SAMPLE PAPER

International Olympiad Foundation

EXCELLENCE IN EDUCATION
International Olympiad Foundation

14+	MCQ	0
OLYMPIADS	FORMAT	NEGATIVE MARKS

OLYMPIAD

Mathematics Olympiad

International Olympiad Foundation (IOF) · www.iof.education

CLASS / GRADE	SUBJECT	DURATION	MAX MARKS
Class 12	IFMO	60 Min	50

GENERAL INSTRUCTIONS

- All questions are Multiple Choice Questions (MCQs) with options A, B, C, D, E
- Each correct answer carries 1 mark. No negative marking for wrong answers.
- Rough work should be done separately. Do not write on question paper.

PAPER HIGHLIGHTS

- **Multiple Choice Questions (MCQ)**
  Five options per question (A, B, C, D, E). Select the single most appropriate answer.
- **No Negative Marking**
  1 mark per correct answer. Zero deductions — attempt every question.
- **Conducted by IOF**
  International Olympiad Foundation — fostering excellence among students across India.

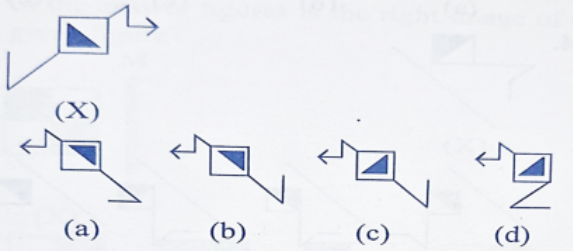
SUBJECTS

Cyber · English · Entrepreneurship · Mathematics · Commerce · Economics · GK & Current Affairs · Science · Western Music · Sanskrit · Indian Music · Hindi · Reasoning & Aptitude · Spell Talent

ALL IOF OLYMPIAD PROGRAMMES

- IFCO — International Foundation Cyber Olympiad
- IFEO — International Foundation English Olympiad
- IFEnO — International Foundation Entrepreneurship Olympiad
- IFMO — International Foundation Mathematics Olympiad
- ICSI — Institute of Company Secretaries of India Commerce Olympiad
- IFEcO — International Foundation Economics Olympiad
- IFGCO — International Foundation General Knowledge & Current Affairs Olympiad
- IFSO — International Foundation Science Olympiad
- IFWMuO — International Foundation Western Music Olympiad
- IFSaO — International Foundation Sanskrit Olympiad
- IFIMuO — International Foundation Indian Music Olympiad
- IFHO — International Foundation Hindi Olympiad
- IFRAO — International Foundation Reasoning & Aptitude Olympiad
- IFSTO — International Foundation Spell Talent Olympiad

Q1. Choose the correct mirror image of the figure (X) when the mirror is placed vertically on the right side of the figure (X). [+1] [-0]



A. (a)

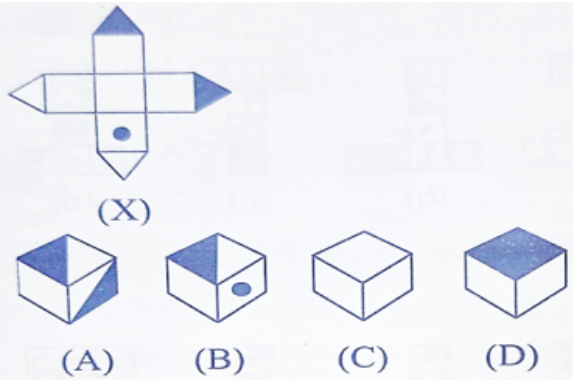
B. (b)

C. (c)

D. (d)

E. None of these

Q2. Select the option which can be formed by folding the given net (X). [+1] [-0]



A. A and B only

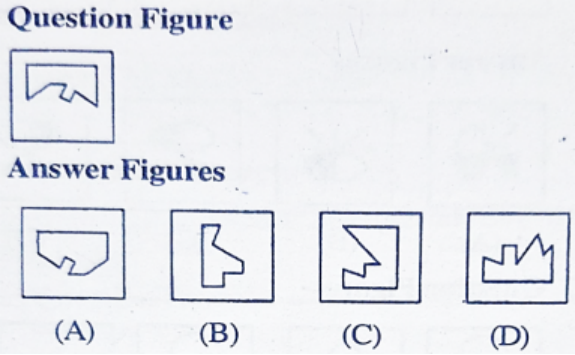
B. B and D only

C. B and C only

D. A and D only

E. None of these

Q3. Choose the option which completes the square given in the question figure. [+1] [-0]



