CUET UG 2023 Mathematics Question Paper PDF (May 22, 2023) (Shift 3)

SECTION: COMMON

1. The probability that a student is not a swimmer is $\frac{1}{5}$. Then the probability that out of five students, four are swimmers is:
   (a) ${}^5C_4\left(\frac{4}{5}\right)^4\frac{1}{5}$
   (b) $\left(\frac{4}{5}\right)^4\frac{1}{5}$
   (c) ${}^5C_4\left(\frac{1}{5}\right)^4\left(\frac{4}{5}\right)$
   (d) $\left(\frac{1}{5}\right)^4\left(\frac{4}{5}\right)$

2. If $P=\begin{bmatrix}1 & x & 3\\ 1 & 3 & 3\\ 2 & 4 & 4\end{bmatrix}$ is the adjoint of 3×3 matrix A and $|A|$ is 4, then x is equal to:
   (a) 4
   (b) 0
   (c) 11
   (d) 5

3. $\int_1^2 \frac{x\,dx}{(x+1)(x+2)}=$
   (a) $\tan^{-1}\frac{32}{27}$
   (b) $\tan^{-1}\frac{27}{32}$
   (c) $\log\frac{32}{27}$
   (d) $\log\frac{27}{32}$

4. The angle of intersection between the curves $y=4-x^2$ and $y=x^2$ is:
   (a) $\frac{\pi}{2}$
   (b) $\frac{\pi}{4}$
   (c) $\tan^{-1}\frac{4}{3}$
   (d) $\tan^{-1}\frac{4\sqrt{2}}{7}$

5. Which of the following statements is incorrect regarding matrices?
   For any matrices A and B of suitable orders,
   (a) $(A')'=A$
   (b) $(KA)'=KA'$ (Where K is any constant)
   (c) $(A+B)'=B'+A'$
   (d) $(AB)'=A'B'$

6. If $f(x)=\begin{cases}ax^2+b, & x<-1\\ bx^2+ax+4 & x\ge -1\end{cases}$ is everywhere differentiable, then:
   (a) $a=2, b=3$
   (b) $a=3, b=2$
   (c) $a=-2, b=3$
   (d) $a=2, b=-3$

7. All points lying inside the triangle formed by the points (5, 0), (–1, 2) and (1, 3) satisfy:
   (A) $3x+2y-18>0$
   (B) $3x+2y>0$
   (C) $2x+y+13<0$
   (D) $2x-3y-12<0$
   (E) $2x-3y+12>0$
   Choose the **correct** answer from the options given below:
   (a) (A) and (B) only
   (b) (B) and (C) only
   (c) (D) and (E) only
   (d) (B), (D) and (E) only

8. If $f(x)=2x$ and $g(x)=\frac{x^2}{2}+1$, then which of the following can be a discontinuous function?
   (a) $f(x)+g(x)$
   (b) $f(x)-g(x)$
   (c) $f(x).g(x)$
   (d) $\frac{g(x)}{f(x)}$

9. Interval in which the function $f(x)=2x^3-3x^2-12x+10$ is decreasing is:
   (a) $(-\infty,-1]$
   (b) $(-\infty,-1]\cup[2,\infty)$
   (c) $[-1,2]$
   (d) $[2,\infty)$

10. For the following probability distribution:

X	1	2	3	4
P(X)	1/10	1/5	3/10	2/5

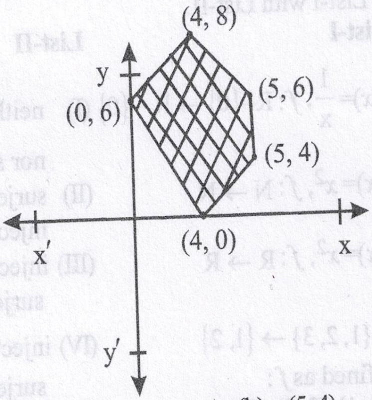
   $E(X^2)$ is equal to:
   (a) 3
   (b) 5
   (c) 7
   (d) 10

