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MATHEMATICS SAMPLE QUESTIONS – VOL.03

1. The domain for which the functions defined by $f(x) = 3x^2 - 1$ and $g(x) = 3 + x$ are equal is
   a. $\left\{-1, \frac{4}{3}\right\}$
   b. $\left\{-1, \frac{4}{3}\right\}$
   c. $\left\{-1, \frac{4}{3}\right\}$
   d. $\left\{-1, \frac{4}{3}\right\}$

2. Find the range of the following functions given by $\frac{|x-4|}{x-4}$
   a. {-1 and 1}
   b. {-2 and 2}
   c. R
   d. Z

3. Find the range of the following functions given by $\sqrt{16-x^2}$
   a. [0,4]
   b. [-4,4]
   c. R
   d. None

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4. If $|z_1| = |z_2| = |z_3|$ and $z_1 + z_2 + z_3 = 0$, then z_1, z_2, z_3 are vertices of

   (a) a right angled triangle (b) an equilateral traingle

   (c) isosceles triangle (d) scalene triangle

5. If $x_n = \cos\frac{\pi}{3^n} + i\sin\frac{\pi}{3^n}$, then $x_1, x_2, x_3, \ldots, x_\infty$ is equal to

   (a) 1 (b) -1

   (c) I (d) –i

6. If $(a_1 + ib_1)(a_2 + ib_2)\ldots(a_n + ib_n) = A + iB$, then $(a_1^2 + b_1^2)(a_2^2 + b_2^2)\ldots\ldots(a_n^2 + b_n^2)$ is equal to

   (a) 1 (b) $A^2 + B^2$

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

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7. If $A = \begin{bmatrix} 2 & 0 & -3 \\ 4 & 3 & 1 \\ -5 & 7 & 2 \end{bmatrix}$ is expressed as the sum of a symmetric and skew – symmetric matrix, then the symmetric matrix is

(a) $\begin{bmatrix} 2 & 2 & -4 \\ 2 & 3 & 4 \\ -4 & 4 & 2 \end{bmatrix}$

(b) $\begin{bmatrix} 2 & 4 & -5 \\ 0 & 3 & 7 \\ -3 & 1 & 2 \end{bmatrix}$

(c) $\begin{bmatrix} 4 & 4 & -8 \\ 4 & 6 & 8 \\ -8 & 8 & 4 \end{bmatrix}$

(d) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

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8. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, then $I + A + A^2 + A^3 + \ldots \infty$ equals to

(a) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

(b) $\begin{bmatrix} -1 & -2 \\ -3 & -4 \end{bmatrix}$

(c) $\begin{bmatrix} 1/2 & -1/3 \\ -1/2 & 0 \end{bmatrix}$

(d) $\begin{bmatrix} -1/4 & 1/3 \\ 1/2 & 0 \end{bmatrix}$

9. If the matrix $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is commutative with the matrix $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$, then

(a) a = 0, b = c

(b) b = 0, c = d

(c) c = 0, d = a

(d) d = 0, a = b

10. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, then $A^2 - 5A + 7I =$

a. 1

b. -1

c. 0

d. 2

11. For the matrix $A = \begin{bmatrix} 3 & 2 \\ 1 & 1 \end{bmatrix}$, find the numbers a and b such that $A^2 + aA + bI = O$.

a. -4,2

b. -4,0

c. 4,1

d. -4,1

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12. If $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$, verify that find A^{-1}

a. $\begin{bmatrix} \frac{3}{4} & \frac{1}{4} & -\frac{1}{4} \\ \frac{1}{4} & \frac{3}{4} & \frac{1}{-4} \\ -\frac{1}{4} & \frac{1}{4} & \frac{3}{4} \end{bmatrix}$

b. $\begin{bmatrix} \frac{3}{4} & \frac{1}{4} & -\frac{1}{4} \\ \frac{1}{4} & \frac{3}{4} & \frac{1}{4} \\ -\frac{1}{4} & \frac{11}{4} & \frac{3}{4} \end{bmatrix}$

c. $\begin{bmatrix} \frac{3}{4} & \frac{1}{4} & -\frac{1}{4} \\ \frac{1}{4} & \frac{3}{4} & \frac{1}{4} \\ -\frac{1}{4} & \frac{1}{4} & \frac{3}{4} \end{bmatrix}$

d. $-\begin{bmatrix} \frac{3}{4} & \frac{1}{4} & -\frac{1}{4} \\ \frac{1}{4} & \frac{3}{4} & \frac{1}{4} \\ -\frac{1}{4} & \frac{1}{4} & \frac{3}{4} \end{bmatrix}$

