Set Operations & Venn Diagrams

Set Theory Worksheet · Grade 6–9

Name: _____ Date: _____

Learning Objectives

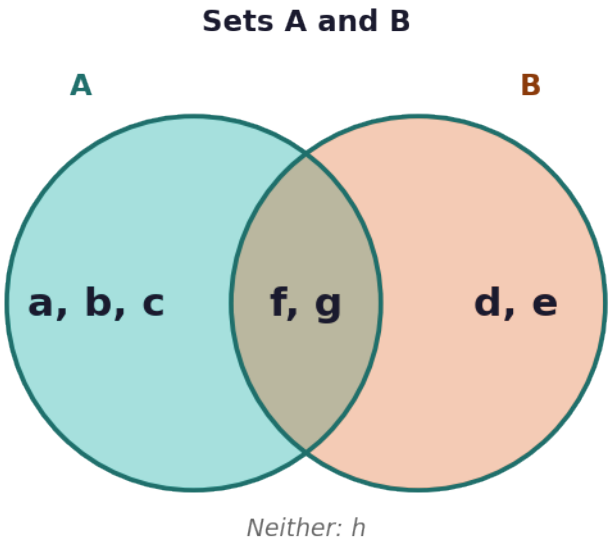
- Identify subsets, universal sets, and elements using Venn diagrams
- Find the complement, intersection, and union of sets
- Classify Venn diagram relationships as disjoint sets or proper subsets

Problems

1. The universal set U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}. List all elements of U.

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

2. Given the Venn diagram below, list the elements that belong only to Set A, only to Set B, and to both sets.



Neither: h

3. U = {1, 2, 3, 4, 5, 6, 7, 8, 9} and A = {1, 3, 5, 7}. Find the complement of A.

$A' = ?$

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4. Decide whether Set A and Set B are disjoint sets or proper subsets, given A = {2, 4, 6} and B = {1, 3, 5, 7}.

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

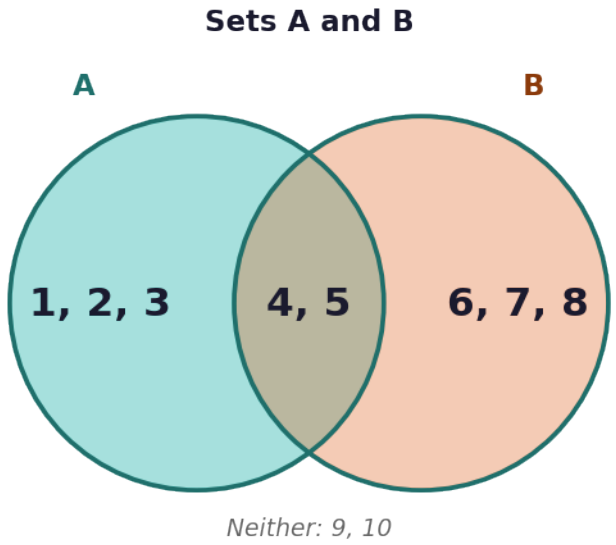
5. U = {a, b, c, d, e, f, g} and A = {b, d, f}. Find the complement of A and draw a Venn diagram to represent it.

$$A' = ?$$

6. Given A = {1, 2, 3, 4, 5} and B = {3, 4, 5, 6, 7}, find the intersection of A and B.

$$A \cap B = ?$$

7. Use the Venn diagram below to answer: What is the union of Set A and Set B? What is the intersection of Set A and Set B?



8. U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, A = {1, 2, 3, 4, 5}, and B = {4, 5, 6, 7}. Find: (a) A ∩ B, (b) A ∪ B, and (c) the complement of B.

