

MAT 1100 FOUNDATION MATHEMATICS TUTORIAL SHEET 1 -2021

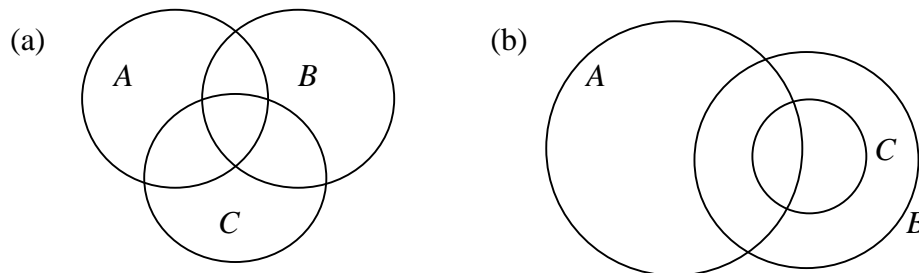
1. Let the universal set $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, the sets $A = \{1, 3, 6, 8, 10\}$, $B = \{2, 4, 5, 6, 8\}$ and $C = \{1, 4, 6, 10\}$. Find the following sets:

- (a) $(A \cap B)'$ (d) $(A' \cup B)'$ (e) $(A \cap B) \cup C$
 (f) $(A \cup B) \cap C$.

2. In the problems below, one of the following relations is true: $A \subset B$, $A = B$, $A \neq B$, $B \subset A$. Write the correct relation in each case.

- | A | B |
|--|--------------------------|
| (a) $\{x 2x + 3 = 11 - 2x\}$ | $\{x 5x + 4 = x + 12\}$ |
| (b) $\{x x^2 + 4 = 40 - 5x\}$ | $\{x 3 + 2x = 11\}$ |
| (c) $\{x x + 4 = x(x + 4)\}$ | $\{x x^2 + 3x - 4 = 0\}$ |
| (d) $\{x x - 1 = 0\} \cup \{x x - 2 = 0\}$ | $\{x x^2 - 3x + 2 = 0\}$ |
| (e) $\{x x + 3 = 4\}$ | $\{x (x + 3)^2 = 16\}$ |

3. In each of the Venn diagrams below shade: (i) $A \cap (B \cup C)$ (ii) $C - (A \cap B)$



4. Illustrate the given identities by drawing Venn diagrams, given that A, B, C are subsets of a universal set U :

- (a) De Morgan's laws:

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

- (b) Distributive laws:

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

(c) $A \cup A' = U$ (d) $A \cap A' = \emptyset$

- (d) Commutative laws:

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

- (e) Associative laws:

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

(f) $A - B = A \cap B'$.

5. Express each of the following in its simplest form:
- (a) $[P' \cup (Q - R)]'$ (b) $X \cup (Y \cap X)$ (c) $(M \cap N) \cup (M \cap N')$
 (d) $A - (A - B)$ (e) $A \cup (B - C)$ (f) $[(A \cap B)' \cup (A - B)]'$
1. Rewrite each interval in set builder form:
 (a) $A = (-10, 10]$ (b) $B = [4, 9]$ (c) $C = (-1, 5)$ (d) $[0, -2)$.
2. Let \mathbb{R} be the universal set and $A = (-1, 6]$, $B = (0, 4)$, $C = \{x: x \geq 4, x \in \mathbb{R}\}$ be its subsets. Illustrate each set on the same number line. Hence, find each of the following sets:
 (a) $A - C$ (b) $(B' \cap C)'$ (c) $(C - A) \cap B$.
3. Express each of the following numbers as a fraction in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$, in its lowest terms:
 (a) $4.\bar{3}$ (b) $-0.2\bar{55}$ (c) $12.34\bar{11}$.
4. Prove that each of the following is an irrational number:
 (a) $\sqrt{3}$ (b) $\sqrt{2} - 1$.
5. Simplify each of the following:
 (a) $2\sqrt{27} - 3\sqrt{48} + \sqrt{75}$ (b) $\sqrt{80} - \sqrt{20} - 2\sqrt{45}$ (c) $\frac{\sqrt{28}}{\sqrt{175}}$.
6. Rationalize the denominator of each of the following:
 (a) $\frac{\sqrt{2}-1}{1+\sqrt{2}}$ (b) $\frac{\sqrt{3}-2}{\sqrt{3}-1}$ (c) $\frac{2+\sqrt{2}}{(\sqrt{2}-1)^2}$.