Delhi University DU MCA Question Paper
Year - 2021

1. If $f(x) = \begin{cases} \frac{1}{|x|}, & |x| > 2 \\ A + B * x^2, & |x| \le 2 \end{cases}$ Then $f(x)$ is differentiable at $x = -2$ for

   (a) $A = \frac{3}{4}, B = -\frac{1}{16}$

   (b) $A = \frac{-3}{4}, B = \frac{1}{16}$

   (c) $A = -\frac{3}{4}, B = -\frac{1}{16}$

   (d) $A = \frac{3}{4}, B = \frac{1}{16}$

2. The equation $e^{x-8} + 2x - 17 = 0$ has ... real root(s),

   (a) 8   (b) 4

   (c) 2   (d) 1

3. Which of the following statements is not true?

   (a) $f(x) = e^{-|x|}$ is uniformly continuous on $(-\infty, \infty)$

   (b) $f(x) = x^2$ is uniformly continuous on $[0, \infty)$

   (c) $f(x) = \frac{1}{x^2}$ is uniformly continuous on $(0, 1)$

   (d) $f(x) = \frac{\sin x^3}{x} + \sqrt{x}$ is uniformly continuous on $[1, \infty)$

4. If $F(x) = \int \frac{dx}{(1+x^2)\sqrt{1-x^2}}$ and $F(1) = 0$ then for $x > 0, F(x)$ is equal to:

   (a) $\frac{1}{\sqrt{2}}\tan^{-1}\left\{\frac{\sqrt{2}x}{\sqrt{1+x^2}}\right\} + \frac{\pi}{\sqrt{2}}$

   (b) $\frac{1}{\sqrt{2}}\tan^{-1}\left\{\frac{\sqrt{2}x}{\sqrt{1+x^2}}\right\} - \frac{\pi}{2\sqrt{2}}$

   (c) $\frac{1}{\sqrt{2}}\tan^{-1}\left\{\frac{\sqrt{2}x}{\sqrt{1-x^2}}\right\} + \frac{\pi}{2\sqrt{2}}$

   (d) $\frac{1}{\sqrt{2}}\tan^{-1}\left\{\frac{\sqrt{2}x}{\sqrt{1-x^2}}\right\} - \frac{\pi}{2\sqrt{2}}$

5. The area of the plane figure bounded by $y = \sqrt{x}, x \in [0,1]$; $y = x^2, x \in [1, 2]$ and $y = -x^2 + 2x + 4, x \in [0,2]$ is :

   (a) 19/3   (b) 10/7

   (c) 3/5   (d) 4/3

6. Let $< S_n >$ be a sequence such that $S_1 = \sqrt{2}$; $S_{n+1} = \sqrt{2S_n}$ for $n \ge 1$. Which one of the following is correct?

   (a) $< S_n >$ is divergent sequence

   (b) $< S_n >$ is convergent sequence and $\lim_{n\to\infty} S_n > 2$.

   (c) $< S_n >$ is bounded above by 2

   (d) $< S_n >$ is decreasing sequence.

7. Given the sequence $< S_n >$ where $S_n = \left[(n+1)(n+2)\dots(n+n) * \frac{1}{n^n}\right]^{\frac{1}{n}}$ The value of $\lim_{n\to\infty} S_n$ is equal to

   (a) $\frac{1}{e}$ (b) $\frac{2}{e}$

   (c) $4/e$ (d) 1

8. The series $\sum_{n=0}^{\infty} \frac{1}{(2n+1)^2}$ converges to:

   (a) $\frac{\pi^2}{6}$ (b) $\frac{\pi^2}{4}$

   (c) $\frac{3\pi^2}{4}$ (d) $\frac{\pi^2}{8}$

9. Let $f: R^2 \to R$ $(x,y) = \begin{cases} \frac{x^2y}{x^2+y^2}, & (x,y) \ne (0,0) \\ 0, & (x,y) = (0,0) \end{cases}$ Then at the point $(0,0)$ the function f is

   (a) Continuous and all directional derivatives of f exist.

   (b) Continuous and not all directional derivatives of f exist.

   (c) Not Continuous and not all directional derivatives of f exist.

   (d) Not Continuous and but all directional derivatives of f exist.

