IMO-Style · Original Practice Content

Class 7 | Mathematics Olympiad

40 Questions · With Answer Key
Syllabax Olympiad Series
syllabax.com

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. If $x = 2 + \sqrt{3}$, what is $x^2 + 1/x^2$?

A. 10
B. 12
C. 14
D. 16

Q2. The sum of first n terms of an AP is $S_n = 3n^2 - 2n$. What is the common difference?

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

Q3. By Fermat's Little Theorem, what is 5^{200} mod 7?

A. 1
B. 2
C. 3
D. 4

Q4. In how many ways can 8 identical balls be distributed into 3 distinct boxes with no box empty?

A. 15
B. 18
C. 21
D. 28

Q5. The equation $\sin x + \cos x = k$ has real solutions when k is in the range:

A. $[-1, 1]$
B. $[-\sqrt{2}, \sqrt{2}]$
C. $[0, \sqrt{2}]$
D. $[-\sqrt{2}, 0]$

Q6. Find the area of the triangle with vertices (0, 0), (4, 0), (0, 3).

A. 4
B. 5
C. 6
D. 8

Q7. If $x > 0$ and $x + 16/x = 10$, what are the possible values of x?

A. $x = 2$ only
B. $x = 8$ only
C. $x = 2$ or $x = 8$
D. No solution

Q8. A box has 5 red, 4 green, 3 blue balls. 2 drawn at random. P(both same colour) = ?

A. 19/66 **B.** 1/3

C. 11/33 **D.** 7/22

Q9. How many integers from 1 to 1000 are divisible by 7 but NOT by 3?

A. 85 **B.** 90

C. 95 **D.** 100

Q10. If log a + log b = log(a + b), which relationship must hold?

A. a = b **B.** 1/a + 1/b = 1

C. a + b = 1 **D.** ab = a + b

Q11. $p(x) = x^3 - 6x^2 + 11x - 6$. What is p(1) + p(2) + p(3)?

A. −6 **B.** 0

C. 6 **D.** 12

Q12. For which values of x is $|x - 3| + |x - 7| = 4$?

A. x = 5 only **B.** $3 \le x \le 7$

C. x = 4 or x = 6 **D.** No solution

Q13. A committee of 4 men and 3 women from 9 men and 7 women. How many ways?

A. 2520 **B.** 3780

C. 4410 **D.** 5040

Q14. What is the sum of the infinite GP: 1/3 + 1/9 + 1/27 + ...?

A. 1/3 **B.** 1/2

C. 2/3 **D.** 1

Q15. What is the minimum value of $f(x) = x^2 + 2x + 5$?

A. 0 **B.** 4

C. 5 **D.** 2

Q16. a, b, c are in AP. Which of the following MUST be true?

A. $2b = a + c$ **B.** $b = ac$

C. $b^2 = ac$ **D.** $1/a + 1/c = 1/b$

Q17. How many 3-digit numbers have exactly two identical digits?

A. 216 **B.** 243

C. 252 **D.** 270

Q18. In right triangle ABC with angle B = 90°, AB = 8, BC = 6. What is cos A?

A. 3/5 **B.** 4/5

C. 3/4 **D.** 5/4

Q19. What is the maximum value of $f(x) = -x^2 + 4x - 3$?

A. −3 **B.** 0

C. 1 **D.** 4

Q20. In a GP, the 4th term is 4 and 7th term is 128. What is the 10th term?

A. 512 **B.** 1024

C. 2048 **D.** 4096

Q21. How many positive integers ≤ 200 have exactly 3 divisors?

A. 4 **B.** 5

C. 6 **D.** 7

Q22. Solve: $\sqrt{(x + 5)} + \sqrt{(x - 3)} = 4$

A. 3 **B.** 4

C. 5 **D.** 6

Q23. Evaluate: Σ (−1)^k × k for k = 1 to 50

A. 25 **B.** 50

C. −25 **D.** 0

Q24. If $xy = 12$, $xz = 18$, $yz = 24$, what is xyz?

A. 48 **B.** 54
C. 60 **D.** 72

Q25. For $xy = 12$ (with $x, y > 0$), what is the minimum value of $x^2 + y^2$?

A. 12 **B.** 16
C. 24 **D.** 48

Q26. What is the value of $\Sigma\, C(10, r)$ for $r = 0$ to 10?

A. 512 **B.** 1023
C. 1024 **D.** 2048

Q27. The sum of the 5 tip angles of a regular pentagram (star) is:

A. 180° **B.** 360°
C. 540° **D.** 720°

Q28. What is the remainder when $x^{100} + 1$ is divided by $(x + 1)$?

A. 0 **B.** 1
C. 2 **D.** 3

Q29. 30 know French, 25 know German, 10 know both (out of 50). P(knows exactly one language) = ?

A. 3/5 **B.** 7/10
C. 4/5 **D.** 9/10

Q30. What is the harmonic mean of 2 and 8?

A. 3 **B.** 3.2
C. 4 **D.** 5

Q31. Find the equation of the line perpendicular to $y = 3x - 2$ and passing through (3, 1).

A. $y = 3x + 1$ **B.** $y = -x/3 + 2$
C. $y = x/3 + 2$ **D.** $y = -3x + 2$

Q32. If $f(x) = x^2 - 1$ and $g(x) = 2x + 1$, what is $f(g(x))$?

A. $4x^2 - 4x$ **B.** $4x^2 + 4x$

C. $2x^2 + 2x$ **D.** $4x^2 + 4x + 1$

Q33. Find x: 3^(2x − 1) = 27^(x − 2)

A. 3 **B.** 4

C. 5 **D.** 6

Q34. What is the determinant of the matrix [[3, 5], [2, 4]]?

A. 1 **B.** 2

C. 3 **D.** 4

Q35. Triangle vertices (0, 0), (6, 0), (3, h). If area = 18 sq units, what is h?

A. 4 **B.** 5

C. 6 **D.** 8

Q36. How many real roots does $P(x) = x^4 - 1$ have?

A. 1 **B.** 2

C. 3 **D.** 4

Q37. In an AP, $T_3 = 7$ and $T_7 = 15$. What is T_{15}?

A. 27 **B.** 29

C. 31 **D.** 33

Q38. How many real roots does $x^4 - 5x^2 + 4 = 0$ have?

A. 1 **B.** 2

C. 3 **D.** 4

Q39. Find the remainder when $f(x) = x^3 - 3x + 2$ is divided by $(x - 1)$.

A. −2 **B.** −1

C. 0 **D.** 1

Q40. A sequence: $a_1 = 1$, $a_2 = 1$, $a_n = a_{n-1} + a_{n-2}$. What is a_8?

A. 13

B. 17

C. 21

D. 24

Answer Key

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

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

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

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

Q38: D Q39: C Q40: C