This Question Paper contains 4 Printed Pages]

# 15E(A)

# MATHEMATICS, Paper - I

*(English version)*

**Parts A and B**

***Time : 2½ Hours]*** ***[Maximum Marks : 50***

**Instructions :**

1. *Answer the questions under* ***Part-A*** *on a separate answer book.*
2. *Write the answers to the questions under* ***Part-B*** *on the question paper itself and attach it to the answer book of* ***Part-A****.*

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## Part - A

**Time : 2 Hours** **Marks : 35**

### SECTION - I

*(Marks : 5×2=10)*

**Note :-**

1. Answer **ANY FIVE** questions choosing **at least TWO** from each of the following two Groups, i.e. **A** and **B** .
2. Each question carries **2** marks.

### GROUP - A

*(Statements and Sets, Functions, Polynomials)*

1. Write the Converse, Inverse and Contrapositive of the conditional statement "If a triangle is an equilateral triangle, then it is an isosceles triangle".

2. Show that $\sim(p \Rightarrow q) \equiv p \wedge \sim q$.

3. $f : A \rightarrow B$ and $f$ have an inverse function $f^{-1} : B \rightarrow A$. State the properties of $f$ for which its inverse exists.

4. Find the value of 'K' so that $x^3 - 3x^2 + 4x + K$ is exactly divisible by $x - 2$.

## GROUP - B

*(Linear Programming, Real numbers, Progressions)*

5. Draw the graph of the inequality $4x + 3y \geq 12$.

6. If $a + b + c = 0$, then show that $x^{a^2b^{-1}c^{-1}} \times x^{a^{-1}b^2c^{-1}} \times x^{a^{-1}b^{-1}c^2} = x^3$.

7. Determine the 25th term of an A.P., whose 9th term is – 6 and common difference is $5/4$.

8. Evaluate :

$$\underset{x \to 0}{Lt} \frac{\sqrt{1+x}-1}{x}$$

*(Marks : 4×1=4)*

## SECTION - II

**Note :-**

1. Answer **ANY FOUR** of the following **SIX** questions.
2. Each question carries **1** mark.

9. Write the truth table of the compound statement $p \wedge (\sim q) \rightarrow p$.

10. Let $f : R \rightarrow R$, $g : R \rightarrow R$ defined by $f(x) = 1 + 2x$, $g(x) = 3 - 2x$ find $fog(3)$.

11. Find the sum and product of the roots of the equation $\sqrt{3}x^2 + 9x + 6\sqrt{3} = 0$.

12. At which of the points A(4, 3), B(0, 7) the function $f(x) = 3x + y$ is minimum ?

13. Solve $|6x - 1| = 5$.

14. Which term of the A.P. 5, 2, –1, ......... is – 22 ?

## SECTION - III *(Marks : 4×4=16)*

**Note :-**

1. Answer **ANY FOUR** questions, choosing **TWO** from each of the following groups, i.e. **A** and **B**.
2. Each question carries 4 marks.

### GROUP - A

*(Statements and Sets, Functions, Polynomials)*

**15.** In a city there are three major news papers A, B and C of which at least two are read by 35% of the population. It is known that news paper C is read by 45% of the population. If the news paper A and B are read by 15% and that all the three read by 10%, what percent of the population read only the news paper C ?

**16.** If $f(x) = 2x+3$, then find the value of $\frac{f(x+h)-f(x)}{h}$, $(h \neq 0)$.

**17.** Let $f, g, h$ be functions defined by

$f(x) = x,\ \ g(x) = 1-x$ and $h(x) = x+1$, find *(i)* $(hog)of$, *(ii)* $ho(gof)$.

From *(i)* and *(ii)* what do you conclude ?

**18.** Using mathematical induction, prove that

$$\frac{1}{1.2}+\frac{1}{2.3}+\frac{1}{3.4}+\ldots\ldots+\frac{1}{n(n+1)}=\frac{n}{n+1}$$

### GROUP - B

*(Linear Programming, Real Numbers, Progressions)*

**19.** A shop keeper sells not more than 30 shirts of each colour. Atleast twice as many white ones are sold as green ones. If the profit on each of the white be Rs. 20/-, and that of green be Rs. 25/-, how many of each kind be sold to give him a maximum profit? (Graph is not necessary).

**20.** If $a^{1/3}+b^{1/3}+c^{1/3}=0$, then show that $(a+b+c)^3 = 27abc$.

**21.** If the sum of the first '$n$' natural numbers is $S_1$ and that of their squares $S_2$ and cubes $S_3$, show that $9S_2^2 = S_3\left(1+8S_1\right)$.

**22.** The A.M., G.M. and H.M. of two positive numbers are A, G, H respectively, then show that $A \geq G \geq H$.

**SECTION - IV** *(Marks : 1×5=5)*

*(Linear Programming, Quadratic Equations)*

**Note :-**

1. Answer **ANY ONE** question from the following.
2. This question carries **5** marks.

**23.** Maximise $f = 3x + y$ subject to the constraints

$8x + 5y \leq 40,$

$4x + 3y \geq 12,$

$x \geq 0,$

$y \geq 0.$

**24.** Draw the graph of $y = x^2 + 5x + 6$ and find the roots of the equation $x^2 + 5x + 6 = 0$.