Set Operations Practice: Union, Intersection, and Complement

Original tasks 1, 2, 3 / complete keys

Task 1

Let U = {1, 2, 3, 4, 5, 6, 7, 8}, A = {1, 3, 5, 7}, and B = {2, 3, 5, 8}. Find A ∪ B and A ∩ B.

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

Reason: For the union, list every element from A and B without repeats: 1, 2, 3, 5, 7, 8. For the intersection, keep only elements in both A and B: 3 and 5 appear in both.

Check: Test each element of U: 1 is in A only, so in union but not intersection; 2 is in B only; 3 and 5 are in both; 7 is in A only; 8 is in B only; 4 and 6 are in neither. The results match.

Task 2

Let U = {a, b, c, d, e, f}, C = {a, c, e}, and D = {b, c, d}. Find C′ and C ∩ D.

Answer: C′ = {b, d, f}; C ∩ D = {c}.

Reason: The complement C′ contains elements of U not in C: b, d, f. The intersection C ∩ D contains elements in both C and D: only c.

Check: Check C′ by confirming each listed element is in U and not in C, and that every element of U not in C is listed. Check C ∩ D by testing each element of C against D.

Task 3

Let U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, E = {2, 4, 6, 8, 10}, and F = {1, 2, 3, 4, 5}. Find (E ∪ F)′.

Answer: (E ∪ F)′ = {7, 9}.

Reason: First compute E ∪ F = {1, 2, 3, 4, 5, 6, 8, 10}. Then take the complement within U: elements of U not in that union are 7 and 9.

Check: Test each element of U: 7 and 9 are in neither E nor F, so they belong in the complement. All other elements appear in E or F. The result matches.

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Original tasks 4 / complete keys

Task 4

Let U = {1, 2, 3, 4, 5, 6, 7, 8}, G = {1, 2, 3, 4}, and H = {3, 4, 5, 6}. Find G ∩ H′.

Answer: G ∩ H′ = {1, 2}.

Reason: First compute H′ = {1, 2, 7, 8}. Then intersect with G: elements in both G and H′ are 1 and 2. Alternatively, G ∩ H′ means elements in G that are not in H, which are 1 and 2.

Check: Test each element of G: 1 and 2 are not in H, so they qualify; 3 and 4 are in H, so they do not. The result is {1, 2}.

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Source rubric / reflection

- [ ] Correctly identifies the universal set and all given sets in roster form.
- [ ] Applies union by listing each distinct element from both sets exactly once.
- [ ] Applies intersection by listing only elements common to both sets.
- [ ] Applies complement relative to the stated universal set.
- [ ] Evaluates combined operations in the correct order, following parentheses.
- [ ] Presents final answers as sets in roster form with no duplicates.
- [ ] Shows a check, such as testing each element of U against the final condition.

Reflection: What did you check, what did you change, and what will you try next?