SCIENCE OLYMPIAD FOUNDATION

SAMPLE PAPER SYLLABUS 2021-22

IMO

CLASS 12

IMO

SOF INTERNATIONAL MATHEMATICS OLYMPIAD

Total Questions : 50 Time : 1 hr.

PATTERN & MARKING SCHEME				
Section	(1) Logical Reasoning	(2) Mathematical Reasoning or Applied Mathematics	(3) Everyday Mathematics	(4) Achievers Section
No. of Questions	15	20	10	5
Marks per Ques.	1	1	1	3

SYLLABUS

Section – 1 : Verbal and Non-Verbal Reasoning.

Section – 2 : Relations and Functions, Inverse Trigonometric Functions, Matrices and Determinants, Continuity and Differentiability, Application of Derivatives, Integrals, Application of Integrals, Differential Equations, Vector Algebra, Three Dimensional Geometry, Probability, Linear Programming.

OR

Section – 2 : Numbers, Quantification, Numerical Applications, Solutions of Simultaneous Linear Equations, Matrices, Determinants, Application of Derivatives, Integration, Application of Integrations, Differential Equations, Probability, Inferential Statistics, Index numbers, Time-based data, Financial Mathematics, Linear Programming.

Section – 3 : The syllabus of this section will be based on the syllabus of Quantitative Aptitude.

Section – 4 : Matrices, Determinants, Application of Derivatives, Integration, Application of Integrations, Differential Equations, Linear Programming, Probability.

LOGICAL REASONING

1. In the given letter series, some of the letters are missing which are given in that order as one of the options below it. Choose the correct option.

a_cb_abcb_a_cbc_bcbc

(A) cccbc (B) cbbac
(C) bccba (D) abbba

2. Following letters are to be coded as follows:

Letter: R D A E J M K T B U I P W H F

Codes: 4 8 5 $ * 1 2 6 % © 7 @ 3 9 #

While coding the given letters, following conditions are to be observed.

Conditions:

(i) If the first letter is a consonant and the last letter is a vowel, then both are to be coded as d.

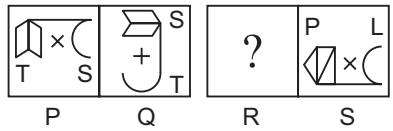
(ii) If both the first and the last letters are consonants, then both are to be coded as the code for the last letter.

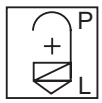
(iii) If the first letter is a vowel and the last letter is a consonant, then their codes are to be interchanged.

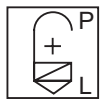
What will be the code for METUFB?

(A) %$6©#1 (B) 1$6©#1
(C) %$6©#% (D) 1$6©#%

3. There is a definite relationship between figures P and Q. Establish a similar relationship between figures R and S by selecting a figure from the options that would replace the (?) in figure R.



(A) 

(B) 

(C) 

(D) 

MATHEMATICAL REASONING

4. $\int \frac{dx}{[(x-1)^3(x+2)^5]^{1/4}} =$

(A) $\frac{4}{3}\left(\frac{x-1}{x+2}\right)^{1/4}+C$ (B) $\frac{4}{3}\left(\frac{x+2}{x-1}\right)^{1/4}+C$

(C) $\frac{1}{3}\left(\frac{x-1}{x+2}\right)^{1/4}+C$ (D) $\frac{1}{3}\left(\frac{x+2}{x-1}\right)^{1/4}+C$

5. Degree of the differential equation

$$\left[1+2\left(\frac{dy}{dx}\right)^2\right]^{3/2} = 5\frac{d^2y}{dx^2} \text{ is}$$

(A) 1 (B) 2
(C) 3 (D) 4

6. The value of x for which the matrix product

$$\begin{bmatrix} 2 & 0 & 7 \\ 0 & 1 & 0 \\ 1 & -2 & 1 \end{bmatrix}\begin{bmatrix} -x & 14x & 7x \\ 0 & 1 & 0 \\ x & -4x & -2x \end{bmatrix}$$

is equal to identity matrix is

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$

(C) $\frac{1}{4}$ (D) $\frac{1}{5}$

APPLIED MATHEMATICS

4. If A and B are square matrices of the same order and A is non-singular, then for a positive integer n, $(A^{-1}BA)^n$ is equal to

(A) $A^nB^nA^n$ (B) $A^nB^nA^{-n}$

(C) $A^{-1}B^nA$ (D) $n(A^{-1}BA)$

5. The area bounded by $y = x^2 + 2$, x-axis, $x = 1$ and $x = 2$ is

(A) $\frac{16}{3}$ sq. units (B) $\frac{17}{3}$ sq. units

(C) $\frac{13}{3}$ sq. units (D) $\frac{20}{3}$ sq. units

6. Records show that probability of a car breaking down while driving through a certain tunnel is 0.0004. The probability that out of 2000 cars that drive through this tunnel at least one will break is

(A) $e^{\frac{-4}{5}}$ (B) $1 - e^{\frac{4}{5}}$

(C) $1 - e^{\frac{-4}{5}}$ (D) $1 + e^{\frac{-4}{5}}$

EVERYDAY MATHEMATICS

7. A can lay railway track between two given stations in 16 days and B can do the same job in 12 days. With the help of C, they did the job in 4 days only. Then C alone can do the job in

(A) $9\frac{1}{5}$ days (B) $9\frac{2}{5}$ days

(C) $9\frac{3}{5}$ days (D) 9 days

8. In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways can they be selected such that at least one boy should be there?

(A) 159
(B) 194
(C) 205
(D) 209

ACHIEVERS SECTION

9. Consider the following statements.

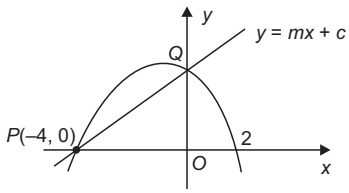
Statement 1 : A tangent parallel to x-axis can be drawn for $f(x) = (x - 1)(x - 2)(x - 3)$ in the interval $[1, 3]$.

Statement 2 : A horizontal tangent can be drawn in Rolle's theorem.

Which of the following options is correct?

(A) Both Statement 1 and Statement 2 are true.
(B) Both Statement 1 and Statement 2 are false.
(C) Statement 1 is true but Statement 2 is false.
(D) Statement 1 is false but Statement 2 is true.

10. The diagram shows a quadratic curve and a straight line $y = mx + c$. They meet at the points P and Q on the x-axis and y-axis respectively.



(a) Find the equation of the quadratic curve.

(b) Find the values of m and c respectively.

	(a)	(b)
(A)	$-x^2 - 2x + 8$	2, 8
(B)	$x^2 + 2x + 8$	6, 4
(C)	$x^2 - 2x - 8$	4, 6
(D)	$-x^2 - 2x + 8$	8, 2

ANSWERS

1. (C) 2. (C) 3. (D)
(MATHEMATICAL REASONING) 4. (A) 5. (B) 6. (D)
(APPLIED MATHEMATICS) 4. (C) 5. (C) 6. (C)
7. (C) 8. (D) 9. (A) 10. (A)