CUET 2024 Paper 1

1. If A and B are symmetric matrices of the same order, then AB - BA is:
   - (a) symmetric matrix
   - (b) zero matrix
   - (c) skew symmetric matrix
   - (d) identity matrix

2. If A is a square matrix of order 4 and $|A| = 4$, then $|2A|$ will be:
   - (a) 8
   - (b) 64
   - (c) 16
   - (d) 4

3. If $\{A\}_{3\times2}[B]_{x\times y} = [C]_{3\times1}$, then:
   - (a) $x = 1, y = 3$
   - (b) $x = 2, y = 1$
   - (c) $x = 3, y = 3$
   - (d) $x = 3, y = 1$

4. If a function $f(x) = x^2 + bx + 1$ is increasing in the interval $[1, 2]$, then the least value of b is:
   - (a) 5
   - (b) 0
   - (c) -2
   - (d) -4

5. Two dice are thrown simultaneously. If X denotes the number of fours, then the expectation of X will be:
   - (a) $\frac{5}{9}$
   - (b) $\frac{1}{3}$
   - (c) $\frac{4}{7}$
   - (d) $\frac{3}{8}$

6. For the function $f(x) = 2x^3 - 9x^2 + 12x - 5, x \in [0, 3]$, match List-I with List-II:

List-I	**List-II**
(A) Absolute maximum value	(I) 3
(B) Absolute minimum value	(II) 0
(C) Point of maxima	(III) -5
(D) Point of minima	(IV) 4

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

7. An objective function $Z = ax + by$ is maximum at points (8, 2) and (4, 6). If $a \geq 0$ and $b \geq 0$ and $ab = 25$, then the maximum value of the function is equal to:
   - (a) 60
   - (b) 50
   - (c) 40
   - (d) 80

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8. The area of the region bounded by the lines $x + 2y = 12$, $x = 2$, $x = 6$ and x-axis is:

(a) 34 sq units
(b) 20 sq units
(c) 24 sq units
(d) 16 sq units

9. A die is rolled thrice. What is the probability of getting a number greater than 4 in the first and the second throw of dice and a number less than 4 in the third throw?

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

10. The corner points of the feasible region determined by

$$x + y \leq 8, \quad 2x + y \geq 8, \quad x \geq 0, \quad y \geq 0$$

are A(0, 8), B(4, 0) and C(8, 0). If the objective function $Z = ax + by$ has its maximum value on the line segment AB, then the relation between a and b is:

(a) $8a + 4 = b$
(b) $a = 2b$
(c) $b = 2a$
(d) $8b + 4 = a$

11. If $t = e^{2x}$ and $y = \log_e t^2$, then $\frac{d^2y}{dx^2}$ is:

(a) 0
(b) $4t$
(c) $\frac{4e^{2t}}{t}$
(d) $\frac{e^{2t}(4t-1)}{t^2}$

12. The value of the integral $\int \frac{\pi}{x^{n+1}-x}\,dx$ is:

(1) $\frac{\pi}{n}\log_e\left|\frac{x^n-1}{x^n}\right| + C$
(2) $\log_e\left|\frac{x^n+1}{x^n-1}\right| + C$
(3) $\frac{\pi}{n}\log_e\left|\frac{x^n+1}{x^n}\right| + C$
(4) $\pi\log_e\left|\frac{x^n}{x^n-1}\right| + C$

13. The value of $\int_0^1 \frac{a-bx^2}{(a+bx^2)^2}\,dx$ is:

(1) $\frac{a-b}{a+b}$
(2) $\frac{1}{a-b}$
(3) $\frac{a+b}{2}$
(4) $\frac{1}{a+b}$

14. The second order derivative of which of the following functions is 5^x?

(1) $5^x \log_e 5$
(2) $5^x (\log_e 5)^2$
(3) $\frac{5^x}{\log_e 5}$
(4) $\frac{5^x}{(\log_e 5)^2}$

15. The degree of the differential equation $\left(1 - \left(\frac{dy}{dx}\right)^2\right)^{3/2} = k\frac{d^2y}{dx^2}$ is:

(1) 1
(2) 2
(3) 3
(4) $\frac{3}{2}$

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16. Let R be the relation over the set A of all straight lines in a plane such that $l_1 \, R \, l_2 \iff l_1$ is parallel to l_2. Then R is:

