IMO 2025

Second Level

International Maths Olympiad

by **Maths Olympiad Foundation**

Time : 45 Mins | **Class-XI** | **Maximum Marks : 50**

General Instructions:

1. **All questions are mandatory.** Read the questions carefully before selecting an answer.
2. The question paper contains **25 MCQ**, each carrying 2 **marks**.
3. No negative marking for unattempt questions; one mark will be deducted for each incorrect /overwriting or multiple answers. Illegible answers may not be evaluated.
4. Answers must be marked by writing the correct option **(A/B/C/D)** in the **Answer Sheet**.
5. **Use of calculators, smart watches, or any electronic devices is strictly prohibited.**
6. Rough work must be done **only in the A4 sheet provided by the invigilator**.
7. Ensure that your **Name, Roll Number, School Code, and other required details** are correctly filled in the Answer Sheet before submission.
8. The **final Answer Sheet along with the question paper must be submitted to the invigilator** before leaving the examination hall.
9. Any form of **unfair practice will lead to immediate disqualification**.

Q.1. **The value of $\text{Cos}^6 x + \text{Sin}^6 x + 3\,\text{Sin}^2 x - 3\,\text{Sin}^4 x$ is equal to:**

(a) 1 (b) 2

(c) 0 (d) None of these

Q.2. **If $\tan 66° + \tan 69° - \tan 66° \tan 69° = 4k$, then the value of k is:**

(a) $\frac{-1}{4}$ (b) $\frac{-1}{2}$ (c) $\frac{1}{2}$ (d) ???

Q.3. **The radius of circle represented by the equation:**

$3x^2 + 3y^2 + kxy + 9x + (k-6)\,y + 3 = 0$

(a) 2 (b) 1.5 (c) 1 (d) ???

Q.4. **A die is thrown $(2n + 1)$ times. The probability that the faces with even numbers appear odd number of times is:**

(a) 1 (b) $\frac{n+1}{2n+1}$ (c) $\frac{n}{2n+1}$ (d) $\frac{1}{2}$

Q.5. $\lim_{x \to \pi} \left[\frac{1 - \sin \frac{x}{2}}{\cos \frac{x}{2} \left(\cos \frac{x}{4} - \sin \frac{x}{4} \right)} \right] =$

(a) $2\sqrt{2}$ (b) $-\sqrt{2}$ (c) $2\sqrt{2}^{-}$ (d) ???

Q.6. **If** $\bar{Z} = x + i'y, Z^{\frac{1}{3}} = p + i`q$ **then** $\frac{\frac{x}{p} + \frac{y}{q}}{p^2 + q^2}$

(a) 2 (b) –2 (c) p^2 (d) q^2

Q.7. **The term independent of *x* in the expansion of** $\left[\frac{x+1}{x^{2/3} - x^{2/3} + 1} - \frac{x-1}{x - x^{1/2}} \right]^{10}$ **is:**

(a) 310 (b) 120 (c) 210 (d) 130

Q.8. $\lim_{x \to \infty} \left[\frac{1 + 2 + 3 \ldots + n}{n + 2} - \frac{n}{2} \right]$ **is:**

(a) 0.25 (b) –0.5 (c) 1 (d) –1

Q.9. **If the circle** $x^2 + y^2 - 4x + 10y - 7 = 0$ **touches the line** $3x + 4y - p = 0$**, then the value of *p* is:**

(a) 16 (b) 30 (c) 21 (d) ???

Q.10. **The sides of a right angled triangle are in arithmetic progression. If the triangle has area 24 square units, then the lengtyh of the smallest side is:**

(a) 4 (b) 6 (c) 8 (d) 2

Q.11. **The coordinates of the point which is equidistant from the points 0 (0, 0, 0), A (a, 0, 0), B (0, b, 0) and C (0, 0, c) are:**

(a) $(0, 0, \frac{a}{2})$ (b) $(0, 0, \frac{b}{2})$

(c) $\left(\frac{a}{2}, \frac{b}{2}, \frac{c}{2} \right)$ (d) $(0, 0, \frac{c}{2})$

Q.12. A rod AB of length 15 cm rests between two coordinate axes in such a way that the point A lies on *x*-axis and B lies on *y*-axis. A point P is taken on the rod in such a way that AB = 6 cm, the locus of point P is:

(a) $2x + 3y = 16$ (b) $4x^2 + 9y^2 = 324$

(c) $x^2 + y^2 = 36$ (d) $9x^2 + 4y^2 = 324$

Q.13. If *a*, *b*, *c* are in A.P. and $k \neq 0$ is a real number then which of the statements is/are correct?

(I) ka, kb, kc are in A.P.

(II) k–a, k–b, k–c are in A.P.

(III) $\frac{a}{k}, \frac{b}{k}, \frac{c}{k}$ **are in A.P.**

(IV) k + a, k + b, k + c are in A.P.