A. (A)

B. (B)

C. (C)

D. (D)

E. None of these

Q4. A man facing east turns 135° to his right hand side walks 5km in the direction and turns 45° towards east and walks 3km in that direction. What direction is he currently facing? [+1] [-0]

A. South-West

B. South

C. East

D. North

E. None of these

Q5. Read the following information and answer the question which follows. [+1] [-0]

If 'A X B' means 'A' is the father of 'B'
If 'A + B' means 'A' is the wife of 'B'
If 'A ÷ B' means 'A' is the daughter of 'B'
If 'A - B' means 'A' is the son of 'B'

How is L related to Q in the expression

L ÷ M x O – P ÷ Q ?

A. Granddaughter

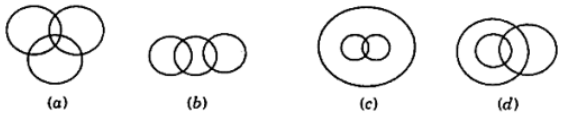
B. Niece

C. Daughter –in-law

D. Daughter

E. None of these

Q6. Which is the most suitable Venn diagram among the following, which represents interrelationship among Antisocial elements, Pick pockets and Black mailers? **[+1]** **[-0]**



A. (a)

B. (b)

C. (c)

D. (d)

E. None of these

Q7. If the 25th of August in a year is Thursday, the number of Mondays in that month is **[+1]** **[-0]**

A. 3

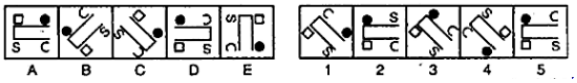
B. 4

C. 5

D. 6

E. None of these

Q8. Choose the correct option to continue the series. **[+1]** **[-0]**



A. 1

B. 2

C. 3

D. 4

E. 5

Q9. In a certain code language, ‘kew xas huna deko’, means ‘she is eating apples’, ‘kew tepo qua’ means ‘she sells toys’ and ‘sul lim deko’ means ‘I like apples’. Which word in the language means ‘she’ and ‘apples’? **[+1]** **[-0]**

A. xas and deko

B. xas and kew

C. kew and deko

D. deko and tepo

E. None of these

Q10. If MADRAS is coded as ODHWGZ then how will CORNER be coded in the same language? **[+1]** **[-0]**

A. ERSVKY

B. ERVSKY

C. ERVSYK

D. EVRSKY

E. None of these

Q11. The missing letters are given in the proper sequence as one of the option. Choose the correct option. [+1]

_aaba_bba_bba_abaa_b [-0]

A. aabab

B. ababa

C. baaba

D. bbaba

E. None of these

Q12. One term in the given number series is wrong. Find out the wrong term. [+1]

5, 27, 61, 122, 213, 340, 509 [-0]

A. 61

B. 27

C. 122

D. 509

E. None of these

Q13. Five groups of letters are given, out of which four are alike in a certain way while one is different. Choose the odd one. [+1]

[-0]

A. BCYZ

B. EFVW

C. HIUV

D. JKQR

E. ABZA

Q14. Choose the odd one out. [+1]

Aravalli hills , Shivalik hills , Mole hills , Satpura hills , Nilgiri hills [-0]

A. Aravalli hills

B. Shivalik hills

C. Mole hills

D. Satpura hills

E. Nilgiri hills

Q15. Select the lettered pair that has the same relationship as the original pair of words. [+1]

Apostate : Religion [-0]

A. Potentate : Kingdom

B. Traitor : Country

C. Bureaucrat : Government

D. Jailor : Law

E. None of these

Q16. Choose the correct option. [+1]

[-0]

If λ be the ratio of the roots of the quadratic equation in x, $3m^2x^2 + m(m-4)x+2 = 0$ then the least value of m for which $\lambda + \frac{1}{\lambda} = 1$, is

A. $-2 + \sqrt{2}$ B. $4 - 2\sqrt{3}$

C. $4 - 3\sqrt{2}$ D. $2 - \sqrt{3}$

A. A

B. B

C. C

D. D

E. None of these

Q17. The value of λ such that sum of the squares of the roots of the quadratic equation, $x^2 + (3 - \lambda)x+2 = \lambda$ has the least value is [+1]

[-0]

