

Worksheet 12.4: Venn Diagrams with Three Sets and Verification of Equality of Sets

1. When constructing a Venn diagram with three sets, which region do you generally complete first?
2. When constructing a Venn diagram with three sets, after completing region V, which regions do you generally complete next?
3. A Venn diagram contains three sets, A, B, and C. If region V contains 6 elements and there are 10 elements in $A \cap B$, how many elements belong in region II? Explain.
4. A Venn diagram contains three sets, A, B, and C. If region V contains 4 elements and there are 12 elements in $B \cap C$, how many elements belong in region VI? Explain.
5. State De Morgan's laws.
6. a) For $U = \{ 1, 2, 3, 4, 5 \}$, $A = \{ 1, 4, 5 \}$, and $B = \{ 1, 4, 5 \}$, does $A \cup B = A \cap B$?

b) By observing your answer to part (a), can we conclude that $A \cup B = A \cap B$ for all sets A and B? Explain.

c) Determine if $A \cup B = A \cap B$ for all sets A and B.

7. Construct a Venn Diagram illustrating the following sets.

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

$$A = \{3, 4, 5, 7, 8, 9\}$$

$$B = \{1, 3, 4, 7\}$$

$$C = \{3, 6, 9, 10\}$$

8. Construct a Venn diagram illustrating the following sets.

$$U = \{\text{peach, pear, banana, apple, grape, melon, carrot, corn, orange, spinach}\}$$

$$A = \{\text{pear, grape, melon, carrot}\}$$

$$B = \{\text{peach, pear, banana, spinach, corn}\}$$

$$C = \{\text{pear, banana, apple, grape, melon, spinach}\}$$

Use Venn diagrams to determine whether the following sets are equal for all sets A and B.

9. $A' \cap B'$, $(A' \cap B)'$

10. $(A \cup B) \cap (B \cup C)$, $B \cup (A \cap C)$