Subset Notation

Set Theory Worksheet · Grade 6–8

Name: _____ Date: _____

Learning Objectives

- Use subset and not-a-subset symbols to describe relationships between sets
- List all distinct subsets of a given set, including the empty set
- Use the formula 2^n to count the number of distinct subsets of a set with n elements

Problems

1. Set A = {2, 4, 6} and Set B = {2, 4, 6, 8, 10}. Is Set A a subset of Set B? Write the correct notation.

$A \subseteq B$ or $A \not\subseteq B$

2. Set A = {m, a, t, h} and Set B = {m, a, t}. Is Set A a subset of Set B? Write the correct notation.

$A \subseteq B$ or $A \not\subseteq B$

3. Write TRUE or FALSE: The empty set (null set) is always a subset of any set.

$\varnothing \subseteq B$ for any set B

4. Set A = {x such that x is a letter in the word 'CAT'} and Set B = {x such that x is a letter in the word 'CATCH'}. List the elements of each set, then determine if A is a subset of B.

$A = \{C, A, T\}$

$B = \{C, A, T, H\}$

5. List ALL distinct subsets of the set {5}.

$\{5\}$

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6. List ALL distinct subsets of the set {1, 2, 3}.

$\{1, 2, 3\}$

7. How many distinct subsets does a set with 4 elements have? Use the formula and show your work.

2^n

8. Set A = {a, e, i, o, u} and Set B = {a, b, c, d, e}. Is A a subset of B? Is B a subset of A? Write the correct notation for each.

$A \subseteq B$ or $A \subseteq B$

$B \subseteq A$ or $B \subseteq A$

9. A set has 5 elements. How many of its distinct subsets contain exactly 2 elements? (Hint: list or use combinations.)

$\binom{5}{2}$

10. Set A = {x such that x is a whole number and $1 \leq x \leq 4$} and Set B = {x such that x is an even whole number and $1 \leq x \leq 10$}. Write both sets in roster form, determine if $A \subseteq B$, and find the total number of distinct subsets of Set A.

$A = \{1, 2, 3, 4\}$

$B = \{2, 4, 6, 8, 10\}$

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Subset Notation — Answer Key

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Answer Key

1. Answer: A ⊆ B (A is a subset of B)

- Check if every element of A is also in B.
- 2 ∈ B ✓, 4 ∈ B ✓, 6 ∈ B ✓
- All elements of A are found in B, so A ⊆ B.

2. Answer: A ⊄ B (A is not a subset of B)

- Check if every element of A is also in B.
- m ∈ B ✓, a ∈ B ✓, t ∈ B ✓, but h ∉ B ✗
- Since h is in A but not in B, A ⊄ B.

3. Answer: TRUE

- By definition, the empty set has no elements.
- Since there are no elements to violate the subset condition, the empty set is a subset of every set.
- The statement is TRUE.

4. Answer: A ⊆ B

- List the distinct letters: A = {C, A, T} and B = {C, A, T, H}.
- Check: C ∈ B ✓, A ∈ B ✓, T ∈ B ✓
- All elements of A are in B, so A ⊆ B.

5. Answer: {5} and ∅ — 2 subsets total

- A set with 1 element has 2^1 = 2 distinct subsets.
- Subset 1: {5} (the set itself)
- Subset 2: ∅ (the empty set)
- Total: 2 distinct subsets.

6. Answer: {1,2,3}, {1,2}, {1,3}, {2,3}, {1}, {2}, {3}, ∅ — 8 subsets

- A set with 3 elements has 2^3 = 8 distinct subsets.
- 3-element subset: {1, 2, 3}
- 2-element subsets: {1,2}, {1,3}, {2,3}
- 1-element subsets: {1}, {2}, {3}
- 0-element subset: ∅
- Total: 8 distinct subsets.

7. Answer: 16 subsets

- The number of distinct subsets of a set with n elements is 2^n.
- Here n = 4, so the number of subsets = 2^4.
- 2^4 = 16.
- There are 16 distinct subsets.

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8. Answer: $A \not\subset B$ and $B \not\subset A$

- Check $A \subseteq B$: $i \notin B$, so $A \not\subset B$.
- Check $B \subseteq A$: $b \notin A$, so $B \not\subset A$.
- This confirms subset notation is NOT commutative.
- Both $A \not\subset B$ and $B \not\subset A$.

9. Answer: 10 subsets

- We need to choose 2 elements from 5, where order does not matter.
- Use the combination formula: C(5,2) = 5! / (2! × 3!)
- C(5,2) = (5 × 4) / (2 × 1) = 20 / 2 = 10.
- There are 10 distinct 2-element subsets.

10. Answer: $A \not\subset B$; Set A has 16 distinct subsets

- List A in roster form: A = {1, 2, 3, 4}.
- List B in roster form: B = {2, 4, 6, 8, 10}.
- Check $A \subseteq B$: $1 \notin B$ and $3 \notin B$, so $A \not\subset B$.
- Count distinct subsets of A: n = 4, so 2^4 = 16 distinct subsets.

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