A. $\frac{4}{9}$

B. 1

C. $\frac{15}{8}$

D. 2

E. None of these

Q18. Three of the six vertices of a regular hexagon are chosen at random. The probability that the triangle with three vertices is equilateral, equals [+1]

[-0]

A. 1/2

B. 1/5

C. 1/10

D. 1/20

E. All of these

Q19. Fifteen coupons are numbered 1, 2, …. 15, respectively, Seven coupons are selected at random one at a time with replacement. The probability that the largest number appearing on a selected coupon is 9, is [+1] [-0]

A. $\left(\frac{9}{16}\right)^6$ B. $\left(\frac{8}{15}\right)^7$

C. $\left(\frac{3}{5}\right)^7$ D. 0

A. A

B. B

C. C

D. D

E. None of these

Q20. For the following question, choose the correct answer from the codes (A), (B), (C) and (D) defined as follows. [+1] [-0]

Consider the system of equations
$ax + by = 0, cx + dy = 0,$
where $a, b, c, d, \in \{0, 1\}$.
Statement I : The probability that the system of equations has a unique solution is 3/8.
Statement II : The probability that the system of equations has a solution, is 1

(A) Statement I is true, Statement II is also true; Statement II is the correct explanation of Statement I.
(B) Statement I is true, Statement II is also true; Statement II is not the correct explanation of Statement I.
(C) Statement I is true; Statement II is false.
(D) Statement I is false, Statement II is true.

A. (A)

B. (B)

C. (C)

D. (D)

E. None of these

Q21. A fair die is tossed repeatedly until a six is obtained. Let X denote the number of tosses required. [+1] [-0]

The Probability that X = 3 equals

A. $\frac{25}{216}$ B. $\frac{25}{36}$

C. $\frac{5}{36}$ D. $\frac{125}{216}$

A. A

B. B

C. C

D. D

E. None of these

Q22. Choose the correct option. [+1]

[-0]

Let $A = \begin{bmatrix} 0 & 2q & r \\ p & q & -r \\ p & -q & r \end{bmatrix}$. If $AA^T = I_3$, then $|p|$ is

A. $\frac{1}{\sqrt{5}}$ B. $\frac{1}{\sqrt{2}}$

C. $\frac{1}{\sqrt{3}}$ D. $\frac{1}{\sqrt{6}}$

A. A

B. B

C. C

D. D

E. None of these

Q23. If A and B are square matrices of equal degree, then which one is correct among the following? [+1]

A. A + B = B + A [-0]

B. A + B = A - B

C. A – B = B - A

D. AB = BA

E. None of these

Q24. Choose the correct option. [+1]

If $A = \begin{bmatrix} 5a & -b \\ 3 & 2 \end{bmatrix}$ and A (adj A) = AA^T, then 5a + b is equal to [-0]

A. -1

B. 5

C. 4

D. 13

E. None of these

Q25. Given, 2x – y + 2z = 2, x - 2y + z = -4, x + y + λz = 4, then the value of λ such that the given system of equations has no solution is [+1]

[-0]

A. 3

B. 1

C. 0

D. -3

E. None of these

Q26. Choose the correct option. [+1]

If the function $f: R - \{1, -1\} \to A$ defined by f(x) = $\frac{x^2}{1-x^2}$, is surjective, then A is equal to [-0]

A. R – [-1) B. [0, ∞)

C.R – [-1, 0) D. R – (-1, 0)

A. A

B. B

C. C

D. D

E. None of these

Q27. Choose the correct option. [+1]

The function $f: \boldsymbol{R} \to \left[-\frac{1}{2}, \frac{1}{2}\right]$ defined as $f(x) = \frac{x}{1+x^2}$ is [-0]

A. invertible

B. injective but not surjective

C. surjective but not injective

D. neither injective nor surjective

E. None of these

Q28. Choose the correct option. [+1]

If $f(x)$ = sin x + cos x, g(x) = $x^2 - 1$, then g{ $f(x)$} is invertible in the domain [-0]

A. $\left[0, \frac{\pi}{2}\right]$ B. $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$

C. $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ D. $[0, \pi]$

A. A

B. B

C. C

D. D

E. None of these

Q29. If y is a function of x and log(x + y) = 2xy, then the value of y'(0) is [+1]

A. 1 [-0]

B. -1

C. 2

D. 0

E. None of these

Q30. Choose the correct option. [+1]

If $x^2 + y^2 = 1$, then [-0]