10. The following parametric equations represents $x = t^2 - t, y = t^2 + t$ (Here t is the parameter)

    (a) Pair of lines   (b) Circle

    (c) Parabola   (d) Hyperbola

11. The eccentricity of ellipse
    $x^2 + 4y^2 - 4x - 8y + 7 = 0$ is
    (a) 1   (b) 1/2
    (c) $\sqrt{3}/2$ (d) $\sqrt{3}$

12. If e and f are eccentricity of a hyperbola and its conjugate respectively then the value of $e^2 + f^2 - 2$ is equal to ...
    (a) $a^2 + b^2$ (b) $a^2 + \frac{b^2}{a^2}$
    (c) $b^2 + \frac{a^2}{b^2}$ (d) $\left(\frac{a}{b}\right)^2 + \left(\frac{b}{a}\right)^2$

13. A sphere of radius 2r passes through the origin and points of intersection of the plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ with the coordinate axes. These four points are used to form a tetrahedron. The locus of the centroid of the tetrahedron is a:
    (a) Circle   (b) Parabola
    (c) Sphere   (d) Cone

14. The value of the gradient of $z = ye^z$ at point (0 ,3) is;
    (a) $3\sqrt{10}$ (b) $10\sqrt{3}$
    (c) $1/\sqrt{10}$ (d) $\sqrt{10}$

15. Which of the following is false:
    (a) Every convergent positive series is convergent.
    (b) Every absolutely convergent series is convergent
    (c) If series $\sum S_n$ converges and $\sum |S_n|$ diverges then $\sum S_n$ conditionally convergent.
    (d) the series $1 - 2^{-2} + 3^{-2} - 4^{-2} + \cdots$ is a divergent series.

16. For $x \in R$, let $f(x) = x^2$ and $g(x) = \sin^2 x$. Let $\alpha, \beta, \alpha < \beta$, be the roots of the quadratic $9x^2 - 9x\pi + 2\pi^2 = 0$. The area bounded by the curve $y(x) = (fog)(x)$, and the lines $x = \alpha, x = \beta, y = 0$, where f o g is the composition of the functions f and g, is
    (a) $\frac{\pi}{8}$ (b) $\frac{\pi}{4} + \frac{5\sqrt{3}}{16}$
    (c) $\frac{\pi}{8} + \frac{9\sqrt{3}}{16}$ (d) $\frac{\pi}{8} + \frac{\sqrt{3}}{4}$

17. The integral $\int \sqrt{x + \sqrt{x^2 + 2}}\, dx = A\left(x + \sqrt{x^2 + 4}\right)^k + \frac{B}{\left(x + \sqrt{x^2+2}\right)^p} + C$, C is the constant of integration. Then
    (a) $A = \frac{1}{2}, B = -3, k = \frac{1}{2}, p = \frac{3}{2}$
    (b) $A = \frac{1}{3}, B = -2, k = \frac{3}{2}, p = \frac{1}{2}$
    (c) $A = \frac{1}{2}, B = -3, k = \frac{1}{2}, p = -\frac{3}{2}$
    (d) $A = \frac{1}{3}, B = -2, k = \frac{1}{2}, p = \frac{3}{2}$

18. Let $K = \{a + b\omega + c\omega^2 : \omega \neq 1, \omega^3 = 1, a, b, c \in Z_5\}$, where Z_5 is the set of integers multiplicative modulo 5. Then which one of the following is NOT correct about K?
    (a) K has no zero divisor
    (b) K has only one idempotent
    (c) Every element of K is not a unit
    (d) K is a field and the number of non isomorphic subfields of K is 2

19. Let $G = U(98) = \{k \in N: k \leq 98,$ and GCD $(k, 98) = 1\}$ be a group, where N is the set of all natural numbers. The number of generators of the largest cyclic subgroup of G is
    (a) 12   (b) 32
    (c) 42   (d) 49

20. Let $M = \begin{bmatrix} i & 0 \\ 0 & -i \end{bmatrix}$ and $N = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ over the field of complex numbers, where $i = \sqrt{-1}$. Let G be a group generated by M and N. Which one of the following is not correct about G?
    (a) G is non-abelian group of order 8
    (b) Centre of G is of order 2
    (c) G has a normal subgroup
    (d) Centre of G is of order 4