$$A \cap B, \quad A \cup B, \quad B'$$

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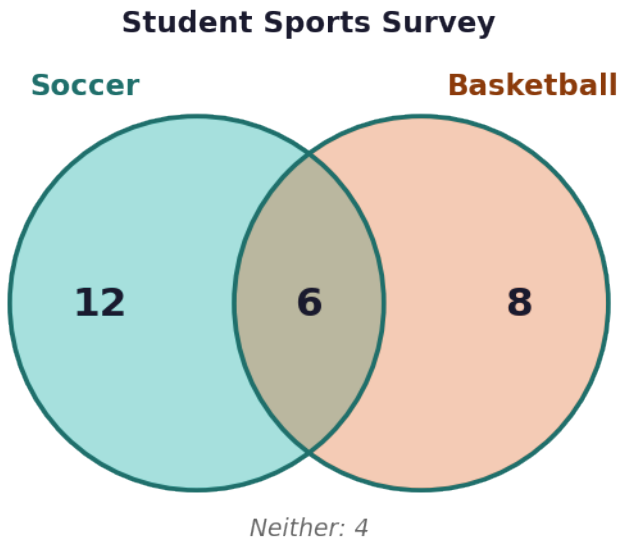
9. U = {a, b, c, d, e, f, g, h}, A = {a, c, e, g}, and B = {a, b, c, d}. Using set operations, find: (a) $A \cap B$, (b) $A \cup B$, (c) the complement of A, and (d) the complement of $A \cap B$.

$$A \cap B, \quad A \cup B, \quad A', \quad (A \cap B)'$$

10. A survey of 30 students found that 18 play soccer, 14 play basketball, 6 play both, and the rest play neither. Draw and label a Venn diagram, then find: (a) how many play only soccer, (b) how many play only basketball, (c) how many play neither, and (d) the complement of the set of students who play at least one sport.



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Set Operations & Venn Diagrams — Answer Key

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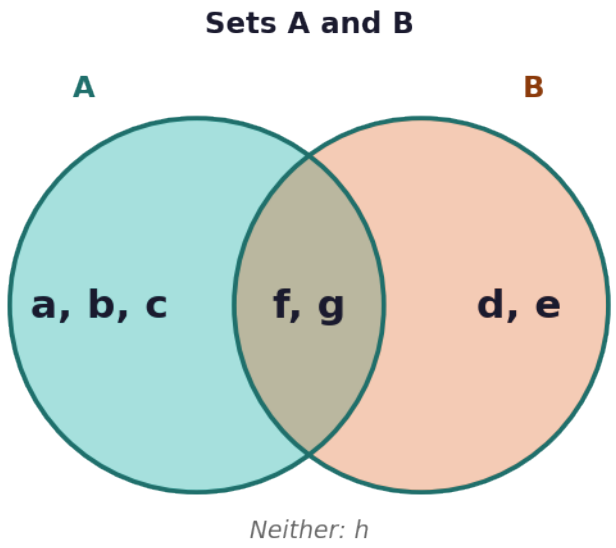
Answer Key

1. Answer: {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

- The universal set U contains all listed elements.
- U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

2. Answer: A only: {a, b, c}; B only: {d, e}; Both: {f, g}; Neither: {h}



- Elements in the left region only belong to A: {a, b, c}.
- Elements in the right region only belong to B: {d, e}.
- Elements in the overlapping region belong to both: {f, g}.
- Elements outside both circles belong to neither: {h}.

3. Answer: A' = {2, 4, 6, 8, 9}

- The complement of A contains all elements in U that are NOT in A.
- U = {1, 2, 3, 4, 5, 6, 7, 8, 9}, A = {1, 3, 5, 7}.
- Remove elements 1, 3, 5, 7 from U.
- A' = {2, 4, 6, 8, 9}.

4. Answer: Disjoint sets — no elements in common

- Check whether any element appears in both A and B.
- A = {2, 4, 6} and B = {1, 3, 5, 7} share no common elements.
- Since they share no elements, A and B are disjoint sets.