A. $yy'' - 2(y')^2 + 1 = 0$ B. $yy'' + (y')^2 + 1 = 0$
C. $yy'' + (y')^2 - 1 = 0$ D. $yy'' + 2(y')^2 + 1 = 0$

A. A

B. B

C. C

D. D

E. None of these

Q31. If the tangent to the curve, $y = x^3 + ax - b$ at the point (1, -5) is perpendicular to the line, $-x + y + 4 = 0$, then which one of the following points lies on the curve? [+1] [-0]

A. (-2, 2)

B. (2, -2)

C. (-2, 1)

D. (2, -1)

E. None of these

Q32. If the curves $y^2 = 6x$, $9x^2 + by^2 = 16$ intersect each other at right angles, then the value of b is [+1] [-0]

A. 6

B. $\frac{7}{2}$

C. 4

D. $\frac{9}{2}$

E. None of these

Q33. A spherical iron ball of radius 10 cm is coated with a layer of ice of uniform thickness that melts at a rate of $50cm^3$ / min. When the thickness of the ice is 5cm, then the rate at which the thickness (in cm/min) of the ice decreases, is [+1] [-0]

A. $\frac{1}{9\pi}$ B. $\frac{1}{18\pi}$
C. $\frac{1}{36\pi}$ D. $\frac{5}{6\pi}$

A. A

B. B

C. C

D. D

E. None of these

Q34. If $f(x)= x^3 + bx^2 + cx + d$ and $0 < b^2 < c$ then in $(-\infty, \infty)$ **[+1]**

[-0]

A. f(x) is strictly increasing function

B. f(x) has a local maxima

C. f(x) is strictly decreasing function

D. f(x) is bounded

E. None of these

Q35. If 20m of wire is available for fencing off a flower-bed in the form of a circular sector, then the maximum area (in sq. m) of the flower-bed is **[+1]**

[-0]

A. 12.5

B. 10

C. 25

D. 30

E. None of these

Q36. Choose the correct option. **[+1]**

The integral $\int sec^{2/3} x \operatorname{cosec}^{4/3} x \, dx$ is equal to (here C is a constant of integration)

[-0]

A. $3\tan^{-1/3} x + C$

B. $-3\tan^{-1/3} x + C$

C. $-3\cot^{-1/3} x + C$

D. $-\frac{3}{4}\tan^{-4/3} x + C$

E. None of these

Q37. Choose the correct option. **[+1]**

Let a function $f: (0,\infty) \to (0,\infty)$ be defined by $f(x)=\left|1-\frac{1}{x}\right|$. Then, f is **[-0]**

A. injective only

B. both injective as well as surjective

C. not injective but it is surjective

D. neither injective nor surjective

E. None of these

Q38. Choose the correct option. [+1]

[-0]

The area (in sq units) of the region $\{(x, y): y^2 \geq 2x \text{ and } (x^2 + y^2 \leq 4x, x \geq 0, y \geq 0\}$ is

A. $\pi - \frac{4}{3}$ B. $\pi - \frac{8}{3}$

C. $\pi - \frac{4\sqrt{2}}{3}$ D. $\frac{\pi}{2} - \frac{2\sqrt{2}}{3}$

A. A

B. B

C. C

D. D

E. None of these

Q39. Choose the correct option. [+1]

[-0]

The area (in sq. units) of the region $A = \{(x, y) : x^2 \leq y \leq x + 2\}$ is

A. $\frac{13}{6}$ B. $\frac{9}{2}$

C. $\frac{31}{6}$ D. $\frac{10}{3}$

A. A

B. B

C. C

D. D

E. None of these

Q40. Choose the correct option. [+1]

[-0]

Let y(x) be a solution of the differential equation $(1+e^x)y' + ye^x = 1$. If $y(0) = 2$ then which of the following statements(s) is /are true?

