SCIENCE OLYMPIAD FOUNDATION

# SAMPLE PAPER SYLLABUS 2016-17

IMO

CLASS **12**

IMO

**SOF INTERNATIONAL MATHEMATICS OLYMPIAD**

Total Questions : 50 | Time : 1 hr.

| PATTERN & MARKING SCHEME | | | | |
|---|---|---|---|---|
| Section | (1) Logical Reasoning | (2) Mathematical Reasoning | (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.

**Section – 3 :** The Syllabus of this section will be based on the Syllabus of Mathematical Reasoning and Quantitative Aptitude.

**Section – 4 :** Higher Order Thinking Questions - Syllabus as per Section – 2.

## 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_a_aba_cbc_

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

**2.** There is a group of letters followed by four combinations of digits/symbols. You have to find out which of the combinations correctly represents the group of letters based on the following coding system and the conditions.

**Letter:** R D A E J M K T B U I P W H F
**Digit/ Symbol:** 4 8 5 $ * 1 2 6 % © 7 @ 3 9 #

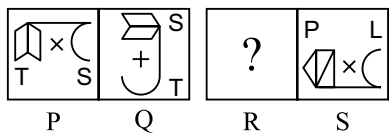
**Conditions:**

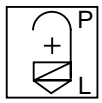
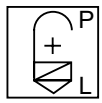
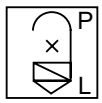
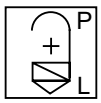
(i) If the first letter is a consonant and the last letter is a vowel, both are to be coded as d.
(ii) If both the first and the last letters are consonants, both are to be coded as the code for the last letter.
(iii) If the first letter is a vowel and the last letter is a consonant, their codes are to be interchanged.

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

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

**6.** The value of $x$ for which the matrix product

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

equals an identity matrix is

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

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

## 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) 10 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 option hold?

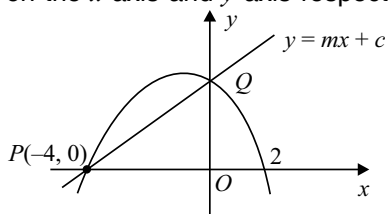
(A) Both statement 1 and statement 2 are true.

(B) Both statement 1 and statement 2 are false.

(C) Statement 1 is true, Statement 2 is false.

(D) Statement 1 is false, 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 |

**SPACE FOR ROUGH WORK**

**ANSWERS**

**IMO –** 1. (C) 2. (C) 3. (D) 4. (A) 5. (B) 6. (D) 7. (C) 8. (D) 9. (A) 10. (A)