MIND CARVER

GLOBAL MATH OLYMPIAD

Achiever Level — Grades 9–10

Mastering Core Mathematical Concepts

Past Paper — For Reference & Practice

40 Questions · 60 Minutes · 2.5 Marks per Question · 100 Marks Total

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Section 1: Advanced Number Theory (20 Marks)

Q1. What is the remainder when 2^{10} is divided by 5?

A. 1 B. 2 C. 4 D. 0

Q2. How many positive divisors does 72 have?

A. 8 B. 10 C. 12 D. 16

Q3. If $a \equiv 3 \pmod 7$ and $b \equiv 4 \pmod 7$, what is $(a + b) \bmod 7$?

A. 0 B. 7 C. 1 D. 12

Q4. What is the greatest common divisor (GCD) of 48 and 180?

A. 6 B. 12 C. 24 D. 36

Q5. The smallest positive integer n such that $n \equiv 1 \pmod 3$, $n \equiv 2 \pmod 4$, and $n \equiv 3 \pmod 5$ is:

A. 53 B. 47 C. 58 D. 62

Q6. If p is a prime number greater than 3, what is $p^2 \bmod 24$?

A. 1 B. 0 C. p D. Cannot be determined

Q7. What is the sum of the digits of the number 9,999,999?

A. 45 B. 54 C. 63 D. 81

Q8. The least common multiple (LCM) of 12, 18, and 30 is:

A. 90 B. 180 C. 360 D. 60

Section 2: Algebraic Problem Solvers (20 Marks)

Q9. What are the roots of the quadratic equation $x^2 - 5x + 6 = 0$?

A. 2 and 3 B. -2 and -3 C. 1 and 6 D. -1 and -6

Q10. If $f(x) = 2x^2 - 3x + 1$, what is f(-1)?

A. 0 B. 6 C. -4 D. 4

Q11. Solve for x: 3^(2x) = 81.

A. 1 B. 2 C. 4 D. 8

Q12. The sum of the first 20 positive integers is:

A. 200 B. 210 C. 220 D. 400

Q13. If $2x + 3y = 12$ and $x - y = 1$, what is the value of $x + y$?

A. 3 B. 4 C. 5 D. 6

Q14. What is the coefficient of x^2 in the expansion of $(x + 2)^4$?

A. 4 B. 6 C. 12 D. 24

Q15. If $a + b = 7$ and $ab = 10$, what is $a^2 + b^2$?

A. 29 B. 49 C. 69 D. 89

Q16. The range of the function $f(x) = x^2 - 4x + 5$ is:

A. $[1, \infty)$ B. $[-1, \infty)$ C. $[5, \infty)$ D. $(-\infty, 1]$

Section 3: Geometric Innovators (20 Marks)

Q17. In a right triangle, if the two legs are 6 cm and 8 cm, what is the hypotenuse?

A. 10 cm B. 12 cm C. 14 cm D. 100 cm

Q18. What is the area of a circle with diameter 10 cm?

A. 10π cm² B. 25π cm² C. 50π cm² D. 100π cm²

Q19. In triangle ABC, angle A = 50° and angle B = 60°. What is angle C?

A. 50° B. 60° C. 70° D. 80°

Q20. Two similar triangles have corresponding sides in ratio 2:3. If the smaller triangle has area 16 cm², what is the area of the larger?

A. 24 cm² B. 36 cm² C. 48 cm² D. 64 cm²

Q21. What is the sum of the interior angles of a hexagon?

A. 540° B. 720° C. 900° D. 1080°

Q22. A rectangle has length 12 cm and diagonal 13 cm. What is its width?

A. 1 cm B. 5 cm C. 7 cm D. 25 cm

Q23. The circumference of a circle is 22π cm. What is its radius?

A. 11 cm B. 22 cm C. 44 cm D. 7 cm

Q24. In a cyclic quadrilateral ABCD, angle A = 80°. What is angle C?

A. 80° B. 100° C. 120° D. 160°

Section 4: Trigonometry Explorers (20 Marks)

Q25. What is the value of sin(30°) + cos(60°)?

A. 0 B. 1 C. 1.5 D. √3/2

Q26. In a right triangle, if angle θ = 45° and the hypotenuse is 10 cm, what is the length of each leg?

A. 5 cm B. 5√2 cm C. 10/√3 cm D. 10√2 cm

Q27. What is tan(45°)?

A. 0 B. 1 C. √3 D. Undefined

Q28. If sin θ = 0.6, what is cos θ (assuming θ is acute)?

A. 0.4 B. 0.6 C. 0.8 D. 1.0

Q29. The angle of elevation of the top of a 20 m tower from a point 20 m away from its base is:

A. 30° B. 45° C. 60° D. 90°

Q30. What is the value of sin²(30°) + cos²(30°)?

A. 0.5 B. 1 C. 1.5 D. 2

Q31. If cos A = 4/5 in a right triangle, what is tan A?

A. 3/5 B. 3/4 C. 4/3 D. 5/4

Q32. The period of the function y = cos(2x) is:

A. π B. 2π C. π/2 D. 4π

Section 5: Probability & Statistics Lab (20 Marks)

Q33. A bag contains 3 red, 4 blue, and 5 green marbles. What is the probability of drawing a blue marble?

A. 1/3 B. 1/4 C. 1/5 D. 4/12

Q34. The mean of {5, 10, 15, 20, 25} is:

A. 10 B. 15 C. 20 D. 75

Q35. When a fair coin is tossed 3 times, what is the probability of getting exactly 2 heads?

A. 1/8 B. 3/8 C. 1/2 D. 3/4

Q36. The median of the data set {3, 1, 7, 5, 9} is:

A. 3 B. 5 C. 7 D. 9

Q37. If the probability of rain is 0.3, what is the probability it does NOT rain?

A. 0.3 B. 0.5 C. 0.7 D. 1.0

Q38. In a class of 30 students, 18 are girls. What percentage are boys?

A. 30% B. 40% C. 50% D. 60%

Q39. The mode of {2, 3, 3, 5, 5, 5, 7} is:

A. 2 B. 3 C. 5 D. 7

Q40. Two dice are rolled. What is the probability of getting a sum of 9?

A. 1/9 B. 1/12 C. 4/36 D. 1/6