11. The differential equation of the family of curves $y=a\sin(bx+c)$, a and c are parameters, is:
   (a) $\frac{d^2y}{dx^2}+b^2y=0$
   (b) $\frac{dy}{dx}+b^2y=0$
   (c) $\frac{d^2y}{dx^2}-b^2y=0$
   (d) $\frac{d^2y}{dx^2}+y=0$

12. $\int e^x\left(\frac{1-x}{1+x^2}\right)^2 dx=$
   (a) $\frac{e^x}{1+x^2}+C$
   (b) $-\frac{e^x}{1+x^2}+C$
   (c) $\frac{e^x}{(1+x^2)^2}+C$
   (d) $-\frac{e^x}{(1+x^2)^2}+C$

13. The area enclosed by the ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ is given by:
   (a) $3\int_0^4\sqrt{9-x^2}\,dx$
   (b) $\frac{3}{4}\int_0^4\sqrt{9-x^2}\,dx$
   (c) $3\int_0^4\sqrt{16-x^2}\,dx$
   (d) $\frac{3}{4}\int_0^4\sqrt{16-x^2}\,dx$

14. The feasible region for an LPP is shown below. Let $Z = 3x - 4y$ be the objective function. Maximum of Z occurs at:



(a) (0, 6) (b) (5, 4)
(c) (4, 8) (d) (4, 0)

15. If $A=\begin{bmatrix}1 & 2\\ 4 & 2\end{bmatrix}$, then the value of K for which $|2A| = K|A|$ is:

(a) -24 (b) 4
(c) 4 (d) 6

SECTION: CORE MATHEMATICS

1. Which of the following statements are correct?
(A) $|A'| = |A|$, where A is the transpose of matrix A
(B) If $A = [a_{ij}]_{3\times3}$, then $|4A| = 64|A|$
(C) $|A| = |\text{adj}\,A|^{n-1}$, where n is the order of the matrix
(D) If A is an invertible matrix of order 2, then $\det(A^{-1})$ is equal to $\dfrac{1}{\det(A)}$

Choose the correct answer from the options given below:
(a) (A), (B), (D), only (b) (A), (C) only
(c) (A), (B), (C) only (d) (A), (D) only

2. The position vector of a point R which divides the line joining two points P and Q whose position vectors are $\hat{i}+2\hat{j}-\hat{k}$ and $-\hat{i}+\hat{j}+\hat{k}$ respectively in the ratio 2:1 externally is:

(a) $-\frac{1}{3}\hat{i}+\frac{4}{3}\hat{j}+\frac{1}{3}\hat{k}$ (b) $-3\hat{i}+3\hat{k}$
(c) $3\hat{i}-3\hat{k}$ (d) $\frac{1}{3}\hat{i}-\frac{4}{3}\hat{j}-\frac{1}{3}\hat{k}$

3. Match List - I with List - II.

List-I	List-II
(A) $x = 2at^2, y = at^4$	(I) Inverse trignometric function
(B) $f(x) = (2x+3)^3$	(II) Implicit function
(C) $xy + y^2 = \tan(x+y)$	(III) Parametric function
(D) $y = \tan^{-1}\left(\dfrac{3x-x^3}{1-3x^2}\right)$, $-\dfrac{1}{\sqrt{3}} < x < \dfrac{1}{\sqrt{3}}$	(IV) Composite function

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

4. If $A=\begin{pmatrix}\cos 2\theta & \sin 2\theta\\ -\sin 2\theta & \cos 2\theta\end{pmatrix}$, then $A^2 =$

(a) $\begin{pmatrix}\cos 4\theta & \sin 4\theta\\ -\sin 4\theta & \cos 4\theta\end{pmatrix}$ (b) $\begin{pmatrix}\cos^2 2\theta & \sin^2 2\theta\\ \sin^2 2\theta & \cos^2 2\theta\end{pmatrix}$

