ILLAWARRA TUTORING

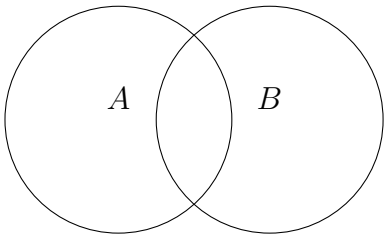
This worksheet will help you learn to represent events using set notation and Venn diagrams, making complex relationships clearer.

Easy Questions

1. Write the set notation for the set of even integers between 1 and 10.
2. Given $A = [a, b, c]$ and $B = [b, c, d]$, write in set notation:
   - the union $A \cup B$,
   - the intersection $A \cap B$, and
   - the difference $A - B$.
3. If the universal set is $U = [1, 2, 3, 4, 5, 6]$ and $A = [1, 3, 5]$, write the complement A' in set notation.
4. Draw a Venn diagram on pen and paper for two sets A and B, indicating the overlapping (intersection) region.
5. In your own words, explain what the notation $A \cap B$ means.

Intermediate Questions

6. Express in set notation the set of prime numbers less than 10.
7. Given $A = [1, 2, 3, 4]$ and $B = [3, 4, 5, 6]$, write the set of common elements (the intersection) in set notation.
8. Let $A = [1, 2, 3]$ and $B = [2, 3, 4]$. Write $A \cup B$ in set notation.
9. Write the set-builder notation for the set $B = x \in \mathbb{N} \mid 1 < x \leq 5$.
10. If $A = [2, 4, 6, 8]$ and the universal set is $U = [2, 4, 6, 8, 10]$, find A'.
11. In a short paragraph, define what is meant by $A \cap B$.
12. Consider the universal set $U = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]$. Let A be the set of numbers divisible by 2 and B be the set of numbers divisible by 3. Write A and B in roster form.
13. Examine the following Venn diagram and state which region represents $A \cap B$.



14. Look at the Venn diagram you would draw for two overlapping sets. Describe in words which parts of the diagram represent $A \cup B$.

15. If $A = [1, 2, 3, 4]$ and $B = [3, 4, 5]$, express $A - B$ in set notation.

16. Given the universal set $U = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]$, $A = [1, 2, 3]$ and $B = [3, 4, 5]$, express $(A \cup B)'$ in terms of U.

17. List the elements in the symmetric difference of $A = [1, 2, 3]$ and $B = [2, 3, 4]$. (Hint: the symmetric difference includes elements that are in one set or the other but not in both.)

18. Write in set notation the statement: "x belongs to A and x does not belong to B."

19. Using set-builder notation, represent the set of even numbers in the universal set $U = [1, 2, \ldots, 20]$.

20. State the meaning of the notation A' and, on pen and paper, sketch a simple diagram to illustrate it.

Hard Questions

21. Draw a labelled Venn diagram with three sets A, B, and C, ensuring that all possible intersections are visible.

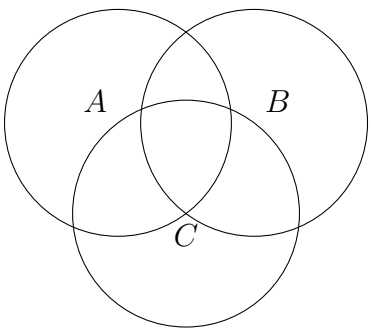
22. Prove using set notation that $(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$.

23. Given $A = [1, 2, 3, 4, 5]$, $B = [4, 5, 6, 7]$, and $C = [5, 7, 8, 9]$, find $A \cap B \cap C$.

24. Express the operation $(A \cap B) \cup (A \cap C) \cup (B \cap C)$ in words and using set notation. Briefly explain what this combination represents.

25. For the universal set $U = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]$, let $A = [1, 2, 3, 4]$ and $B = [3, 4, 5, 6]$. Verify that $A - B = A \cap B'$ by writing both sides in set notation.

26. Examine the diagram below and identify the region corresponding to $A \cup (B' \cap C)$.



27. In a survey, 50 students study French and 30 study German, with 20 studying both languages. Represent the sets F (French) and G (German) using set notation, and on pen and paper, draw and label the corresponding Venn diagram.

28. Using set-builder notation, define the set S of all real numbers x in the interval $[0, 10]$ such that x does not belong to the set A where $A = x \in [0, 10] \mid x < 5$.

29. Write the expression for the complement of $(A \cup B \cup C)$ and simplify it using De Morgan's Law.

30. Prove that $(A \cap B)' = A' \cup B'$ for any sets A and B using set notation.