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# CLASS: XI
# ANNUAL EXAMINATION (2024 – 25)
# SUBJECT: MATHEMATICS (041)
# SET-C1

**Time: 3 Hrs.** **Max. Mark: 80**

General Instructions:

Read the following instructions very carefully and strictly follow them:

(i) This Question paper contains 38 questions. All questions are compulsory.

(ii) This Question paper is divided into five Sections - A, B, C, D and E.

(iii) In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.

(iv) In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.

(v)In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.

(vi) In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.

(vii) In Section E, Questions no. 36 to 38 are Case study-based questions, carrying 4 marks each.

(viii) There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and one subpart each in 2 questions of Section E

## SECTION A
**(Multiple Choice Questions) Each question carries 1 mark.**

1. On the real axis, if $A = [0,3]$ and $B = [2,6]$, then $A \cap B$ is
   a) $[2,3]$ b) $(2,3)$ c) $(0,6)$ d) $[0,6]$

2. Let $S = \{x: x \text{ is a positive multiple of } 3 \text{ less than } 100\}$, $P = \{x: x \text{ is a prime number less than } 20\}$. Then $n(S) + n(P) =$
   a) 30 b) 33 c) 34 d) 41

3. If $R$ be a relation from a set $A$ to a set B then
   a) $R = A \cup B$ b) $R = A \cap B$ c) $R \subseteq A \times B$ d) $R \subseteq B \times A$

4. Let $n(A) = 4$, then the number of relations on A is
   a) $2^4$ b) $2^8$ c) $2^{4!}$ d) $2^{16}$

5. The value of $\sin 50° - \sin 70° + \sin 10°$ is equal to
   a) 0 b) 1 c) 2 d) $\frac{1}{2}$

6. Which of the following numbers is/are rational:

a) $\sin 15°$ b) $\cos 15°$ c) $\sin 15° \cos 15°$ d) $\sin 15° \cos 75°$

7. If $i = \sqrt{-1}$ then $1 + i^2 + i^3 - i^6 + i^8$ is equal to
   a) $2 - i$ b) 1 c) 3 d) $-1$

8. If $x, y \in R$, then $x + iy$ is a non-real complex number if
   a) $x = 0$ b) $y = 0$ c) $x \neq 0$ d) $y \neq 0$

9. If $x^2 > 16$, then x belongs to
   a) $(-4,4)$ b) $(0,4)$ c) $(4, \infty)$ d) $(-\infty, -4) \cup (4, \infty)$

10. In how many ways can be bowler take four wickets in a single 6 balls over?
    a) 6 b) 15 c) 20 d) 30

11. If second term of a G.P. is 2 and the sum of its infinite term is 8, then its first term is
    a) $\frac{1}{4}$ b) $\frac{1}{2}$ c) 2 d) 4

12. If the arithmetic and geometric means of two numbers are 10 and 8 respectively, then one number exceeds the other number by
    a) 8 b) 10 c) 12 d) 16

13. The centre of the circle $x^2 + y^2 - 6x + 4y - 12 = 0$ is $(a, b)$ then $(2a + 3b)$ is
    a) 0 b) 2 c) 3 d) 5

14. The locus of a point for which $y = 0, z = 0$ is
    a) $x$ −axis b) $y$ −axis c) $z$ −axis d) $z$ and $y$ axes

15. The value of $\lim_{x \to 0} \frac{\log(1-3x)}{x}$ is
    a) $-\frac{1}{3}$ b) $-3$ c) 3 d) $\frac{1}{3}$

16. If $xy = 4$, then $\frac{dy}{dx} =$
    a) $-\frac{x}{y}$ b) $-\frac{4}{y^2}$ c) $4x^2$ d) $-\frac{4}{x^2}$

17. The value of $\lim_{x \to \pi} \frac{\sin x}{x - \pi}$ is
    a) 1 b) 2 c) $-1$ d) $\pi$

18. Three unbiased coins are tossed. If the probability of getting at least 2 tails is p, then value of 8p is
    a) 0 b) 1 c) 3 d) 4

**ASSERTION- REASONING**

Of the following statements, choose the correct one.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true and R is not correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

19. Assertion (A): Product of five consecutive natural numbers is divisible by 4!.
Reason (R): Product of $n$ consecutive natural number is divisible by $(n+1)!$

20. Assertion (A): The ratio of the radii of two circles at the centres of which two equal arcs subtend angles of $30°$ and $70°$ is 21:10.
Reason (R): Number of radians in an angle subtended at the centre of a circle by an arc is equal to the ratio of the length of the arc to the radius of the circle.

## SECTION B

**(All Questions are compulsory. In case of internal Choice, attempt any one question only)**

21. Given $A = \{1,2,3,5\}$ and $B = \{4,6,9\}$. Define a relation R from A to B by $R = \{(x,y): |x-y| = odd, x \in A, y \in B\}$. Write R in roster form. Also, find its domain and range.
**OR**
Draw the graph of the Constant function $f: R \to R; f(x) = 2\ \forall x \in R$. Also, find its domain and range.

