

Statements and Symbolic Logic

Logic & Set Theory Worksheet · Grade 9–11

Name: _____

Date: _____

Learning Objectives

- Identify whether a sentence is a valid statement in set logic (true or false, but not both simultaneously)
- Distinguish statements from opinions, commands, and questions
- Use symbolic variables (P, Q, R, S) to represent logical statements

Problems

1. Is the following sentence a valid statement in set logic? 'The Earth revolves around the Sun.' Write YES or NO and state its truth value.

2. Is the following sentence a valid statement in set logic? 'Close the door.' Write YES or NO and explain why.

3. Is the following sentence a valid statement in set logic? 'What is the population of Japan?' Write YES or NO and explain why.

4. Is the following sentence a valid statement in set logic? 'Pizza is the best food in the world.' Write YES or NO and explain why.

5. Is the following sentence a valid statement in set logic? 'William Shakespeare wrote Romeo and Juliet.' Write YES or NO and state its truth value.

6. Let P represent 'Tokyo is the capital of Japan' and Q represent 'The moon is made of cheese.' Identify the truth value of each statement, then write the symbol that represents each one.

P, Q

7. Classify each of the following as a statement (S), opinion (O), command (C), or question (Q): (a) $2 + 2 = 5$ (b) Please sit down. (c) Summer is the best season. (d) Mars is a planet.

Scan to watch



8. Given the following statements, assign the symbolic variables P, Q, and R to each, then state their truth values: (1) 'The Nile is the longest river in the world.' (2) 'Abraham Lincoln was the first President of the United States.' (3) 'Sound travels faster than light.'

P, Q, R

9. Determine which of the following sentences are valid statements in set logic. For each valid statement, assign a symbolic variable (P, Q, R, or S) and state whether it is true or false. (a) 'Is 7 a prime number?' (b) '7 is a prime number.' (c) 'Memorize the multiplication table.' (d) 'A triangle has four sides.'

10. Let P = 'All mammals are warm-blooded,' Q = 'A square has 5 sides,' R = 'The Sun rises in the west,' and S = 'Water boils at 100 degrees Celsius at standard pressure.' (a) State the truth value of each symbolic statement. (b) Write two compound expressions using the symbolic variables that combine a true and a false statement. (c) Explain why all four qualify as valid statements in set logic.

P, Q, R, S

Scan to watch



Statements and Symbolic Logic — Answer Key

Logic & Set Theory Worksheet · Grade 9–11

Answer Key

1. Answer: YES — it is a true statement

- A valid statement in set logic must be either true or false, but not both simultaneously.
 - The Earth revolving around the Sun is a scientific fact — it is definitively TRUE.
 - Since it has a clear truth value, it qualifies as a valid statement in set logic.
-

2. Answer: NO — it is a command, not a statement

- A valid statement must be either true or false.
 - 'Close the door' is a command or instruction given to someone.
 - Commands are neither true nor false, so this is NOT a valid statement in set logic.
-

3. Answer: NO — it is a question, not a statement

- A valid statement must be either true or false.
 - 'What is the population of Japan?' is a question — it asks for information.
 - Questions cannot be assigned a truth value of true or false, so this is NOT a valid statement.
-

4. Answer: NO — it is an opinion, not a statement

- A valid statement must have a definite truth value based on fact.
 - 'Pizza is the best food' is an opinion — it can be true for some people and false for others simultaneously.
 - Since it cannot be definitively true or false, it is NOT a valid statement in set logic.
-

5. Answer: YES — it is a true statement

- Check if the sentence can be assigned a definite truth value.
 - It is a historical fact that William Shakespeare wrote Romeo and Juliet — this is TRUE.
 - Since it is definitively true, it is a valid statement in set logic.
-

6. Answer: P is TRUE; Q is FALSE

- P: 'Tokyo is the capital of Japan' — this is a well-known geographic fact, so P is TRUE.
 - Q: 'The moon is made of cheese' — this is scientifically false, so Q is FALSE.
 - Both P and Q are valid statements in set logic because each has exactly one truth value.
-

7. Answer: (a) S — false statement; (b) C; (c) O; (d) S — true statement

- (a) ' $2 + 2 = 5$ ' has a definite truth value (FALSE) — it is a statement.
 - (b) 'Please sit down' is a command/instruction — not a statement.
 - (c) 'Summer is the best season' is a matter of personal preference — it is an opinion.
 - (d) 'Mars is a planet' is a scientific fact (TRUE) — it is a statement.
-

8. Answer: P = TRUE; Q = FALSE; R = FALSE

- P: 'The Nile is the longest river in the world' — generally accepted as TRUE.

Scan to watch



- Q: 'Abraham Lincoln was the first President of the United States' — FALSE; George Washington was the first president.
- R: 'Sound travels faster than light' — FALSE; light travels far faster than sound.
- All three are valid statements in set logic because each is either true or false.

9. Answer: (b) is P — TRUE; (d) is Q — FALSE; (a) and (c) are not valid statements

- (a) 'Is 7 a prime number?' is a question — not a valid statement.
- (b) '7 is a prime number' is a mathematical fact (TRUE) — valid statement; assign P.
- (c) 'Memorize the multiplication table' is a command — not a valid statement.
- (d) 'A triangle has four sides' is a mathematical claim (FALSE — triangles have 3 sides) — valid statement; assign Q.

10. Answer: P = TRUE, Q = FALSE, R = FALSE, S = TRUE; e.g. P and Q, or R and S

- (a) P: 'All mammals are warm-blooded' — TRUE (biological fact). Q: 'A square has 5 sides' — FALSE (a square has 4 sides). R: 'The Sun rises in the west' — FALSE (it rises in the east). S: 'Water boils at 100°C at standard pressure' — TRUE (scientific fact).
- (b) Two compound expressions combining a true and false statement: P and Q (combines a TRUE with a FALSE); R and S (combines a FALSE with a TRUE).
- (c) All four qualify as valid statements in set logic because each sentence can be assigned exactly one definite truth value — either true or false — and none of them are opinions, commands, or questions.

Scan to watch

