



ITL PUBLIC SCHOOL
ANNUAL EXAMINATION(2022-23)

Date:10.02.23

Class: XI

MATHEMATICS(041) – SET A

Time: 3 hrs

M. M: 80

General Instructions:

1. This Question paper contains - **five Sections** A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. **Section A** has 18 One mark Questions and 02 Assertion-Reason based questions of 1 mark each.
3. **Section B** has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. **Section C** has 6 Short Answer (SA)-type questions of 3 marks each.
5. **Section D** has 4 Long Answer (LA)-type questions of 5 marks each.
6. **Section E** has 3 Source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

SECTION A

Each question carries 1 mark

- 1 Let A and B be two sets having 4 and 7 elements respectively. Then write the maximum number of elements that $A \cup B$ can have. 1
- 2 If p, q be two A.M.'s and G be one G.M. between two numbers, then write G^2 in terms of p and q only. 1
- 3 Let $f(x)$ be a function defined by $f(x) = \begin{cases} 4x - 5, & \text{if } x \leq 2 \\ x - \lambda, & \text{if } x > 2 \end{cases}$. Find λ , if $\lim_{x \rightarrow 2} f(x)$ exists. 1
- 4 If $f(1) = 1, f'(1) = 2$, then write the value of $\lim_{x \rightarrow 1} \frac{\sqrt{f(x)} - 1}{\sqrt{x} - 1}$. 1
- 5 Write the least positive integral value of n for which $\left(\frac{1+i}{1-i}\right)^n$ is equal to 1. 1
- 6 What is the probability that a randomly chosen two digit positive integer is a multiple of 3? 1
- 7 Find the value of $\sin^2 75^\circ + \sin^2 15^\circ$ 1
- 8 If n is any positive integer, write the value of $\frac{i^{4n+1} - i^{4n-1}}{2}$ 1
- 9 Expand using binomial theorem : $\left(x + \frac{2}{x}\right)^4$ 1
- 10 Write the set $X = \left\{1, \frac{1}{4}, \frac{1}{9}, \frac{1}{16}, \frac{1}{25}, \dots\right\}$ in set builder form. 1
- 11 Solve the following in equations: $\frac{5x-2}{3} - \frac{7x-3}{5} > \frac{x}{4}$ 1
- 12 If ${}^{43}C_{r-6} = {}^{43}C_{3r+1}$, then find the value of r. 1
- 13 Find the range of the function $f(x) = \frac{x^2-9}{x-3}$ 1
- 14 Find the eccentricity of the hyperbola satisfying the given conditions vertices $(0, \pm 3)$, Length of conjugate axis is 6. 1
- 15 Find the value of λ , if the lines $3x - 4y - 13 = 0, 8x - 11y - 33 = 0$ and $2x - 3y + \lambda = 0$ are concurrent. 1
- 16 Find the image of $(-2, 3, 4)$ in the yz - plane. 1

- 17 Find the value of $\tan\left(\frac{11\pi}{6}\right)$ 1
- 18 Find the distances of the point P (- 4,3,5) from y axis. 1
- 19 ASSERTION-REASON BASED QUESTIONS(19,20) 1

In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

- (a) Both A and R are true and R is the correct explanation of A.
 (b) Both A and R are true but R is not the correct explanation of A.
 (c) A is true but R is false.
 (d) A is false but R is true.

ASSERTION: The number of terms in the expansion of $\{(3x + y)^8 - (3x - y)^8\}$ are 4.

REASON: If n is even then the expansion of $\{(x + a)^n - (x - a)^n\}$ have $(n + 2)/2$ terms.

- 20 Assertion (A) The fourth term of a GP is the square of its second term and the first term is -3, then its 7th term is equal to - 2187. 1
- Reason (R) : the nth term of G.P is ar^{n-1}

SECTION B

This section comprises of very short answer type-questions (VSA) of 2 marks each

- 21 Find the equation of the line mid-way between the parallel lines $9x + 6y - 7 = 0$ and $3x + 2y + 6 = 0$ 2
- 22 Using binomial theorem, prove that $6^n - 5n$ always leaves the remainder 1 when divided by 25. 2

OR

If a and b are distinct integers, prove that $a^n - b^n$ is divisible by (a - b), whenever $n \in \mathbb{N}$.

- 23 Evaluate: $\lim_{x \rightarrow 5} \frac{x-5}{\sqrt{6x-5} - \sqrt{4x+5}}$ 2

OR

Find the value of k, if

$$\lim_{x \rightarrow 1} \frac{x^4 - 1}{x - 1} = \lim_{x \rightarrow k} \frac{x^3 - k^3}{x^2 - k^2}.$$

- 24 If α and β are different complex numbers with $|\beta| = 1$, find $\left| \frac{\beta - \alpha}{1 - \bar{\alpha}\beta} \right|$ 2

OR

Find real value of x and y for which the following equalities hold:

$$(1+i)y^2 + (6+i) = (2+i)x$$

- 25 Show that the points A (1, 3, 4), B (- 1, 6,10), C (- 7, 4, 7) and D (- 5, 1, 1) are the vertices of a rhombus. 2

SECTION C

(This section comprises of short answer type questions (SA) of 3 marks each)

- 26 Evaluate: (a) $\lim_{x \rightarrow 0} \frac{\cot 2x - \operatorname{cosec} 2x}{x}$ (b) $\lim_{x \rightarrow 0} \frac{\sin 2x + \sin 3x}{2x + \sin 3x}$ 1.5+1.5
- 27 a) Redefine the function: $f(x) = |x - 1| + |x + 6|$. 1.5+1.5
 b) Let $A = \{1,2,3,4,5,6\}$. Let R be a relation on A defined by $\{(a, b): a, b \in A, b \text{ is exactly divisible by } a\}$ (i) Write R in roster form (ii) Find the range of R.