A. $y(-4) = 0$

B. $y(-2) = 0$

C. y(x) has a critical point in the interval (-1, 0)

D. y(x) has no critical point in the interval (-1, 0)

E. None of these

Q41. If a curve passes through the point (1, -2) and has slope of the tangent at any point (x, y) on it as $\frac{x^2-2y}{x}$, then the curve also passes through the point [+1]

[-0]

A. $(\sqrt{3}, 0)$

B. (-1, 2)

C. $(-\sqrt{2}, 1)$

D. (3 , 0)

E. None of these

Q42. Let a = 3i + 2j + 2k and b= i + 2j – 2k be two vectors. If a vector perpendicular to both the vectors a+b and a-b has the magnitude 12, then one such vector is [+1] [-0]

A. 4(2i + 2j + k)

B. 4(2i - 2j - k)

C. 4(2i + 2j - k)

D. 4(-2i - 2j + k)

E. None of these

Q43. Let A(3, 0, -1), B(2, 10, 6) and C(1, 2, 1) be the vertices of a triangle and M be the mid-point of AC. If G divides BM in the ratio 2:1, then cos (∠GOA) (O being the origin) is equal to [+1] [-0]

A. $\frac{1}{\sqrt{15}}$ B. $\frac{1}{2\sqrt{15}}$

C. $\frac{1}{\sqrt{30}}$ D. $\frac{1}{6\sqrt{10}}$

A. A

B. B

C. C

D. D

E. None of these

Q44. Choose the correct option. [+1] [-0]

If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are unit coplanar vectors, then the scalar triple product $[\,2\vec{a} - \vec{b} \quad 2\vec{b} - \vec{c} \quad 2\vec{c} - \vec{a}\,]$ is

A. 0

B. 1

C. -√3

D. √3

E. None of these

Q45. A plane which bisects the angle between the two given planes 2x – y + 2z – 4 = 0 and x+ 2y + 2z – 2 = 0, passes through the point [+1] [-0]

A. (1, -4, 1)

B. (1, 4, -1)

C. (2, 4, 1)

D. (2, -4, 1)

E. None of these

Q46. The distance of the point (1, 1, 1) from the plane passing through the point (-1, -2, -1) and whose normal is perpendicular to both the lines L_1 and L_2 is [+1] [-0]

A. 2/√75units

B. 7/√75units

C. 13/√75units

D. 23/√75units

E. None of these

Q47. Choose the correct option. [+1] [-0]

At present, a firm is manufacturing 2000 items. It is estimated that the rate of change of production P with respect to additional number of workers x is given by $\frac{dP}{dx} = 100 - 12\sqrt{x}$. If the firm employees 25 more workers, then the new level of production of items is

A. 2500

B. 3000

C. 3500

D. 4500

E. None of these

Q48. The area (in sq. units) of region described by $\{(x, y), y^2 \leq 2x \text{ and } y \geq 4x - 1\}$ is [+1] [-0]

A. $\frac{7}{32}$

B. $\frac{5}{64}$

C. $\frac{15}{64}$

D. $\frac{9}{32}$

E. None of these

Q49. Choose the correct option. **[+1]**

[-0]

If $\int x^5 e^{-4x^8}\, dx = \frac{1}{48} e^{-4x^8} f(x)+C$

Where C is a constant of integration, then $f(x)$ is equal to

A. $- 4x^3 -1$

B. $4x^3 + 1$

C. $- 2x^3 - 1$

D. $– 2x^3 + 1$

E. None of these

Q50. Choose the correct option. **[+1]**

[-0]

If $f(x) = \sin x + \cos x$, $g(x) = x^2 – 1$, then $g\{(f(x))\}$ is invertible in the domain

A. $\left[0, \frac{\pi}{2}\right]$ B. $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$

C. $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ D. $[0, \pi]$

A. A

B. B

C. C

D. D

E. None of these

INTERNATIONAL OLYMPIAD FOUNDATION (IOF)

ANSWER KEY

Mathematics Olympiad

www.iof.education

CLASS / GRADE	SUBJECT	TOTAL QUESTIONS	MAX MARKS
Class 12	IFMO	50	50

ANSWER SHEET — 50 QUESTIONS

Q#	ANS	Q#	ANS	Q#	ANS	Q#	ANS	Q#	ANS
Q01	C	Q11	A	Q21	A	Q31	B	Q41	A
Q02	C	Q12	B	Q22	B	Q32	D	Q42	B
Q03	A	Q13	C	Q23	A	Q33	B	Q43	A
Q04	B	Q14	C	Q24	B	Q34	A	Q44	A
Q05	A	Q15	B	Q25	B	Q35	C	Q45	D
Q06	C	Q16	C	Q26	C	Q36	B	Q46	C
Q07	C	Q17	D	Q27	C	Q37	D	Q47	C
Q08	C	Q18	C	Q28	B	Q38	B	Q48	D
Q09	C	Q19	B	Q29	A	Q39	B	Q49	A
Q10	B	Q20	B	Q30	B	Q40	C	Q50	B