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MATHEMATICS — Paper I

(New Syllabus)

Time Allowed : $2\frac{1}{2}$ Hours]

[Maximum Marks : 100

PART – I

N. B. :   i)   This Part contains *two* Sections, **Section – A** and **Section – B**.

ii)   **Section – A** contains Multiple Choice Questions. Answer *all* the 20 questions. Each question carries *one* mark.

iii)   **Section – B** contains 15 questions. Answer any *ten* questions. Each question carries *two* marks.

SECTION – A

I.   Choose the correct answer from the given alternatives : $20 \times 1 = 20$

1.   The number of terms in the A.P. 7, 13, 19, ... , 97 is
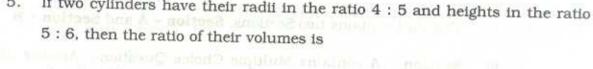
   a)   97

   b)   17

   c)   16

   d)   15.

2.   The ratio of sum of n terms of an A.P. to the sum of m terms is 256 : 441. Then the ratio of the mth term to the nth term is

   a)   31 : 41

   b)   16 : 21

   c)   21 : 16

   d)   41 : 31.

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3. If $1^2 + 2^2 + \ldots + 10^2 = 385$, then $2^2 + 4^2 + 6^2 + \ldots + 20^2$ is

   a) 770

   b) 1150

   c) 1540

   d) 385×385.

4. If n, p, q are in G.P., then the expression for p in terms of n and q is

   a) $\dfrac{n}{q}$

   b) $(nq)^{1/2}$

   c) $q^2 n$

   d) nq.

5. If two cylinders have their radii in the ratio $4 : 5$ and heights in the ratio $5 : 6$, then the ratio of their volumes is

   a) $8 : 15$

   b) $15 : 8$

   c) $6 : 5$

   d) $4 : 5$.

6. A sector of a circle of radius 21 cm and central angle 120° is made into a cone by bringing its radii together. Radius of the cone thus obtained is

   a) 21 cm

   b) 7 cm

   c) 14 cm

   d) 10·5 cm.

7. The relation between the volume V of a sphere of radius r and its surface area S is

   a) $V = \dfrac{2}{3} r S$

   b) $V = \dfrac{r}{3} S$

   c) $V = \dfrac{4}{3} S r$

   d) $V = 4S$.

8. If A and B are any two sets, then $A \cap B' =$

   a) $A + B$

   b) $A - B$

   c) $A \cup B$

   d) $A' \cap B$.

9. If $\{(4, 5), (5, x)\}$ represents a constant function, then the value of x is

   a)   3   b)   4

   c)   5   d)   6.

10. Given $f(x) = (-1)^x$ is a function from N to Z. The range of f is

   a) $\{1\}$ b) N

   c) $\{1, -1\}$ d) Z.

11. The pre-images of 5 under the function

   $$f = \{(2, -5), (3, 5), (4, -5), (5, 5)\} \text{ is}$$

   a)   2 and 3   b)   3 and 5

   c)   3 and 4   d)   6.

12. $f(x) = x^2 - x$, then $f(x-1) - f(x+1)$ is

   a) $4x$ b) $4x + 2$

   c) $2 - 4x$ d) $4x - 2$.

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

   a)   Rs. 250   b)   Rs. 125

   c)   Rs. 375   d)   Rs. 500.

14. The quarterly interest due on Rs. 1,000 at 12% rate of interest is

   a)   Rs. 120   b)   Rs. 40

   c)   Rs. 30   d)   Rs. 60.

15. If the difference between C.I. and S.I. on Rs. 2,000 for 2 years is Rs. 20, then the rate of interest is

    a)   10%

    b)   20%

    c)   30%

    d)   15%.

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

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

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

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

    d) $p\left(-\dfrac{3}{2}\right) = 0.$

17. The G.C.D. of $4(x-1)^2(x+2)$ and $6(x-1)(x-2)$ is

    a) $24(x-1)^2(x^2-1)$

    b) $x-1$

    c) $2(x-1)$

    d) $24(x-1).$

18. $\dfrac{a^2}{a^2 - b^2} + \dfrac{b^2}{b^2 - a^2} =$

    a) $a - b$

    b) $a + b$

    c) $a^2 - b^2$

    d)   1.

19. $\dfrac{x+3}{x^2 - x - 6} \equiv \dfrac{A}{x+2} +$

    a) $\dfrac{A}{x+3}.$

    b) $\dfrac{B}{x+3}$

    c) $\dfrac{B}{x-3}$

    d) $\dfrac{B}{x^2 - x - 6}.$

20. If α and β are the roots of the equation $x^2 + 2x + 8 = 0$, then the value of $\dfrac{\alpha}{\beta} + \dfrac{\beta}{\alpha}$ is

    a) $\dfrac{1}{2}$

    b)   6

    c) $-\dfrac{3}{2}$

    d) $\dfrac{3}{2}$

SECTION – B

II.   Answer any *ten* questions : $10 \times 2 = 20$

21. Which term of the sequence 13, 15, 17, ... is 71 ?

22. The 5th term of an A.P. is 27 and the 8th term is 12. Determine the A.P.

23. Evaluate : $3 + 6 + ... + 210$.

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

25. A conical tent of 56 m base diameter requires 3080 sq.m of canvas for the curved surface. Find its vertical height.

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. If $A = \{ 1, 3, 5 \}$, B is the set of integers and $f : A \rightarrow B$ defined by

     $f(x) = x^2 - 1$, find the range of f.

