LRO · Original Practice Content

Class 7 | Logical Reasoning Olympiad

40 Questions · With Answer Key
Syllabax Olympiad Series
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Instructions: Each question has one correct answer. Choose the best option (A/B/C/D). Answer key is provided at the end. This paper is for practice only — not an official exam paper. Recommended time: **45 minutes**.

Q1. In propositional logic, what does De Morgan's Law ¬(P ∨ Q) ≡ ___ state?

A. ¬P ∨ ¬Q
B. P ∧ Q
C. ¬P ∧ ¬Q
D. ¬P ∨ Q

Q2. A bag has 5 red, 4 blue, 3 green balls. Two are drawn without replacement. P(both red) = ?

A. 5/33
B. 1/6
C. 2/11
D. 1/11

Q3. What is the number of onto (surjective) functions from a 3-element set to a 2-element set?

A. 4
B. 8
C. 6
D. 3

Q4. Which of these is NOT a tautology?

A. P ∨ ¬P
B. (P → Q) ∨ (Q → P)
C. P ∧ ¬P
D. (P ∧ Q) → P

Q5. Abductive reasoning is best described as:

A. deriving facts from general laws
B. generalising from specific observations
C. inferring the best or most likely explanation for an observation
D. reasoning by analogy

Q6. In the 'Knights and Knaves' puzzle: A says 'At least one of us is a knave'. Knights always tell the truth; Knaves always lie. Therefore:

A. A is a Knave
B. B is a Knight
C. A is a Knight and B is a Knave
D. Both are Knights

Q7. How many 5-digit palindromes exist?

A. 800 | **B.** 1000 | **C.** 900 | **D.** 500

Q8. In a 6×6 grid, how many squares of ALL sizes are there?

A. 140 | **B.** 196 | **C.** 91 | **D.** 216

Q9. Which is a VALID argument? ∀x(P(x) → Q(x)); P(a); therefore:

A. ∀x Q(x) | **B.** P(b) | **C.** Q(a) | **D.** ¬Q(a)

Q10. If Euler's path exists in a graph, how many vertices with odd degree must it have?

A. 0 or 1 | **B.** 1 or 3 | **C.** 0 or 2 | **D.** exactly 4

Q11. The statement 'If a triangle is equilateral, then all its angles are equal' is true. Its converse is:

A. If all angles are not equal, it is not equilateral | **B.** If a triangle is not equilateral, its angles are not all equal | **C.** If all angles of a triangle are equal, it is equilateral | **D.** Equilateral triangles exist

Q12. What is the sum of the series 1/1×2 + 1/2×3 + 1/3×4 + ... + 1/n(n+1) in closed form?

A. 1/(n+1) | **B.** n+1 | **C.** n/(n+1) | **D.** 1/n

Q13. In how many ways can 8 people be arranged in a circle?

A. 8! | **B.** 8!/2 | **C.** 7! | **D.** 6!

Q14. Which of the following is NOT a logical fallacy?

A. Ad hominem | **B.** Slippery slope | **C.** Modus ponens | **D.** False dichotomy

Q15. The number of ways to select a committee of 3 from 10 people including exactly 1 woman, given 4 women and 6 men:

A. 40
B. 24
C. 60
D. 90

Q16. 'All A are B; Some B are C; therefore some A are C.' Is this valid?

A. Yes — always valid
B. Yes if all B are C
C. No — the middle term B is not fully distributed
D. Yes if A and C overlap

Q17. The Pigeonhole Principle guarantees that in any group of 367 people:

A. two share the same name
B. at least two are born in the same month
C. at least two share the same birthday
D. at least two have the same age

Q18. Which is the INVERSE of 'If it rains, the match is cancelled'?

A. If the match is not cancelled, it did not rain
B. If the match is cancelled, it rained
C. If it does not rain, the match is not cancelled
D. The match is cancelled or it does not rain

Q19. Sherlock Holmes says: 'You've been in Afghanistan, I perceive.' This reasoning style is:

A. deductive — guaranteed conclusion
B. inductive — generalization from data
C. abductive — best explanation of clues
D. hypothetical syllogism

Q20. How many 4-letter arrangements of the word MATHEMATICS use only unique letters?

A. 990
B. 1800
C. 2520
D. 5040

Q21. P: Some A are B. Q: All B are C. What can be concluded?

