Basic Set Notation

Algebra Worksheet · Grade 9–11

Name: _____ Date: _____

Learning Objectives

- Write sets using roster method and set-builder notation
- Determine the cardinality of a set and identify empty sets
- Use set membership notation and identify equivalent sets

Problems

1. Write the set of the first five natural numbers using the roster method.

2. Write the set of all vowels in the English alphabet using the roster method.

3. Find the cardinality of set A = {4, 8, 12, 16, 20, 24}.

$$A = \{4, 8, 12, 16, 20, 24\}$$

4. Determine whether the statement is true or false: 7 is an element of set B = {1, 3, 5, 7, 9}.

$$7 \in B = \{1, 3, 5, 7, 9\}$$

5. Determine whether the statement is true or false: 6 is NOT an element of set C = {2, 4, 6, 8, 10}.

$$6 \notin C = \{2, 4, 6, 8, 10\}$$

6. Write the set of even numbers between 1 and 11 (not including 1 and 11) using set-builder notation.

$$\{x \mid x \text{ is even and } 1 < x < 11\}$$

7. Identify which of the following represents an empty set (null set) and explain why. Set P = {x | x is a whole number less than 0}, Set Q = {0}.

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$$P = \{x \mid x \in \mathbb{W},\ x < 0\}, \quad Q = \{0\}$$

8. Determine whether sets A = {1, 2, 3} and B = {a, b, c} are equivalent sets. Justify your answer.

$$A = \{1, 2, 3\}, \quad B = \{a, b, c\}$$

9. Write the set of all integers x such that x squared equals 9 using set-builder notation, then list the elements using the roster method and state the cardinality.

$$\{x \mid x \in \mathbb{Z},\ x^2 = 9\}$$

10. Given sets A = {2, 4, 6, 8} and B = {1, 3, 5, 7}, answer all of the following: (a) Find |A| and |B|. (b) Are A and B equivalent sets? (c) Are A and B equal sets? (d) Is 5 an element of A? Write the correct membership notation. (e) Write B in set-builder notation.

$$A = \{2, 4, 6, 8\}, \quad B = \{1, 3, 5, 7\}$$

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Basic Set Notation — Answer Key

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Answer Key

1. Answer: {1, 2, 3, 4, 5}

- The first five natural numbers are 1, 2, 3, 4, and 5.
- List them inside curly braces separated by commas.
- Answer: {1, 2, 3, 4, 5}

2. Answer: {a, e, i, o, u}

- Identify all vowels in the English alphabet: a, e, i, o, u.
- List them inside curly braces.
- Answer: {a, e, i, o, u}

3. Answer: |A| = 6

- Count the number of distinct elements in set A.
- Elements: 4, 8, 12, 16, 20, 24 — that is 6 elements.
- The cardinality |A| = 6.

4. Answer: True

- Check if 7 appears in the set B = {1, 3, 5, 7, 9}.
- 7 is listed as an element of B.
- Therefore the statement $7 \in B$ is TRUE.

5. Answer: False

- Check if 6 appears in set C = {2, 4, 6, 8, 10}.
- 6 is listed in C, so saying $6 \notin C$ is incorrect.
- Therefore the statement is FALSE.

6. Answer: {x | x is an even number, 1 < x < 11} = {2, 4, 6, 8, 10}

- Identify the condition: x is even and strictly between 1 and 11.
- Set-builder form: { x | x is even and 1 < x < 11 }.
- Roster verification: {2, 4, 6, 8, 10}.

7. Answer: P is the empty set; Q is not empty

- Whole numbers are 0, 1, 2, 3, ... — none of them are less than 0.
- So P has no elements; P = ∅ (empty set).
- Q contains the element 0, so Q is not empty. |Q| = 1.

8. Answer: Yes, A and B are equivalent sets because |A| = |B| = 3

- Two sets are equivalent if they have the same cardinality (same number of elements).
- |A| = 3 and |B| = 3.
- Since |A| = |B|, sets A and B are equivalent (though not equal, since their elements differ).

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9. Answer: {-3, 3}; cardinality = 2

- Set-builder notation: { x | x ∈ ■, $x^2 = 9$ }.
- Solve $x^2 = 9$: x = 3 or x = -3.
- Roster method: {-3, 3}.
- Cardinality: |{-3, 3}| = 2.

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10. Answer: |A|=4, |B|=4; equivalent: yes; equal: no; 5 ∉ A; B={x | x is odd, 1 ≤ x ≤ 7}

- (a) Count elements: |A| = 4, |B| = 4.
- (b) Since |A| = |B| = 4, sets A and B are equivalent.
- (c) A and B do not share the same elements (A has evens, B has odds), so A ≠ B; they are NOT equal.
- (d) 5 is not in A = {2, 4, 6, 8}, so the correct notation is 5 ∉ A.
- (e) B in set-builder notation: { x | x is an odd integer, 1 ≤ x ≤ 7 }.

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