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**MATHEMATICS — Paper I**Time Allowed :  $2\frac{1}{2}$  Hours ]

[ Maximum Marks : 100

**PART - I****SECTION - A**

Answer all questions.

20 × 1 = 20

I. Choose the correct answer from the given alternatives :

1. For an A.P.  $S_n = n^2 - n + 1$ . The second term of the series is

1) 2

2) 3

3) 4

4) -2.

2. The number of terms in the A.P. 7, 13, 19, ..... , 97 is

1) 97

2) 17

3) 16

4) 15.

3. A radioactive sample decays and the remaining sample at infinite time is given by  $b = 1 - \left( \frac{1}{2} + \frac{1}{4} + \dots \text{to } \infty \right)$ , then  $b$  is

1) 0

2) 1

3)  $\frac{1}{\sqrt{2}}$ 4)  $\frac{1}{2}$ 

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10. If  $f : X \rightarrow Y$ , where  $X = \{ 1, 2, 3, 4 \}$ ,  $Y = \{ 5, 6 \}$  is given by  $f = \{ (1, 5), (2, 5), (3, 6), (4, 6) \}$ , then  $f$  is a
- 1) one-one function                      2) many-one function  
3) constant function                      4) one-one onto function.
11. If  $g(x) = x^2$ ;  $h(x) = 2x + 1$  then  $g \circ h$  is
- 1)  $2x^2 + 1$                                   2)  $2x + x^2$   
3)  $(2x + 1)^2$                                 4)  $(2x)^2 + 1$ .
12. If  $\{ (4, 5), (5, x) \}$  represents a constant function then the value of  $x$  is
- 1) 3    2) 4  
3) 5    4) 6.
13. A recurring deposit of Rs. 50 per month at 10% S.I. per annum will fetch at the end of 2 years an interest of
- 1) Rs. 250                                      2) Rs. 125  
3) Rs. 375                                      4) Rs. 500.
14. The quarterly interest due on Rs. 1000 at 12% rate of interest is
- 1) Rs. 120                                      2) Rs. 40  
3) Rs. 30                                        4) Rs. 60.
15. If the difference between C.I. and S.I. on Rs. 2800 for 2 years is Rs. 7, then the rate of interest is
- 1) 8%    2) 20%  
3) 10%    4) 5%.

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16. If  $3x + 2$  is a factor of  $p(x)$ , then

1)  $p\left(\frac{2}{3}\right) = 0$

2)  $p\left(\frac{3}{2}\right) = 0$

3)  $p\left(\frac{-2}{3}\right) = 0$

4)  $p\left(\frac{-3}{2}\right) = 0$ .

17. If one root of the equation is the reciprocal of the other root in

$$ax^2 + bx + c = 0, \text{ then}$$

1)  $a = c$

2)  $a = b$

3)  $b = c$

4)  $c = 0$ .

18. The partial fraction representation of  $\frac{x}{(x+1)^2}$  is

1)  $\frac{A}{(x+1)}$

2)  $\frac{A}{(x+1)} + \frac{B}{(x+1)^2}$

3)  $\frac{Ax+B}{(x+1)^2}$

4)  $\frac{Ax+B}{x+1} + \frac{Cx+D}{(x+1)^2}$ .

19. The H. C. F. of  $2(x^2 - 4)$  and  $4(x^2 - 9)(x+2)$  is

1)  $4(x^2 - 4)$

2)  $(x-2)(x^2 - 9)$

3)  $2(x+2)$

4)  $2(x^2 - 9)(x+2)$ .

20.  $\frac{a^2}{a^2 - b^2} + \frac{b^2}{b^2 - a^2} =$

1)  $a - b$

2)  $a + b$

3)  $a^2 - b^2$

4) 1.

## SECTION - B

II. Answer any ten questions :

 $10 \times 2 = 20$ 

21. For what value of  $n$ , the  $n$ th term of the series  $3 + 10 + 17 + \dots$  and  $63 + 65 + 67 + \dots$  are equal ?

22. Which term of the progression  $1, 2, 4, 8, \dots$  is 512 ?

23. Evaluate :

$$26 + 27 + \dots + 65.$$

24. The volume of a cylinder is  $448\pi$  cu. cm and height 7 cm. Find its curved surface area.

25. Two cones have their heights in the ratio  $5 : 3$  and the radii of their bases in the ratio  $2 : 1$ . Find the ratio of their volumes.

26. 8 metallic spheres each of radius 2 cm are melted and cast into a single sphere. Calculate the radius of the new sphere.