A. All A are C
B. No A is C
C. Some A are C
D. Some C are not A

Q22. Which reasoning pattern is DEDUCTIVE? 'All humans are mortal. Socrates is human. Therefore Socrates is mortal.' This demonstrates:

A. induction
B. analogy
C. deduction via categorical syllogism
D. abduction

Q23. A number has exactly 4 factors. It must be of the form:

A. p^2 or $p \times q$ (where p,q are distinct primes)
B. p^3 only
C. p^3 or $p \times q$ (where p,q are distinct primes)
D. p^2 only

Q24. What is the number of ways to arrange 4 boys and 3 girls in a row so that all girls are together?

A. 720
B. 144
C. 1440
D. 2520

Q25. In Boolean logic, the expression $(A \wedge B) \vee (A \wedge \neg B)$ simplifies to:

A. $A \wedge B$
B. B
C. A
D. $A \vee B$

Q26. Which of the following cannot be the sum of two prime numbers?

A. 10
B. 20
C. 27
D. 12

Q27. Inference: 'Every time A wins, B loses; B did not lose.' Conclusion: 'A did not win.' This is:

A. modus ponens
B. affirming the consequent
C. modus tollens
D. hypothetical syllogism

Q28. In the 'Unexpected Hanging Paradox', the prisoner's reasoning fails because:

A. logic has no role in legal proceedings
B. the judge's statement is contradictory
C. self-reference creates a paradox that undermines backward induction
D. the judge is lying

Q29. The birthday paradox: in a group of 23 randomly chosen people, the probability that two share a birthday is approximately:

A. 10%
B. 30%
C. 50%
D. 70%

Q30. The sum $1^2 + 2^2 + 3^2 + \ldots + n^2 = n(n+1)(2n+1)/6$. For $n = 10$, the sum is:

A. 330
B. 220
C. 385
D. 440

Q31. Which is the NEXT term: 2, 3, 7, 43, 1807, ___? (Each term = product of all previous terms + 1)?

A. 3,263,443

B. 3,263,442

C. 3,263,443

D. 3,263,444

Q32. In predicate logic, '∃x P(x)' is the negation of:

A. ∃x ¬P(x)

B. ∀x P(x)

C. ∀x ¬P(x)

D. ¬∃x ¬P(x)

Q33. What fallacy is committed in: 'We must either increase taxes or cut services. We should not cut services. Therefore, we must increase taxes.'?

A. None — this is a valid disjunctive syllogism

B. False dichotomy if there are other options

C. Ad hominem

D. Slippery slope

Q34. The number of surjections from an n-set to a k-set uses inclusion-exclusion. For n=4, k=3, the count is:

A. 24

B. 48

C. 36

D. 60

Q35. 'Zeno's paradox of Achilles and the Tortoise' is resolved by:

A. Achilles can never pass the tortoise

B. geometry of infinite regress

C. convergence of a geometric series to a finite sum

D. the impossibility of division

Q36. In a tournament of 16 players (single elimination), how many games are played?

A. 16

B. 8

C. 15

D. 32

Q37. P → Q is equivalent to which of these?

A. Q → P

B. ¬Q → ¬P

C. P ← Q

D. ¬P → ¬Q

Q38. How many ways can 6 people be divided into 2 groups of 3 (groups are not labelled)?

A. 60

B. 30

C. 10

D. 20

Q39. Which of the following is NOT provable in Peano arithmetic (Gödel's incompleteness)?

A. 1+1=2

B. commutativity of addition

C. the consistency of Peano arithmetic itself

D. the definition of prime numbers

Q40. In a class, 40% passed in English, 60% passed in Maths, 20% failed both. What % passed both?

A. 10%

B. 15%

C. 20%

D. 25%

Answer Key

Q1: C Q2: C Q3: C Q4: C Q5: C Q6: C Q7: C Q8: C Q9: C Q10: C

Q11: C Q12: C Q13: C Q14: C Q15: C Q16: C Q17: C Q18: C Q19: C

Q20: A Q21: C Q22: C Q23: C Q24: A Q25: C Q26: C Q27: C Q28: C

Q29: C Q30: C Q31: A Q32: C Q33: B Q34: C Q35: C Q36: C Q37: B

Q38: C Q39: C Q40: C