28. $A = \{ -8, -7, -5, 1, 2, 4 \}$, $B = \{ -7, 1, 3, 4, 5, 6 \}$ and

     $C = \{ -8, -5, 2, 4, 6, 7 \}$; find $(A - B) \cap (A - C)$.

29. Given $f(x) = 7x - 3$ and $g(x) = x^2 - 2$; show that $f \circ g \neq g \circ f$.

30. Find the difference between C.I. and S.I. on Rs. 8,000 at 5% per annum for 3 years.

31. A person deposits Rs. 40 in a bank every month at 10% S.I. per annum. How much will he get at the end of 3 years ?

32. If the polynomials $ax^3 + 4x^2 + 3x - 4$ and $x^3 - 4x + a$ leave the same remainder when divided by $x - 3$, find the value of a.

33. Find the H.C.F. of $(x - 3)^2$; $x^2 - 9$ and $x^2 - x - 6$.

34. Given $(2A + B) x + (A + B) \equiv 11x + 7$; find the values of A and B.

35. If α and β are the roots of the equation $3x^2 - 5x + 2 = 0$, find the value of $\dfrac{\alpha^2}{\beta} + \dfrac{\beta^2}{\alpha}$.

PART – II

N. B. : i)   This Part contains *four* Sections, **Section – C, Section – D, Section – E** and **Section – F**.

ii) **Section – C** and **Section – E** contain 3 questions each. Answer any *two* questions in each Section.

iii) **Section – D** and **Section – F** contain 4 questions each. Answer any *three* questions in each Section.

iv) Each question carries *five* marks.

SECTION – C

III.   Answer any *two* questions :

$$2 \times 5 = 10$$

36. Three numbers are in Arithmetic Progression and their sum is 15. If 1, 3, 9 are added to them respectively, they form a G.P. Find the numbers.

37. How many terms of the series $1 + 6 + 11 + \ldots\ldots$ must be taken so that their sum is 970 ?

38. Find three numbers in G.P. whose sum is 52 and the sum of their product in pairs is 624.

SECTION – D

IV.   Answer any *three* questions :

$$3 \times 5 = 15$$

39. Using Venn diagram, verify $A - (B \cap C) = (A - B) \cup (A - C)$.

40. Given $f (x) = x^2 + 4$; $g (x) = 3x - 2$; $h (x) = x - 5$; verify $f o (g o h) = (f o g) o h$.

41. Umayal deposited Rs. 8,000 in a bank which pays 8% S.I. per annum for 2 years. Noorjahan deposited Rs. 8,000 in another bank for 2 years which pays 7·5% C.I. per annum. Who will get more and how much ?

42. How much one should deposit every month in a bank paying 5% S.I. per annum on monthly R.D., if at the end of 6 years one wants to get Rs. 3,318 ?

SECTION – E

V.   Answer any *two* questions : $2 \times 5 = 10$

43. A hollow cylindrical pipe has a total surface area of 1320 sq.cm. If its internal diameter is 8 cm and height is 7 cm, find its external radius.

44. A sector of a circle of radius 12 cm has the angle 120°. If it is rolled up so that two bounding radii are joined together to form a cone, find the volume of the cone.

45. A hollow spherical shell has an inner radius of 8 cm. If the volume of the material is $\dfrac{1952\,\pi}{3}$ c.c., find the thickness of the shell.

SECTION – F

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

46. If $ax^3 + bx^2 + x - 6$ has $x + 2$ as a factor and leaves a remainder 4 when divided by $x - 2$, find the values of a and b.

47. Find the values of a and b, if $49x^4 - 70x^3 + 109x^2 + ax - b$ is to be a perfect square.

48. Split into partial fractions :

$$\frac{4x^2 - x - 9}{(x - 1)^2 (x + 2)}$$

49. If the roots of $(a - b)x^2 + (b - c)x + (c - a) = 0$ are equal, prove that $2a = b + c$.

PART – III

N. B. :   i)   This Section contains 2 questions. Answer any *one* question.

         ii)   Each question carries *ten* marks.

SECTION – G

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

50. Draw the graph of $y = x^2 - 2x - 8$ and hence solve the equation

$x^2 - 2x - 15 = 0$.

51. Solve graphically : $x^2 - x - 12 = 0$.