21. Let $F: \mathbb{R} \to \mathbb{R}$ be a twice differentiable function, and $g: \mathbb{R}^2 \to \mathbb{R}$ be given by $g(x, y) = f(x^2 - y^2)$. Then $\frac{\partial}{\partial x}\left(\frac{\partial g}{\partial x}\right) + \frac{\partial}{\partial y}\left(\frac{\partial g}{\partial y}\right) - 2\frac{\partial}{\partial x}\left(\frac{\partial g}{\partial y}\right)$ equals
    (a) $4(x + y)^2 f''(x^2 - y^2)$
    (b) $4(x - y)^2 f''(x^2 - y^2)$
    (c) $4(x^2 - y^2 - 2xy)f''(x^2 - y^2)$
    (d) $4(x^2 + y^2 + xy)f''(x^2 - y^2)$

22. Let z be a complex number satisfying $3|z − 12| = 5|z − 8i|$ and $|z − 4| = |z − 8|$, where $i = −1$. If Re (z) and Im (z) are the real and the imaginary parts of z respectively, then value of Re (z) + Im (z) equals
(a) -11   (b) 23
(c) 21   (d) -13

23. Let the Taylor's series of the function $f(x) = \frac{1}{(1−x)^3}$ at x = 0 be $\sum_0^\infty a_n x^n$. The value of $a_{15} − a_{13}$ is equal to
(a) 2   (b) 30
(c) 31   (d) 62

24. The growth rate $\frac{dN}{dt}$ of the population N of the rabbits in a certain wildlife garden in proportional to the unutilized opportunity for growth described by the differential equation $\frac{dN}{dt} = k(750 − N)$, where k is the constant of proportionality. It is given that the population of the rabbits at $t = 0$ is 100, and after 2 years their population has grown to 230. The population of rabbits after 4 years is
(a) 234   (b) 316
(c) 433   (d) 334

25. The number of cyclic subgroups of order 15 in a group $G = Z_{30} \oplus Z_{20}$ equals
(a) 12   (b) 6
(c) 5   (d) 4

26. Which one of the following sets is NOT a subring of the ring $M_2(R)$, of all 2×2 real matrices?
(a) $\left\{\begin{pmatrix} a & b \\ 0 & c \end{pmatrix} : a, b \cdot c \in \mathbb{R}\right\}$
(b) $\left\{\begin{pmatrix} a & a \\ b & b \end{pmatrix} : a, b \cdot c \in \mathbb{R}\right\}$
(c) $\left\{\begin{pmatrix} a & 1 \\ 1 & b \end{pmatrix} : a, b \cdot c \in \mathbb{R}\right\}$
(d) $\left\{\begin{pmatrix} a & b \\ b & a \end{pmatrix} : a, b \cdot c \in \mathbb{R}\right\}$

27. In a triangle ABC, let sides AB and AC be represented by the vectors $\hat{\imath} − 3\hat{\jmath} + \sqrt{2}\hat{k}$ and $3\hat{\imath} + \hat{\jmath} + \sqrt{2}\hat{k}$, respectively. Let θ be the $\angle ABC$

and d be the length of the median of ΔABC drawn from A on the side BC, then
(a) $\theta = 180° − \cos^{-1}\sqrt{\frac{5}{12}}$ and $d = \sqrt{7}$
(b) $\theta = 180° − \cos^{-1}\sqrt{\frac{5}{12}}$ and $d = \sqrt{5}$
(c) $\theta = \cos^{-1}\sqrt{\frac{5}{12}}$ and $d = \sqrt{7}$
(d) $\theta = \cos^{-1}\sqrt{\frac{5}{12}}$ and $d = \sqrt{5}$

28. Let $M = \begin{bmatrix} 50 & 20 \\ 20 & 80 \end{bmatrix}$. Let λ_1 and λ_2 be the eigenvalues of M and their eigenvectors be $X1 = \begin{pmatrix} 20 \\ \lambda_1 − 50 \end{pmatrix}$ and $X2 = \begin{pmatrix} \lambda_2 − 80 \\ 20 \end{pmatrix}$, respectively. The value of $(X1 + X2)^T(X1 − X2) + (X1)^T X2$ equals
(a) 5600   (b) 1600
(c) 0   (d) 4000

29. Let Re(z) and Im(z) be the real and imaginary parts of any complex number z , and arg(z) denotes the principal argument of z. Let z1 and z2 be two distinct complex numbers such that Re(z1) = |z − 2| and Re(z2) = |z2 − 2|. If arg(z1 − z2) = π /6 then
(a) Im(z1 + z2) = $4\sqrt{3}$
(b) Im(z1 + z2) = $\frac{4}{\sqrt{3}}$
(c) Re(z1 − z2) = 8
(d) Re(z1 − z2) = 9