(a) I and IV only (b) II and III only

(c) II and IV only (d) All of the above

Q.14. A hollow cube of internal edge 22 cm is filled with spherical marbles of diameter 0.5 cm, and it is assumed that $\frac{1}{8}$ **space of the cube remains unfilled. Then the number of marbles that the cube can accomodate is:**

(a) 142296 (b) 142396 (c) 142496 (d) 142596

Q.15. In what ratio shall I add water to liquid detergent costing ₹ 480 per litre to get the resulting mixture worth ₹ 300 per litre.

(a) 5:3 (b) 3:8 (c) 3:5 (d) 5:8

Q.16. Pipes A and B can fill a tank in 4 hours and 5 hours respectively. Another pipe C can empty the full tank in 10 hours. If all the three pipes are opened together, then the tank will be filled in_____ hours.

(a) $1\frac{2}{7}$ (b) $2\frac{6}{7}$ (c) $3\frac{5}{7}$ (d) $4\frac{6}{7}$

Q.17. Consider the statement given below:

(I) Sin *x* is positive in first and second quadrants

(II) If Sin *x* + Sin *y* + Sin *z* = 3 then $\cos^3 x + \cos^3 y + \cos^3 z = \cos x \cos y \cos z$

(III) The value of $f(x) = 3 \sin \sqrt{x^2 - x + 1}$ **lie in the interval [–1, 1]**

(IV) If $\frac{\pi}{2} < x < \frac{3\pi}{2}$ **, then** $\sqrt{\frac{1+\sin x}{1-\sin x}} + \sqrt{\frac{1-\sin x}{1+\sin x}} = -2\sec x$ **Which of the statements given above are correct?**

(a) I and II only (b) II, III and IV only

(c) I, II and IV only (d) All of the above

Q.18. Which of the following statements is/are not true?

(I) In the binomial expansion of $(1 + a)^{m+n}$, the coefficients of a^m and a^n are equal.

(II) If the coefficients of p^{th} and q^{th} terms in the expansion of $(1 + x)^n$ are equal, then $p + q = n$

(III) $n_{c_r} = n_{c_{n-r}}$

(IV) The largest coefficients in the expansion of $(1 + x)^{40}$ is $40_{c_{20}}$

(a) III only (b) II only

(c) I, III and IV (d) I, II and IV

Q.19. The equation of circle drawn with the two foci of $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ as the end points of diameter is:

(a) $x^2 + y^2 = a^2 + b^2$ (b) $x^2 + y^2 = a^2$

(c) $x^2 + y^2 = 2a^2$ (d) $x^2 + y^2 = a^2 - b^2$

Q.20. The maximum value of $\sin^2\left(\frac{2\pi}{3} + x\right) + \sin^2\left(\frac{2\pi}{3} - x\right)$ is:

(a) $\frac{1}{2}$ (b) $\frac{3}{2}$ (c) $\frac{3}{4}$ (d) $\frac{1}{4}$

Q.21. If $\sin\theta$ and $\cos\theta$ are the roots of the equation $ax^2 - bx + c = 0$, then a, b, c satisfy the relation:

(a) $a^2 + b^2 + 2ac = 0$ (b) $a^2 - b^2 + 2ac = 0$

(c) $a^2 - c^2 + 2ab = 0$ (d) $a^2 - b^2 - 2ac = 0$

Q.22. If $\tan\frac{x}{2} = \sqrt{\frac{1-e}{1+e}}\tan\frac{\alpha}{2}$ then $\cos\alpha$ is:

(a) $1 - e\cos(\cos x + e)$ (b) $\frac{1 - e\cos x}{\cos x - e}$

(c) $\frac{1 + e\cos x}{\cos x - e}$ (d) $\frac{\cos x - e}{1 - e\cos x}$

Q.23. The solution set of the inequality $\frac{|x| + 4}{|x| - 4} < 0$ is:

(a) $(-\infty, -4] \cup [4, \infty)$

(b) $(-\infty, -4) \cup [4, \infty)$

(c) $(-4, -4)$

(d) $[-4, 4]$

Q.24. The distance between the orthocentre and circumcentre of a triangle with vertices $(1,2)$, $(2,1)$ and $\left(\frac{3+\sqrt{3}}{2}, \frac{3+\sqrt{3}}{2}\right)$ **is:**

(a) 0

(b) $\sqrt{2}$

(c) $3+\sqrt{3}$

(d) $3-\sqrt{3}$

Q.25. If $y = 1 - \frac{x}{1!} + \frac{x^2}{2!} - \frac{x^3}{3!} + \frac{x^4}{4!}$ **then** $\frac{dy}{dx}$ **is:**

(a) $-y$

(b) y

(c) $-y-1$

(d) $-y+1$