13. Given that $\frac{d}{dx}$ f(x) = f′(x). The relationship f′(a + b) = f′(a) + f′(b) is valid if f(x) is equal to

(a) x (b) x^2

(c) x^3 (d) x^4

14. The derivative of f(x) = $|x|^3$ at x = 0

(a) 0 (b) 1

(c) -1 (d) not defined

15. If y = $\sqrt{\sin x + y}\,, then$ $\frac{dy}{dx}$ equals to

(a) $\frac{\sin x}{2y-1}$ (b) $\frac{\cos x}{2y-1}$

(c) $\frac{\sin x}{2y+1}$ (d) $\frac{\cos x}{2y+1}$

16. If y = (1 + x^2) $\tan^{-1}$ x – x, then $\frac{dy}{dx}$ =

(a) $\tan^{-1}x$ (b) 2x $\tan^{-1}x$

(c) 2x $\tan^{-1}x$ – 1 (d) $\frac{2x}{tan^{-1}x}$

17. Let f : R → R be defined by f(x) = $\begin{cases} k-2x, if\ x\ \le -1 \\ 2x+3, if\ x > \ -1 \end{cases}$. If f has a local minimum at x = -1, then a possible value of k is

(a)1 (b) 0 (c) -$\frac{1}{2}$ (d) -1

18. The value of α for which the function f(x) = α sin x + $\frac{1}{3}$ sin 3x has an extremum at x = $\frac{\pi}{3}$ is

(a) 1 (b) – 1 (c) 0 (d) 2

19. The minimum value of f(x) = $|3 - x|$+ 7 is

(a) 0 (b) 6 (c) 7 (d) 8 (e) 10

20. Area of the region bounded by the curve y^2= 4x, y – axis

a. 2

b. $\frac{9}{4}$

c. $\frac{9}{3}$

d. $\frac{9}{2}$

21. Using integration find the area of the triangular region whose sides have the equations y = 2x + 1,y = 3x and x = 4.

a.27

b.24

c.23

d.28

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22. $\int \cot^6 x \, dx$

a. $-\frac{1}{5}\cot^5 x+\frac{1}{3}\cot^3 x-\cot x-x+C$

b. $-\cot^5 x+\frac{1}{3}\cot^3 x-\cot x-x+C$

c. $-\frac{1}{5}\cot^5 x+\frac{1}{3}\cot^3 x+\cot x-x+C$

d. $-\frac{1}{5}\cot^5 x+\frac{1}{3}\cot^3 x-\cot x+C$

23. Two sides of a triangle are given by the roots of the equation $x^2 – 5x + 6 = 0$ and the angle between the sides is $\frac{\pi}{3}$. Then, the perimeter of the triangle is

(a) $5 + \sqrt{2}$
(b) $5 + \sqrt{3}$
(c) $5 + \sqrt{5}$
(d) $5 + \sqrt{7}$

24. In ΔABC, if the median AD makes an angle θ with AC, and AB = 2AD, then sin θ equals

(a) Sin C
(b) Sin B
(c) Sin A
(d) None of these

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25. The base angle of triangle are $22\frac{1}{2}^{0}$ and $112\frac{1}{2}^{0}$. If b is the base and h is the height of the triangle, then

(a) B = 2h
(b) B = 3h
(c) B = $(1 + \sqrt{3})$h
(d) 2b = 3h

26. Evaluate : $\cot^{-1}\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}$

a. $\frac{x}{2},\ y \in \left(0 \frac{\pi}{4}\right)$

b. $\frac{x}{2},\ x \in \left(0 \frac{\pi}{4}\right)$

c. $\frac{x}{3},\ x \in \left(0 \frac{\pi}{4}\right)$

d. $\frac{x}{5},\ x \in \left(0 \frac{\pi}{4}\right)$

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27. Evaluate : $\tan^{-1}\left(\frac{\sqrt{1+x}-\sqrt{1-x}}{\sqrt{1+x}-\sqrt{1-x}}\right)$

a. $\frac{\pi}{3}+\frac{1}{2}\cos^{-1}x,\ x\in\left(0\frac{\pi}{4}\right)$

b. $\frac{\pi}{4}+\frac{1}{2}\cos^{-1}x,\ x\in\left(1\frac{\pi}{4}\right)$

c. $\frac{\pi}{4}+\frac{1}{3}\cos^{-1}x,\ x\in\left(0\frac{\pi}{4}\right)$

d. $\frac{\pi}{4}+\frac{1}{2}\cos^{-1}x,\ x\in\left(0\frac{\pi}{4}\right)$

28. Evaluate : $\frac{9\pi}{8}-\frac{9}{4}\sin^{-1}\frac{1}{3}$

a. $\frac{9}{4}\sin^{-1}\frac{3\sqrt{2}}{3}$

b. $\frac{9}{4}\sin^{-1}\frac{4\sqrt{2}}{3}$

c. $\frac{9}{4}\sin^{-1}\frac{2\sqrt{2}}{3}$

d. $\frac{9}{4}\sin^{-1}\frac{3\sqrt{2}}{3}$

29. The 5th term of the sequence $\frac{10}{9}, \frac{1}{3}\sqrt{\frac{20}{3}}, \frac{2}{3}, \ldots$ is

   a. $\frac{1}{3}$

   b. 1

   c. $\frac{2}{5}$

   d. $\sqrt{\frac{2}{3}}$

30. If the sum of series $1+\frac{3}{x}+\frac{9}{x^2}+\frac{27}{x^3}+\ldots.$ to ∞ is a finite number, then

   a. $x< 3$

   b. $x > \frac{1}{3}$

   c. $x < \frac{1}{3}$

   d. $x > 3$

31. Sum to n terms of the series

$$\frac{1}{1.\ 2.\ 3.\ 4}+\frac{1}{2.\ 3.\ 4.\ 5}+\frac{1}{3\ .4.\ 5.\ 6}+\ \ldots\ldots\ldots, \text{ is}$$