30. Which one of the following statements is NOT correct in the ring= $Z_4 \oplus Z_6$?
(a) The set of all units in R is $\{(1, 1), (1, 5), (3, 1), (3, 5)\}$
(b) The set of all nilpotent elements in R is $\{(0.0),(0, 2)\}$
(c) The total number of the zero-divisors in R is 28.
(d) The set of zero-divisors is {(a, b) : a = 0, 2 and b = 0, 2, 3, 4 }

31. Given that $3^x = 656$. The value of $5^{x−5}$ is ......
(a) 81   (b) 125

(c) 225 (d) 1/125

32. What is the next term in the series 6, 20, 42, 72, 110, ... is
(a) 156 (b) 210
(c) 110 (d) 119

33. Next term in the series zaa, yeb, xic, wod, vue, ... is
(a) uaf (b) uef
(c) teg (d) tag

34. Age of a child is half of the age of father. Twenty years ago the age of father was 10 times the age of son. What is the age of father?
(a) 60 years (b) 55 years
(c) 50 years (d) 45 years

35. In a race of 1 Kilometer, athlete A beats athlete B by 50 meters, in another race of 500 meters, athlete B beats athlete C by 50 meters. By how many meters (Approximately) can athlete A beat athlete C in a race of 400 meters?
(a) 50 meters (b) 58 meters
(c) 62 meters (d) 72 meters

36. Persons A, B, and C can finish a work in 15, 10, and 12 days respectively. Person B and person C start the work together but are asked to leave after 4 days. In how many days will the remaining work be done by person A?
(a) 2 days (b) 3 days
(c) 4 days (d) 5 days

TOPIC:- MCA B

The causes and physical characteristics of pandemics and disasters are very different. More than any previous disaster such as Ebola, HIV, SARS, TB and malaria, the Coronavirus Disease (COVID-19) has exposed underlying risks and vulnerabilities and challenged the traditional notion of risk .The impact on population groups with pre-existing vulnerabilities has been particularly severe especially where the health crisis has turned into a humanitarian and economic crisis. There

are examples of countries. In the Asia-Pacific region that experienced disasters in the year or months before the onset of the COVID-19 pandemic and where the impacts of both the virus itself and the government response to contain its spread have either reinforced the socio-economic impacts of the previous disaster or have impeded planned recovery efforts. In April 2020, the small island states of Fiji, Solomon Islands, Tonga and Vanuatu were impacted by Tropical Cyclone Harold. While they were relatively isolated from the health risks of COVID-19 due to early closure of borders, they were already feeling the effects of economic losses due to reduced market demand from tourism, fisheries and global commodities.

37. Which of the following is a vulnerable group?
(a) Persons with pre-existing disabilities
(b) People living with pet animals
(c) People living in multi-storeyed buildings
(d) People living in residential complexes

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they were relatively isolated from the health risks of COVID-19 due to early closure of borders, they were already feeling the effects of economic losses due to reduced market demand from tourism, fisheries and global commodities What disaster struck island states of Fiji?
(a) Earthquake   (b) Floods
(c) Cyclone   (d) Economic losses

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(a) COVID 19 has challenged the traditional notion of risk.
(b) In Fiji economic losses occurred due to reduced market from tourism.

(c) Many countries experienced disasters in the years or months before the onset of the COVID-19
(d) The characteristics of TB and COVID 19 are same.

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(a) 'CO' stands for 'corona,' 'VI' for 'virus,' and 'D' for disease.
(b) 'CO' stands for 'corona,' 'V' for 'virus,' 'I' for induced and 'D' for disease.
(c) 'CO' stands for 'corona,' 'V' for 'virus,' 'I ' for incite and 'D' for disease
(d) 'CO' stands for 'corona,' 'V' for 'virus,' 'I ' for indicative and 'D' for disease

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(a) A week   (b) Months
(c) Years   (d) Decades

