Register Number

MATHEMATICS — Paper I

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

[Maximum Marks : 100

N. B. :   i)   The paper consists of *five* Sections A, B, C, D and E.

ii)   Read the instructions under each Section carefully, before you start answering.

iii)   Diagrams may be drawn wherever necessary.

iv)   Rough work should be done at the bottom of the pages of the answer-book.

SECTION – A

Note :   Answer all the *ten* questions. $10 \times 1 = 10$

1.   If $A = \{1, 2, 3\}$ and $B = \{2, 4, 5, 6\}$, then $A - B$ is

1) $\{2\}$

2) $\{3\}$

3) $\{1, 3\}$.

2.   If $f(x) = 2^x - 2$, then $f(2)$ is =

1)   2

2)   0

3)   8.

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3. If log 2 = 0·3010, log 3 = 0·4771, then log 24 is

1) 0·7781

2) 0·1761

3) 1·3801.

4. The 5th term of the G.P. 125, 25, 5, ... is

1) $\dfrac{1}{125}$

2) $\dfrac{1}{5}$

3) $\dfrac{1}{25}$.

5. Volume of a sphere is

1) $4 \pi r^3$

2) $\dfrac{4}{3} \pi r^3$

3) $\dfrac{2}{3} \pi r^3$.

6. The curved surface area of a cylinder is

1) $2 \pi r h$

2) $4 \pi r^2$

3) $\pi r l$.

7. The L.C.M. of $6x^2yz$, $8xy^2z^3$ and $12x^3y^3z^2$ is

   1) $6xyz$

   2) $12x^2y^2z^2$

   3) $24x^3y^3z^3$.

8. The value of $\dfrac{x^3 - y^3}{x - y}$ is

   1) $x^2 - y^2$

   2) $x^2 + xy + y^2$

   3) $x^2 - 2xy + y^2$.

9. The roots of the quadratic equation $x^2 - 7x - 18 = 0$ are

   1) $9, -2$

   2) $-9, 2$

   3) $9, 2$.

10. The square root of $\dfrac{100a^{10}b^{16}}{81}$ is

    1) $\dfrac{10a^5b^8}{9}$

    2) $\dfrac{10a^{10}b^4}{9}$

    3) $\dfrac{10a^5b^8}{3}$.

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SECTION – B

Note : Answer any *ten* questions.   10 × 3 = 30

11. If $A = \{2, 3, 5, 6, 8\}$, $B = \{2, 4, 6, 7, 9\}$ and $C = \{2, 3, 4, 6, 9, 10\}$,

 find $(A - B) \cap (A - C)$.

12. In a group of boys, 40 like to play Hockey, 75 like to play Cricket and 15 like both

 the games. Find how many boys are in the group.

13. If $f(x) = \begin{cases} 2x - 3, & -5 \le x \le 0 \\ x + 2, & 1 \le x \le 5 \\ 3x - 1, & 6 \le x \le 10 \end{cases}$

   Find $f(0) - f(3) + 2f(7)$.

14. If $f(x) = 2x + 5$ and $g(x) = 3x$, find $f \circ g$.

15. Evaluate $76 \cdot 51 \times 0 \cdot 03741$.

16. Find the number of significant digits in $(200)^{14}$.

17. Find the 7th term of the G.P. 9, 3, 1, ...

18. Find the sum up to 10 terms of the G.P. $\dfrac{1}{24}, \dfrac{1}{12}, \dfrac{1}{6}, ...$.

19. Mr. Narayanan earns Rs. 1,26,000 as annual income (excluding HRA). What is

 his income tax ?

20. Find the volume of a hemisphere of radius 21 cm.

21. Three spheres have their volumes in the ratio 8 : 27 : 64. Find the ratio of their

 surface areas.

22. If one root of the equation $2x^2 - x - k = 0$ is twice the other, find k.

23. Find the G.C.D. of $x^3 + y^3$, $x^4 - y^4$.

24. Simplify $\dfrac{3a^2 + 7a - 6}{6a^2 - a - 2}$.

25. Find the square root of $x^4 - 4x^3 + 10x^2 - 12x + 9$.

SECTION – C

Note : Answer *all* the questions, choosing either *(a)* or *(b)* in each question.

