

Foundations of Formal Logic

Logic · Answer Key · 18 Questions

1. In what year did Gottlob Frege publish 'Begriffsschrift', a seminal work introducing quantifiers and propositional calculus?

- A) 1879**
- B) 1884
- C) 1893
- D) 1902

2. Which philosopher, in 1910, co-authored 'Principia Mathematica' which aimed to derive all mathematical truths from logical axioms?

- A) Gottlob Frege
- B) Bertrand Russell**
- C) David Hilbert
- D) Kurt Gödel

3. The standard definition of a 'consistent' set of formulas in first-order logic is one from which no contradiction (represented as 'P and not P') can be derived. How many distinct truth values are there in classical propositional logic?

- A) 1
- B) 2**
- C) 3
- D) 4

4. Alfred Tarski's work on the concept of truth was significantly developed in a paper published in which year?

- A) 1933**
- B) 1936
- C) 1944
- D) 1950

5. Kurt Gödel's incompleteness theorems were first presented in a paper published in 1931. How many incompleteness theorems are generally attributed to Gödel?

- A) 1
- B) 2**
- C) 3
- D) 4

6. The notation '?' for universal quantification was introduced by Gottlob Frege. Approximately how many distinct symbols were used in the original formulation of Frege's 'Begriffsschrift'?

- A) Around 20
- B) Around 50**
- C) Around 100
- D) Around 200

7. The Lukasiewicz logic, named after Jan Lukasiewicz, introduced many-valued logic. In his early work on three-valued logic in 1920, what was the third truth value he introduced?

- A) Indeterminate**
- B) Possible
- C) Contingent
- D) Unknown

8. George Boole published 'An Investigation of the Laws of Thought' in what year, laying the groundwork for Boolean algebra?

- A) 1847
- B) 1854**
- C) 1864
- D) 1874

9. How many variables are typically required to represent all possible truth-functional relationships between two propositions in propositional logic?

- A) 1
- B) 2**
- C) 3
- D) 4

10. The logical connective 'material implication' (if... then...) is often represented by the symbol '->'. How many rows are in a truth table for two propositional variables?

- A) 2
- B) 3
- C) 4**
- D) 8

11. Which logician is credited with formalizing the concept of a 'recursive function' in 1934, a key development in computability theory and logic?

- A) Kurt Gödel
- B) Alonzo Church**
- C) Alan Turing
- D) Stephen Kleene

12. The principle of explosion states that from a contradiction, anything can be proven. In classical logic, ' $P \rightarrow \neg P$ ' implies ' Q ' for any proposition ' Q '. How many distinct ways can the biconditional ' $P \leftrightarrow Q$ ' be true?

- A) 1
- B) 2**
- C) 3
- D) 4

13. David Hilbert's program, aiming to establish the consistency of mathematics, was influential in the early 20th century. In which decade did he first formally outline his program?

- A) 1900s
- B) 1910s
- C) 1920s**
- D) 1930s

14. The satisfiability problem (SAT) is a fundamental problem in computational logic. It asks whether a given propositional logic formula can be made true. For a formula with ' n ' variables, what is the maximum number of possible truth assignments?

- A) n
- B) $2n$
- C) n^2
- D) 2^n**

15. In modal logic, ' $\Box$ ' represents necessity. How many distinct logical axioms are fundamental to the standard modal system K?

- A) 1**
- B) 2
- C) 3
- D) 4

16. The concept of a 'model' in logic refers to an interpretation under which a formula is true. How many distinct models can a simple propositional formula with one variable have at most?

- A) 1
- B) 2**
- C) 3
- D) 4

17. The proof of the completeness of first-order logic was first provided by Kurt Gödel in which year?

- A) 1929**
- B) 1930
- C) 1931
- D) 1932

18. The term 'tautology' refers to a formula that is always true, regardless of the truth values of its components. For a propositional logic formula with 3 variables, how many distinct truth values can be evaluated across all possible assignments?

- A) 1**
- B) 2
- C) 3
- D) 4