27. Given  $f(x) = 3x - 2$ ,  $g(x) = kx + 3$ ; find  $k$  so that  $f \circ g = g \circ f$ .

28. Given  $A = \{-8, -7, -5, 1, 2, 4\}$ ;  $B = \{-7, 1, 3, 4, 5, 6\}$ ;  $C = \{-8, -5, 2, 4, 6, 7\}$ . Find  $A - (B \cup C)$ .

29. Let  $A = \{0, 1, 2, 3\}$ ;  $B = \{1, 2, 5, 10, 16\}$  and  $f = \{(x, y) : y = x^2 + 1, x \in A \text{ and } y \in B\}$ . List the elements of  $f$  and identify the function.

30. The difference between S.I. & C.I. for 2 years on a sum of money lent at  $6\frac{2}{3}\%$  is Rs. 14. Find the sum.

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31. Swamy deposited Rs. 3000 in a bank as a fixed deposit for 2 years paying 10% p.a. and receives interest half yearly. Find the interest received by him in 2 years.
32. For what value of  $m$  is  $2x^3 - x^2 - 3mx - 24$  exactly divisible by  $x - 2$  ?
33. Given  $p(x - 1) + q(x - 3) = 5x - 9$ ; find the values of  $p$  and  $q$ .
34. If  $\alpha$  and  $\beta$  are the roots of the equation  $3x^2 - 6x + 4 = 0$ , find the value of  $\alpha^2 + \beta^2$ .
35. The sum of a number and its reciprocal is  $2\frac{1}{30}$ . Find the number.

### PART - II

#### SECTION - C

- III. Answer any *two* questions : 2 × 5 = 10
36. Find four numbers in A.P. whose sum is 20 and the sum of whose squares is 120.
37. If  $S_1, S_2, S_3$  be the sum to  $n, 2n$  and  $3n$  terms respectively of an A.P., show that  $S_3 = 3(S_2 - S_1)$ .
38. Find the 5th term of the G.P. whose 3rd term is  $\frac{3}{8}$  and 7th term is  $\frac{3}{128}$ .

#### SECTION - D

- IV. Answer any *three* questions : 3 × 5 = 15
39. Using Venn Diagram verify  $A - (B \cup C) = (A - B) \cap (A - C)$ .
40. If  $A = \{-3, -1, 1, 3\}$ ,  $B = \{0, 1, 2, 3, 4\}$  and  $f : A \rightarrow B$  is defined by  $f(x) = \frac{3-x}{2}$ , represent the function as
- i) an arrow diagram
  - ii) a set of ordered pairs
  - iii) a table
  - iv) a graph.

41. Seba deposited Rs. 14,000 as a special deposit for 3 years and the interest was compounded yearly at the rate of 10% p.a. Find the maturity value of the deposit.

42. Sita invests Rs. 25 in a bank at the beginning of each month for 36 months.

If she gets Rs. 1066.50 at the end of 36 months, find the rate of interest.

**SECTION - E**

V. Answer any *two* questions :

2 × 5 = 10

43. Through a cylindrical tunnel of diameter 21 m water flows uniformly at the rate of 18 km per hour. How much water will flow through it in 20 minutes ?

44. Find the capacity of a bucket having the radius of the top as 36 cm and that of the bottom as 12 cm. Its depth is 35 cm.

45. A hemispherical bowl has volume of material  $\frac{122\pi}{3}$  c.c. Its external diameter is 10 cm. Find its thickness.

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## SECTION - F

VI. Answer any *three* questions : $3 \times 5 = 15$ 

46.  $R_1$  and  $R_2$  are the remainders when the polynomials  $x^3 + 2x^2 - 5ax - 7$  and  $x^3 + ax^2 - 12x + 6$  are divided by  $x + 1$  and  $x - 2$  respectively. If  $2R_1 + R_2 = 6$ , find the value of  $a$ .
47. Decompose into partial fractions :  $\frac{x}{(x+1)(x+2)(x+3)}$ .
48. If  $9x^4 + 12x^3 + 28x^2 + ax + b$  is a perfect square, find the values of  $a$  and  $b$ .
49. If  $\alpha$  and  $\beta$  are the roots of the equation  $x^2 - 3x - 4 = 0$ , form the equation whose roots are  $\frac{1}{\alpha^2}, \frac{1}{\beta^2}$ .

## PART - III

## SECTION - G

VII. Answer any *one* question : $1 \times 10 = 10$ 

50. Solve graphically  $x^2 - 5x + 6 = 0$ .
51. Draw the graph of  $y = x^2 + 2x - 3$  and hence solve the equation  $x^2 - x - 6 = 0$ .
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