- 28 How many litres of water will have to be added to 1125 litres of the 45% solution of acid so that the resulting mixture will contain more than 25% but less than 30% acid content? 3

OR

- a) A man wants to cut three lengths from a single piece of board of length 100 cm. The second length is to be 5 cm longer than the shortest and third length is to be twice as long as the shortest. What are the possible lengths for the shortest board if third piece is to be at least 5 cm longer than the second.
- b) Solve:

$$|3x - 2| \leq \frac{1}{2}$$

- 29 On her vacations Veena visits four cities A, B, C and D in a random order. What is the probability that she visits. 3
- (i) A before B? (ii) A before B and B before C?
(iii) A first and B last?

- 30 Prove that : 3

$$2 \cos \frac{\pi}{13} \cos \frac{9\pi}{13} + \cos \frac{3\pi}{13} + \cos \frac{5\pi}{13} = 0$$

OR

Show that : $\sqrt{2 + \sqrt{2 + \sqrt{2 + 2 \cos 8\theta}}} = 2 \cos \theta$

- 31 Find the equation of the circle passing through the points (1, -2) and (4, -3) and centre lies on the line $3x + 4y = 7$. 3

OR

A rod of length 12 m moves with its ends always touching the coordinate axes. Determine the equation of the locus of a point P on the rod, which is 3 cm from the end in contact x-axis.

SECTION D

(This section comprises of long answer-type questions (LA) of 5 marks each)

- 32 The mean and standard deviation of 20 observations are found to be 10 and 2 respectively. On rechecking, it was found that an observation 8 was incorrect. Calculate the correct mean and standard deviation if the wrong item is omitted. 5

OR

The following table gives the distribution of income of 100 families in a village. Calculate the mean and Standard Deviation :

Income (Rs)	0-1000	1000-2000	2000-3000	3000-4000	4000-5000	5000-6000
No. of Families	18	26	30	12	10	4

- 33 a) Differentiate $\sin x^2$ from first principle. 3+1+1
 b) If $y = \left(\frac{2-3 \cos x}{\sin x}\right)$, find $\frac{dy}{dx}$ at $x = \frac{\pi}{6}$
 c) Differentiate the following function w.r.t. x: $(x + \sec x)(x - \tan x)$

OR

- a) Differentiate $\tan(3x+1)$ from first principle
 b) Differentiate the following function w.r.t. x: $(x + \cot x)(x - \operatorname{cosec} x)$
 c) If for $f(x) = \lambda x^2 + \mu x + 12$, $f'(4) = 15$ and $f'(2) = 11$, then find λ and μ .
- 34 a) If the first and the nth terms of a G. P. are a and b respectively and if P is the product of the first n terms, prove that $P^2 = (ab)^n$. 3+2

- b) If $x = 1 + a + a^2 + \dots \infty$, where $|a| < 1$ and $y = 1 + b + b^2 + \dots \infty$, where $|b| < 1$.
Prove that :

$$1 + ab + a^2b^2 + \dots \infty = \frac{xy}{x+y-1}$$

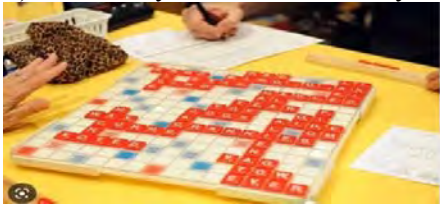
- 35 If $\tan \alpha = \frac{p}{q}$, where $\alpha = 6\beta$, α being an acute angle, prove that 5

$$\frac{1}{2} \{p \operatorname{cosec} 2\beta - q \sec 2\beta\} = \sqrt{p^2 + q^2}$$

SECTION E

CASE STUDY QUESTIONS

- 36 Alka is doing an experiment in which she has to arrange letters of word ALLAHABAD given in puzzle in order to form words with or without meaning using all letters 4
- a) How many words start and end with letter A?
b) How many words can be formed when all A's donot come together?
c) How many words have exactly 3 letters in between H and B?



- 37 In a game Ravi told his friend Mohan to make a 4-digit number greater than 5000 from the digits 0, 1, 3, 5 and 7, then he asked him to calculate the Probability of forming number divisible by 5 when 2+2
- (i) the digits may be repeated (ii) the repetition of digits is not allowed.
- 38 A person is standing at a point **A** of a triangular park **ABC** whose vertices are **A**(2, 0), **B** (3, 4) and **C**(5, 6). Based on the above information answer the following :- 4
- a) Find the equation of **BC**.
b) Person **A** wants to reach on path **BC** in least time. Find the coordinates of the point on **BC** where he meets and the equation of the path he follows .
c) Find the shortest distance travelled by **A** to reach on path **BC**.