22. Show that $\tan 3x \tan 2x \tan x = \tan 3x - \tan 2x - \tan x$.

23. If the extremities of a diagonal of a square are $(1,-2,3)$ and $(2,-3,5)$ then find the length of the side of square.

24. Evaluate: $\lim_{x\to 0}\left(\frac{\sin 2x+3x}{2x+\tan 7x}\right)$.

25. If $A$ and $B$ are mutually exclusive events such that $P(A) = 0.35$ and $P(B) = 0.45$, then find $P(A' \cap B')$.
**OR**
If A, B and C are three mutually exclusive and exhaustive events of an experiment such that $3P(A) = 2P(B) = P(C)$, then find the value of P(A).

## SECTION C

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

26. If $A = \{1,3,5,7,11,13,15,17\}$, $B = \{2,4,6,8,\dots,18\}$ and $U = \{1,2,3,4,\dots,20\}$ where $U$ is universal set then find $A' \cup [(A \cup B) \cap B']$.

27. Evaluate: $(1+i)^6 + (1-i)^3$ and find its conjugate.

28. Solve for $x$: $|x+1| + |x| > 3$.
**OR**

A manufacturer has 600 litres of a 12% solution of acid. How many litres of a 30% a acid solution must be added to it so that acid content in the resulting mixture will be more than 15% but less than 18%?

29. A student has to answer 10 questions, choosing at least 4 from each of parts A and B. If there are 6 questions in Part A and 7 in Part B, in how many ways can the student choose 10 questions?

**OR**

Find the number of words with or without meaning which can be made using all the letters of the word $AGAIN$. If these words are written as in a dictionary, what will be the 49th word?

30. Find $(a+b)^4-(a-b)^4$. Hence, evaluate $\left(\sqrt{3}+\sqrt{2}\right)^4-\left(\sqrt{3}-\sqrt{2}\right)^4$.

31. Find $\lim_{x\to 1} f(x)$, where $f(x)=\begin{cases} 5x-4, & 0<x\leq 1 \\ 4x^3-3x, & 1<x<2 \end{cases}$.

**OR**

Differentiate: $f(x)=\frac{\sec x-1}{\sec x+1}+x^2\sin x \ w.r.t.x.$

## SECTION D

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

32. Find the value of the expression:

$$3\left[\sin^4\left(\frac{3\pi}{2}-\alpha\right)+\sin^4(3\pi+\alpha)\right]-2\left[\sin^6\left(\frac{\pi}{2}+\alpha\right)+\sin^6(5\pi-\alpha)\right]$$

**OR**

If $\alpha$ and $\beta$ are the solutions if the equation $a\tan\theta+b\sec\theta=c$, then show that $\tan(\alpha+\beta)=\frac{2ac}{a^2-c^2}$.

33. If n Arithmetic Means are inserted between 1 and 31 such that the ratio of the 7th and $(n-1)^{th}$ means is 5:9. Find $n$.

34. A line is such that its segment between the lines $5x-y+4=0 \ and \ 3x+4y-4=0$ is bisected at the point (1,5). Obtain its equation.

35. Calculate the mean, variance and standard deviation for the following distribution:

| Class | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 | 90-100 |
|---|---|---|---|---|---|---|---|
| Frequency | 3 | 7 | 12 | 15 | 8 | 3 | 2 |

**OR**

The mean of 5 observations is 4.4 and their variance is 8.24. If three of the observations are 1, 2 and 6, find the other two observations.

## SECTION E

**(This section comprises of 3 case-study/passage-based questions of 4 marks each with subparts. The first two case study questions have three subparts (i), (ii), (iii) of marks 1, 1, 2 respectively. The third case study question has two subparts of 2 marks each)**

36. 5 students Arpit, Akshay, David, Aditya and Raghav, each of age 16 years are selected from Class 11 for the school football team. Their heights in centimetres are 182,181,180.5,180 and 179.5 respectively.
Answer the following questions by taking A as the set of ages of students and B as set of heights of students.

i) Write sets A and B in roster form.
ii) Find the cartesian product of two sets A and B.
iii) Find the total number of relations from A to B.
OR
Check whether $A \times B$ and $B \times A$ are functions or not.

37. Window is in the shape of parabola with an isosceles triangle inscribed in it. The triangle is formed in such a way that the vertices of triangle coincide with vertex of parabola and end points of the latus rectum. The equation of parabola is given by $x^2 = 24y$.
Based on the above information, answer the following:
i) Find the vertices of triangle.
ii) Find the length of the altitude of the triangle.
iii) Find the coordinates of the focus of the parabola and the length of the latus rectum.
OR
Find the area of the triangle.

38. The probability that a new railway bridge will get an award for its design is 0.48, the probability that it will get an award for the efficient use of materials is 0.36, and that it will get both awards is 0.2. What is the probability, that
i) It will get at least one of the 2 awards.
ii) It will get only one of the awards.