   a. $\frac{n^3}{3(n+1)(n+2)(n+3)}$

   b. $\frac{n^3+6n^2-3n}{6(n+2)(n+3)(n+4)}$

   c. $\frac{15n^2+7n}{4n(n+1)(n+5)}$

   d. $\frac{n^3+6n^2+11n}{18(n+1)(n+2)(n+3)}$

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32. $\lim\limits_{x \to \infty}(1+\sin x)^{2\cot x}$

a. a^3

b. a^2

c. e^2

d.none

33. $\lim\limits_{x \to 1}(\log_3 3x)^{\log_x 3}$

a.e

b.f

c.f2

d.2

34. $\lim\limits_{x \to 0}(\cos x)^{\cot x}$

a. $e^0 = 1$

b. $e^1 = 1$

c. $e^2 = 3$

d. $e^2 - e\,e$

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35. There are two urns. Urn A has 3 distinct red balls and urn B has 9 distinct blue balls. From each urn two balls are taken out at rondom and then transferred to the other. The number of ways in which this can be done is

a.66 b.108 c.3 d.36

36. The number of straight lines can be formed out of 10 points of which 7 are collinear

a.26 b.21 c.25 d.none

37. Total number of arrangements of the letters in the expression $a^3b^2c^4$ when written at full length is

a.1260 b.2520 c.610 d.none

38. A lady gives a dinner party to 5 guests to be selected from nine friends. The number of ways of forming the party of 5, given that two of the friends will not attended the party together is

a.56 b.126 c.91 d.none

39. A fair die is thrown twenty times. The probability that on the tenth throw the fourth six appears is

    a. $\frac{{}^{20}C_{10} \times 5^6}{6^{20}}$
    b. $\frac{120 \times 5^7}{6^{10}}$
    c. $\frac{84 \times 5^6}{6^{10}}$
    d.none of these

40. A coin is tossed to times. The probability of getting exactly six heads is

    a. $\frac{512}{513}$
    b. $\frac{105}{512}$
    c. $\frac{100}{153}$
    d. ${}^{10}C_6$

41. For a binomial variate X, if x = 3 and $P(X = 1) = 8$, P(X=3), then p =

    a. 4/5
    b. 1/5
    c. 1/3
    d.2/3

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42. The value of $C_0^2 - C_1^2 + C_2^2 - \ldots\ldots C_{15}^2 =$

a.15 b.- 15 c.0 d.51

43. If is the expansion of $\left(x^2 + \frac{2}{x}\right)^n$,the 13th term is independent of x, then the sum of the divisors of n is

a.36 b.38 c.39 d.32

44. The fourth term in the binomial expansion of $\left(x^2 + \frac{2}{x^2}\right)^n$ is independent of x, then n =

a.2 b.3 c.4 d.6

45. If $x \in R$, the least value of the expression $\frac{x^2 - 6x + 5}{x^2 + 2x + 1}$, is

(a) -1 (b) -1/2

(c) -1/3 (d) none of these

46. If y = tan x cot 3x, $x \in R$, then

(a) $\frac{1}{3} < y < 1$ (b) $\frac{1}{3} \le y \le 1$

(c) $\frac{1}{3} \le y \le 3$ (d) none of these

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47. The value of $\sqrt{8+2\sqrt{8+2\sqrt{8+2\sqrt{8}}}}$, is

(a) 10 (b) 6

(c) 8 (d) 4

48. If f(x) = $(x + 1)^{\cot x}$ is continuous at x = 0, then f(0) =

(a) $\frac{1}{e}$

(b) 0

(c) e

(d) $-\frac{1}{e}$

49. The function

$f(x) = \begin{cases} x & x \text{ is irrational} \\ 1 & x \text{ is rational} \end{cases}$ is

(a) Continuous at x = 1

(b) Discontinuous only at 0

(c) Discontinuous at 0, 1

(d) Discontinuous every where

50. If f : R → R is defined by

$f(x) = \begin{cases} \frac{x-2}{x^2+3x+2} & x \in R - \{-1,-2\} \\ -1 & x = -2 \\ 0 & x = -1 \end{cases}$

Then f is continuous on the set

(a) R

(b) R - $\{-2\}$

(c) R - $\{-1\}$

(d) R - $\{-1,-2\}$

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ANSWER KEYS:

1	A	11	D	21	D	31	D	41	D
2	A	12	C	22	A	32	C	42	C
3	A	13	B	23	D	33	A	43	C
4	B	14	A	24	C	34	A	44	D
5	C	15	B	25	A	35	B	45	D
6	B	16	B	26	B	36	C	46	B
7	A	17	D	27	D	37	A	47	D
8	A	18	D	28	C	38	C	48	D
9	C	19	C	29	C	39	C	49	D
10	C	20	B	30	D	40	B	50	C