5. Answer: A' = {a, c, e, g}

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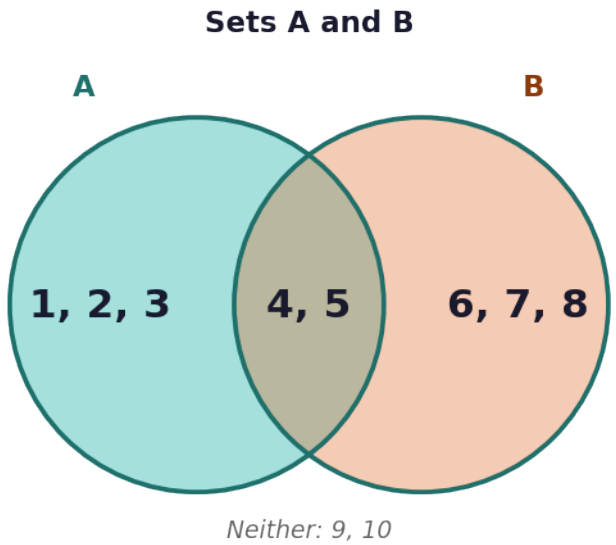
- List all elements in U: {a, b, c, d, e, f, g}.
- A = {b, d, f} — these stay inside the circle.
- All elements of U NOT in A form the complement: {a, c, e, g}.
- In the Venn diagram, A' = {a, c, e, g} appear outside the circle but inside the rectangle.

6. Answer: A ∩ B = {3, 4, 5}

- The intersection contains only elements found in BOTH A and B.
- A = {1, 2, 3, 4, 5} and B = {3, 4, 5, 6, 7}.
- Common elements: 3, 4, and 5.
- A ∩ B = {3, 4, 5}.

7. Answer: A ∪ B = {1,2,3,4,5,6,7,8}; A ∩ B = {4,5}



- Union (A ∪ B) includes all elements inside either circle: {1, 2, 3, 4, 5, 6, 7, 8}.
- Intersection (A ∩ B) includes only elements in the overlapping region: {4, 5}.
- Elements 9 and 10 are outside both sets and belong to neither.

8. Answer: A ∩ B = {4,5}; A ∪ B = {1,2,3,4,5,6,7}; B' = {1,2,3,8,9,10}

- A ∩ B: elements in both A and B → {4, 5}.
- A ∪ B: all elements in A or B → {1, 2, 3, 4, 5, 6, 7}.
- B' : elements in U but NOT in B → {1, 2, 3, 8, 9, 10}.

9. Answer: A ∩ B = {a,c}; A ∪ B = {a,b,c,d,e,g}; A' = {b,d,f,h}; (A ∩ B)' = {b,d,e,f,g,h}

- A ∩ B: elements in both A={a,c,e,g} and B={a,b,c,d} → {a, c}.
- A ∪ B: all elements in A or B → {a, b, c, d, e, g}.
- A': elements in U not in A → {b, d, f, h}.
- (A ∩ B)': elements in U not in {a, c} → {b, d, e, f, g, h}.

10. Answer: Soccer only: 12; Basketball only: 8; Neither: 4; Complement of 'at least one sport': 4 students

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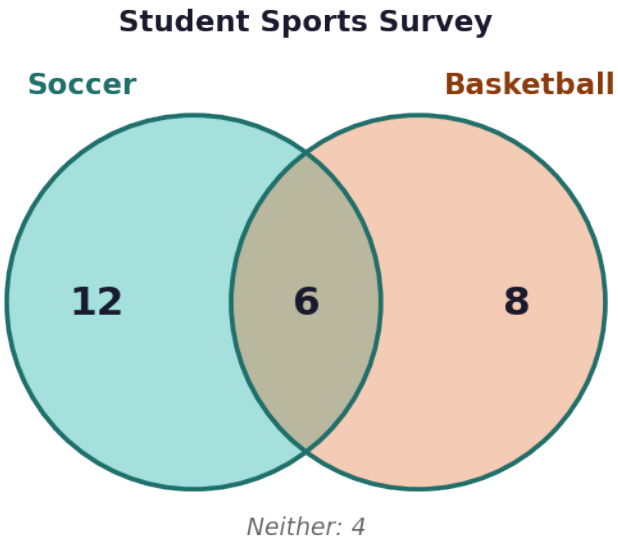

- Soccer only = total soccer – both = 18 – 6 = 12.
- Basketball only = total basketball – both = 14 – 6 = 8.
- Students playing at least one sport = 12 + 8 + 6 = 26.
- Neither = total students – at least one = 30 – 26 = 4.
- The complement of 'at least one sport' is the set of students who play neither = 4 students.

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