Topic :- MCA C

42. Air pollution is the single greatest environmental risk to living beings and one of the main causes of death and disease globally. Air pollution affects all but it disproportionately affects women, children and the elderly, especially in low-income populations as they are often exposed to high levels of ambient air pollution and indoor air pollution from cooking and heating with wood fuel and kerosene and also has a negative impact on ecosystems. Some air pollutants, such as black carbon, methane, hydro- fluorocarbons and ground-level ozone, are also short-lived climate pollutants and are responsible for a significant portion of air pollution-related deaths, as well as impacts on crops and hence food security, so their reduction has co-benefits for the climate. The average atmospheric lifetime of a single black carbon soot particle is only two or three weeks. Methane has an atmospheric lifetime of 12 years. Ground-level ozone lasts only a few hours to a few days in the atmosphere. The average HFC lifespan, weighted by their respective emissions, is 15 years. All countries need to substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination by 2030, as well as to reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management by 2030. Today, the international community acknowledges that improving air quality can enhance climate change mitigation and that climate change mitigation efforts can improve air quality. Seventh of September every year is designated as the International Day of Clean Air for blue skies. Air pollution disproportionately affects...especially in low-income populations

(a) Women only   (b) children only
(c) Elderly
(d) Women, children and the elderly

43. Air pollution is the single greatest environmental risk to living beings and one of the main causes of death and disease globally. Air pollution affects all but it disproportionately affects women, children and the elderly, especially in low-income populations as they are often exposed to high levels of ambient air pollution and indoor air pollution from cooking and heating with wood fuel and kerosene and also has a negative impact on ecosystems. Some air pollutants, such as black carbon, methane, hydro- fluorocarbons and ground-level ozone, are also short-lived climate pollutants and are responsible for a significant portion of air pollution-related deaths, as well as impacts on

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(a) Air pollution can cause food security.

(b) Reducing short lived pollutants can improve the climate.

(c) Adverse per capita environmental impact of cities is under control

(d) Climate change mitigation efforts can improve air quality.

44. Air pollution is the single greatest environmental risk to living beings and one of the main causes of death and disease globally. Air pollution affects all but it disproportionately affects women, children and the elderly, especially in low-income populations as they are often exposed to high levels of ambient air pollution and indoor air pollution from cooking and heating with wood fuel and kerosene and also has a negative impact on ecosystems. Some air pollutants, such as black carbon, methane, hydro- fluorocarbons and ground-level ozone, are also short-lived climate pollutants and are responsible for a significant portion of air

What is the full form of SLCP?

(a) Short-Lived Climate Pollutants

(b) Short-Lived Climate Pollution

(c) Short-Lived Carbon Pollutants

(d) Short-Life Climate Pollutants

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(a) 17th September   (b) 7th September
(c) 27th September   (d) 30th September

46. Air pollution is the single greatest environmental risk to living beings and one of the main causes of death and disease globally. Air pollution affects all but it disproportionately affects women, children and the elderly, especially in low-income populations as they are often exposed to high levels of ambient air pollution and indoor air pollution from cooking and heating with wood fuel and kerosene and also has a negative impact on ecosystems. Some air pollutants, such as black carbon, methane, hydro- fluorocarbons and ground-level ozone, are also short-lived climate pollutants and are responsible for a significant portion of air pollution-related deaths, as well as impacts on crops and hence food security, so their reduction has co-benefits for the climate. The average atmospheric lifetime of a single black carbon soot particle is only two or three weeks.

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Match List I with List II

	List I		List II
A.	Black Carbon	.	12 years
B.	Methane	I.	15 years
C.	Hydro-Fluorocarbons	II.	2-3 Weeks
D.	Ground-level Ozone	V.	Few Hours to few days

Choose the correct answer from the options given below
(a) A - III, B - I, C - II, D - IV
(b) A - II, B - III, C - IV, D - I
(c) A - IV, B - II, C - III, D - I
(d) A - I, B - IV, C - II, D - III

Topic:- MCA D

47. What is the floating point representation of 12.25?
    (a) 1100.01   (b) 1100.11001
    (c) 1100.10   (d) 1100.10011

48. Consider the following function:

```
void swap (int x, int y)
  {
        int temp = x;
        x = y;
        y = temp;
      }
```
The above function is invoked as follows:
```
int a = 3;
int b = 4;
swap (a, b);
```
What will be the values assigned to a and b on execution of the function call: swap (a, b)?

(a) a = 3, b = 3   (b) a = 3, b = 4

(c) a = 4, b = 3   (d) a = 4, b = 4

49. The value of n in the following code segment is
```
int a[ ] ={1, 2, 3, 4};
int i = 0, n;
i++ ;
n = a[++i];
```
(a) 1   (b) 2

(c) 3   (d) 4

50. The following bit pattern denotes a negative integer in two's complement form. 1111111111111010 What value does it represent?

(a) – 6   (b) – 4

(c) – 2   (d) – 1

ANSWER-KEY

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