (ii) $B = \{d, e, f, g]$ (iii) $C = \{a, c, e, g\}$ (iv) $D = \{f, g, h, a)$

A. $n\pi + (-1)^n \dfrac{\pi}{6}, n \in Z$

B. $n\pi + (-1)^n \dfrac{\pi}{3}, n \in Z$

C. $n\pi \pm \dfrac{\pi}{6}, n \in Z$

D. $n\pi \pm \dfrac{\pi}{3}, n \in Z$

Answer: A

3. Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{1, 2, 3, 4\}$, $B = \{2, 4, 6, 8\}$ and $C = \{3, 4, 5, 6\}$. Find (i) A' (ii) B' (iii) $(A \cup C)'$ (iv) $(A \cup B)'$ (v) $(A')'$ (vi) $(B-C)'$

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4. Fill in the blanks to make each of the following a true statement : (i) $A \cup A' = \ldots$

(ii) $\varphi' \cap A =$ ...(iii) $A \cap A' =$ ... (iv)

$\cup' \cap A =$ ...

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5. Let U be the set of all triangles in a plane. If

A is the set of all triangles with at least one

angle different from 60°, what is A' ?

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6. Draw appropriate Venn diagram for each of the following :(i) $(A \cup B)'$ (ii) $A' \cap B'$ (iii) $(A \cap B)'$ (iv) $A' \cup B'$

7. If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{2, 4, 6, 8\}$ and $B = \{2, 3, 5, 7\}$. Verify that(i) $(A \cup B)' = A' \cap B'$ (ii) $(A \cup B)' = A' \cup B'$