$6 \times 5 = 30$

26. a) Verify by Venn diagram : $(A \cap B)^l = A^l \cup B^l$.

OR

b) In a group of 100 girls, 50 wear earings, 40 wear bangles, 70 wear necklaces, 24 wear earings and bangles, 21 wear bangles and necklaces, 34 wear necklaces and earings. If 5 do not wear any of them, find how many wear all the three.

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27. a) Given $f(x) = 3x + 2$, $g(x) = 1 - 7x$. Verify the commutative property of composition of two functions.

OR

b) Given $f(x) = 2x + 5$, $g(x) = x + 3$, $h(x) = 3x + 1$.

Verify $f \, o \, (g \, o \, h) = (f \, o \, g) \, o \, h$.

28. a) Evaluate using logarithms : $\dfrac{0 \cdot 7154 \times 4 \cdot 193}{2149}$.

OR

b) Find the value of $\dfrac{bRt}{V-b}$ if $b = 1 \cdot 53$, $R = 2 \cdot 835$, $V = 10 \cdot 07$, $t = 532$.

29. a) Mr. Somu's annual income is Rs. 93,400 exclusive of HRA. He contributes Rs. 700 p.m. towards P.F., Rs. 3,600 towards L.I.C. and Rs. 2,800 towards N.S.S. and also Rs. 4,000 in N.S.C. Compute the income tax to be paid.

OR

b) Mr. Shanker is an employee in a company. He pays Rs. 500 p.m. towards P.F. and Rs. 2,400 towards L.I.C. premium. If his annual income excluding HRA is Rs. 75,400, what is his income tax due ?

30. a) A solid metallic cone of radius 2 cm and height 8 cm is melted and recast into a solid sphere. Find the diameter of the sphere so formed.

OR

b) Find how many litres of water will flow through a cylindrical pipe of radius 3·5 cm in 40 minutes, if the water flows at the rate of 12 km/hr.

31. a) Find the three terms in a G.P. whose sum is 42 and product is 512.

OR

b) Find the sum up to n terms of the series $3 + 33 + 333 + \ldots\ldots\ldots$.

SECTION – D

Note :   Answer *all* the questions, choosing either *(a)* or *(b)* in each question.

$$4 \times 5 = 20$$

32. a)   Simplify the following :

$$\frac{1}{2m^2 + 3m - 2} - \frac{1}{3m^2 + 7m + 2} - \frac{1}{6m^2 - m - 1}.$$

OR

b)   Simplify the following :

$$\frac{a^2 - (b-c)^2}{(a-b)^2 - c^2} \times \frac{b^2 - (c-a)^2}{(b-c)^2 - a^2} \times \frac{c^2 - (a-b)^2}{(c-a)^2 - b^2}$$

33. a)   If the roots of the equation $x^2 - px + q = 0$ differ by unity, prove that $p^2 = 4q + 1$.

OR

b)   If α and β are the roots of the equation $x^2 - 3x - 2 = 0$, find the equation whose roots are $\alpha + 3$, $\beta + 3$.

34. a)   Resolve into partial fractions $\dfrac{(5x - 1)}{(x + 2)(x + 3)}$.

OR

b)   Resolve $\dfrac{m^2}{(m - 1)^2}$ into partial fractions.

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35. a) Find the L.C.M. of $x^2 + 8x + 15$, $x^2 + 11x + 30$, $x^2 + 9x + 18$.

OR

b) The G.C.D. and L.C.M. of the two polynomials are ($x + 3$) and ($x + 3$) ($x - 8$) ($x + 2$). If one of the polynomials is $x^2 - 6x - 16$, find the other polynomial.

SECTION – E

Note : Answer the question, choosing *one* of the alternatives *(a)* or *(b)*.

10

36. a) Draw the graph of the equation $y = 2x^2 - x - 6$ and using it solve the equation $2x^2 - x - 6 = 0$.

OR

b) Solve graphically : $x^2 - 3x - 10 = 0$.

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