(c) $\begin{pmatrix}1 & 0\\ \sin 2\theta & \cos 2\theta\end{pmatrix}$ (d) $\begin{pmatrix}\cos 6\theta & \sin 6\theta\\ -\sin 6\theta & \cos 6\theta\end{pmatrix}$

5. Owner of a whole sale computers shop plans to sell 2 types of computers. A desktop and portable model. If x is the number of desktops and y is the number of portable model and the shop's capacity cannot exceed 250 units. Which of the following is correct?
(a) $x+y=250$ (b) $x+y\leq 250$
(c) $x+y\geq 250$ (d) $x+y>250$

6. The value of C, in Rolle's theorem for the function $f(x) = e^x \sin x$, when $x\in[0,\pi]$ is:
(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$
(c) $\frac{\pi}{2}$ (d) $\frac{3\pi}{4}$

7. Integrating factor of $(x \log_e x)\dfrac{dy}{dx} + y = 2\log_e x$ is:
(a) x (b) e^x
(c) $\log_e x$ (d) $\log_e(\log_e x)$

8. Match List-I with List-II.

List-I	List-II
(A) $\lvert A^T\rvert$	(I) $B^{-1}A^{-1}$
(B) A (adj A)	(II) (adj A)
(C) $A^{-1}\lvert A\rvert$	(III) (adj A) A
(D) $(AB)^{-1}$	(IV) $\lvert A\rvert$

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

9. Match List-I with List - II.

List-I	List-II
(A) $y = \log(\sin x)$	(I) $\dfrac{d^2y}{dx^2} = -\dfrac{1}{x^2}$
(B) $y = e^{(1+\log x)}$	(II) $\dfrac{d^2y}{dx^2} = 2$
(C) $y = \log\lvert x\rvert$	(III) $\dfrac{d^2y}{dx^2} = 0$
(D) $y = x^2+4x-1$	(IV) $\dfrac{d^2y}{dx^2} = -\text{cosec}^2 x$

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

10. Match List -I with List -II

List - I	List -II
(A) Area of triangle Δ with adjacent sides $\vec{a}$ and $\vec{b}$	(I) $\vec{a}\times\vec{b}$
(B) Area of parallelogram with adjacent side $\vec{a}\times\vec{b}$	(II) $\frac{1}{2}\left\|\vec{a}\times\vec{b}\right\|$
(C) $(\vec{a}-\vec{b})\times(\vec{a}+\vec{b})$	(III) $\left\|\vec{a}\times\vec{b}\right\|$
(D) $\|\vec{a}\|\|\vec{b}\|\sin\theta\hat{n}$, where symbols have their usual meaning	(IV) $2(\vec{a}\times\vec{b})$

Choose the correct answer from the options given below:

(a) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)
(b) (A)-(IV), (B)-(I), (C)-(III), (D)-(II)
(c) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)
(d) (A)-(II), (B)-(IV), (C)-(III), (D)-(I)

11. Let $y=\log_e\left(\frac{a+b\sin x}{a-b\sin x}\right)$, then value of $\frac{dy}{dx}$ is:

(a) $\frac{ab\cos x}{a^2-b^2\sin^2 x}$
(b) $\frac{ab\cos x}{a^2+b^2\sin^2 x}$
(c) $\frac{a\sin x}{a^2-b^2\sin^2 x}$
(d) $\frac{2ab\cos x}{a^2-b^2\sin^2 x}$

12. Cartesian equation of plane passing through the points (2,–4, 5) and perpendicular to the line with direction ratios (3,–1, 2) is:

(a) $3x-y+2z=0$
(b) $3x-y+2z=20$
(c) $2x-4y+5z=0$
(d) $2x-4y+5z=45$

13. The appropriate change in the volume V of a cube of side x metres caused by increasing the side by 2% is:

(a) $0.06x^3\,m^3$
(b) $0.02x^3\,m^3$
(c) $3x^2\,m^3$
(d) $0.02x\,m^3$

14. The equation of tangent to the curve $x=a\cos^3 t$, $y=a\sin^3 t$ at t is:

(a) $x\sec t+y\operatorname{cosec} t=a$
(b) $x\sec t-y\operatorname{cosec} t=a$
(c) $x\operatorname{cosec} t+y\sec t=a$
(d) $x\operatorname{cosec} t-y\sec t=a$

15. The set of values of K for which the system of equations $\begin{bmatrix}2&3&1\\4&5&0\\1&K&3\end{bmatrix}\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}5\\6\\7\end{bmatrix}$ gives a unique solution is:

(a) $\left\{\frac{5}{4}\right\}$
(b) $\left\{-\frac{5}{4},\frac{5}{4}\right\}$
(c) $\left\{\frac{11}{4}\right\}$
(d) $R-\left\{\frac{11}{4}\right\}$

16. Match List-I with List-II.

List-I	List-II
(A) $f(x)=\frac{1}{x}$, $f:R-\{0\}\to R-\{0\}$	(I) neither injective nor surjective
(B) $f(x)=x^2$, $f:N\to N$	(II) surjective but not injective
(C) $f(x)=x^2$, $f:R\to R$	(III) injective but not surjective
(D) $f:\{1,2,3\}\to\{1,2\}$ defined as f: $\{(1,1),(2,2),(3,1)\}$	(IV) injective and surjective

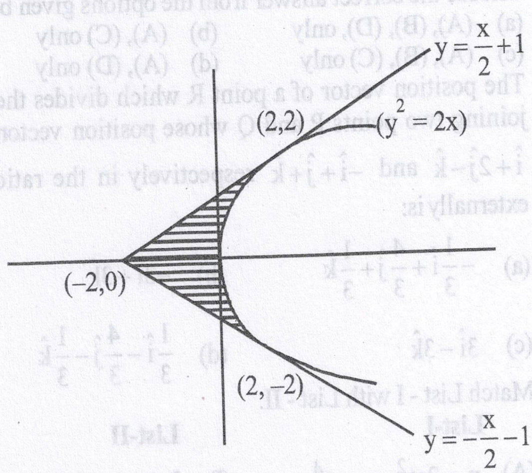
Choose the correct answer from the options given below:

(a) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)
(b) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)
(c) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)
(d) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)

17. The black and red die are rolled. The conditional probability of obtaining a sum greater than 9 given that the black die resulted in a 5 is:

(a) $\frac{1}{3}$
(b) $\frac{1}{6}$
(c) $\frac{1}{18}$
(d) $\frac{1}{9}$

18. Calculate the shaded area as given below:



(a) $\frac{8}{3}$ sq. units
(b) $\frac{8}{5}$ sq. units
(c) 3 sq. units
(d) 8 sq. units

19. The region represented by the system of inequalities $x, y\ge 0$; $2x+3y\ge 4$; $x\ge 1$ is:

(a) unbounded in first quadrant
(b) unbounded in first and second quadrant
(c) bounded in first quadrant
(d) not feasible

20. The value of the determinant $\Delta = \begin{vmatrix} 1! & 2! & 3! \\ 2! & 3! & 4! \\ 3! & 4! & 5! \end{vmatrix}$ is:

(a) 2! (b) 3!
(c) 4! (d) 5!

21. $\int_0^{\pi/2} \sqrt{1-\sin 2x}\,dx$ is equal to:

(a) $2\sqrt{2}$ (b) $2(\sqrt{2}+1)$
(c) 2 (d) $2(\sqrt{2}-1)$

22. Let $A = PQ$. The elementary operation on A, that produces the same effect as it does on applying on P and keeping Q unchanged is:

(A) $R_i \leftrightarrow R_j$ (B) $R_i \to R_i + KR\hat{j}$
(C) $C_i \to KC_i$ (D) $C_i \to C_i + KC_j$

Choose the correct answer from the options given below:

(a) (A) and (B) only (b) (A), (B) and (D) only
(c) (A), (C) and (D) only (d) (B) and (D) only

23. The principal value of $\cot^{-1}\left(\frac{-1}{\sqrt{3}}\right)$ is:

(a) $-\frac{2\pi}{3}$ (b) $\frac{2\pi}{3}$
(c) $\frac{\pi}{3}$ (d) $-\frac{\pi}{3}$

24. $\int e^x (\tan x + \log_e \sec x)\,dx =$

(a) $e^x \log_e \sec x + C$ (b) $\log_e \sec x + C$
(c) $e^x \tan x + C$ (d) $e^x \sec x + C$

25. Distance between the point (3, 4, 5) and the point where the line $\frac{x-3}{1} = \frac{y-4}{2} = \frac{z-5}{2}$ meets the plane $x+y+z=17$ is:

(a) 1 (b) 2
(c) 3 (d) $\frac{3}{2}$

26. Urn I contains 6 red balls and 4 black balls and Urn II contains 4 red balls and 6 black balls. One ball is drawn at random from Urn I and placed in Urn II. If one ball is drawn at random from Urn II, then the probability that it is a red ball is:

(a) $\frac{3}{5}$ (b) $\frac{4}{11}$
(c) $\frac{23}{55}$ (d) $\frac{2}{5}$

27. The differential equation $y = xp + \sqrt{x^2p^3+4}$ where $p = \frac{dy}{dx}$ is:

(A) of order 1 (B) of degree 1
(C) of order 2 (D) of degree 3

Choose the correct answer from the options given below:

(a) (A) and (B) only (b) (A) and (D) only
(c) (B) and (C) only (d) (C) and (D) only

28. The area enclosed between the curve $x^2+y^2=16$ and the coordinate axes in the first quadrant is:

(a) 12π sq. units (b) 8π sq. units
(c) 4π sq. units (d) 2π sq. units

29. Let R be a relation on the set of natural numbers N defined by nRm if n divides m. Then R is:

(A) Reflexive Relation (B) Symmetric Relation
(C) Transitive Relation (D) Identity Relation

Choose the correct answer from the option given below:

(a) (A) and (C) only (b) (A) and (B) only
(c) (A) and (D) only (d) (B) and (C) only

30. If the rate of change of area of a circle is equal to the rate of change of its diameter, then its radius is equal to:

(a) $\frac{1}{2\pi}$ unit (b) $\frac{1}{\pi}$ unit
(c) $\frac{\pi}{2}$ unit (d) π unit

31. If $f(x) = \sqrt{x}$, $g(x) = 2x-3$, then domain of $fog(x)$ is:

(a) $\left[\frac{3}{2}, \infty\right)$ (b) $\left[\frac{1}{2}, \infty\right)$
(c) $\left(\frac{3}{2}, \infty\right)$ (d) $\left[\frac{5}{2}, \infty\right)$

32. The given function $f(x) = [x]$ is discontinuous at:

(a) every integer (b) every even number
(c) every real number (d) at zero only

33. The maximum value of $2x^3 - 24x + 107$ in the interval [1, 3] is:

(a) 87 (b) 89
(c) 90 (d) 85

34. The equation of curve whose slope is given by $\frac{dy}{dx} = x$ and which passes through $\left(1, \frac{5}{2}\right)$ is:

(a) $y = x^2 + \frac{5}{2}$ (b) $y = \frac{x^2}{2} + 2$
(c) $y = \frac{x^2}{3} + \frac{2}{3}$ (d) $y = 3x^2 + 5$

35. If the shortest distance between the lines l_1 and l_2 given by $\vec{r} = a\hat{i} + 2\hat{j} - \hat{k} + \lambda(2\hat{i} - \hat{j} + \hat{k})$ and $\vec{r} = \hat{i} - \hat{j} + \hat{k} + \mu(2\hat{i} - \hat{j} + \hat{k})$ is $\sqrt{\frac{35}{6}}$ units, the values of 'a' can be:

(a) 0, –8 (b) 0, 8
(c) 2, 6 (d) –2, 6