(1) Symmetric
(2) An Equivalence relation
(3) Transitive
(4) Reflexive

17. The probability of not getting 53 Tuesdays in a leap year is:

(1) $\frac{2}{7}$
(2) $\frac{1}{7}$
(3) 0
(4) $\frac{5}{7}$

18. The angle between two lines whose direction ratios are proportional to $1, 1, -2$ and $(\sqrt{3}-1), (-\sqrt{3}-1), -4$ is:

(1) $\pi/3$
(2) 2
(3) $\pi/6$
(4) $\pi/2$

19. If $(\vec{a}-\vec{b})\cdot(\vec{a}+\vec{b}) = 27$ and $|\vec{a}| = 2|\vec{b}|$, then $|\vec{b}|$ is:

(1) 3
(2) 2
(3) 5/6
(4) 6

20. If $\tan^{-1}\left(\frac{2}{3^{-x}+1}\right) = \cot^{-1}\left(\frac{3}{3^{x}+1}\right)$, then which one of the following is true?

(1) There is no real value of x satisfying the above equation.
(2) There is one positive and one negative real value of x satisfying the above equation.
(3) There are two real positive values of x satisfying the above equation.
(4) There are two real negative values of x satisfying the above equation.

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21. If A, B and C are three singular matrices given by $A = \begin{bmatrix} 1 & 4 \\ 3 & 2a \end{bmatrix}$, $B = \begin{bmatrix} 3b & 5 \\ 4 & 2 \end{bmatrix}$ and $C = \begin{bmatrix} a+b+c & c+1 \\ a+c & c \end{bmatrix}$, then the value of abc is:

(1) 15
(2) 30
(3) 45
(4) 90

22. The value of the integral $\int_{\log_e 3}^{\log_e 2} \left(\frac{e^{2x}-1}{e^{2x}+1}\right) dx$ is:

(1) $\log_e 3$
(2) $\log_e 4 - \log_e 3$
(3) $\log_e 9 - \log_e 4$
(4) $\log_e 3 - \log_e 2$

23. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three vectors such that $\vec{a}+\vec{b}+\vec{c} = \vec{0}$, where $\vec{a}$ and $\vec{b}$ are unit vectors and $|\vec{c}| = 2$, then the angle between the vectors $\vec{b}$ and $\vec{c}$ is :

(1) 60°
(2) 90°
(3) 120°
(4) 180°

24. Let $[x]$ denote the greatest integer function. Then match List-I with List-II:

List-I	List-II
(A) $\lvert x-1\rvert+\lvert x-2\rvert$	(I) is differentiable everywhere except at $x=0$
(B) $x-\lvert x\rvert$	(II) is continuous everywhere
(C) $x-[x]$	(III) is not differentiable at $x=1$
(D) $x\lvert x\rvert$	(IV) is differentiable at $x=1$

Choose the correct answer from the options given below:

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

25. The rate of change (in cm^2/s) of the total surface area of a hemisphere with respect to radius r at r = $\sqrt[3]{1.331}$ cm is:

(a) 66π
(b) 6.6π
(c) 3.3π
(d) 4.4π

26. The area of the region bounded by the lines $\frac{x}{7\sqrt{3}a}+\frac{y}{b}=4, x=0$ and $y=0$ is:

(a) $56\sqrt{3}ab$
(b) $56a$
(c) $ab/2$
(d) $3ab$

27. If A is a square matrix and I is an identity matrix such that $A^2=A$, then $A(I-2A)^3+2A^3$ is equal to:

(a) $I+A$
(b) $I+2A$
(c) $I-A$
(d) A

28. Match List-I with List-II:

List-I	List-II
(A) Integrating factor of $xdy-(y+2x^2)dx=0$	(I) $\frac{1}{x}$
(B) Integrating factor of $(2x^2-3y)dx=xdy$	(II) x
(C) Integrating factor of $(2y+3x^2)dx+xdy=0$	(III) x^2
(D) Integrating factor of $2xdy+(3x^3+2y)dx=0$	(IV) x^3

Choose the correct answer from the options given below:

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

29. If the function $f: N \to N$ is defined as

$$f(n)=\begin{cases} n-1, & \text{if n is even} \\ n+1, & \text{if n is odd,} \end{cases}$$

then

(A) f is injective
(B) f is into
(C) f is surjective
(D) f is invertible

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Choose the correct answer from the options given below:

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

30. $\int_0^{\pi/2} \frac{1-\cot x}{\csc x+\cos x} dx =$

(a) 0
(b) $\frac{\pi}{4}$
(c) ∞
(d) $\frac{\pi}{12}$

31. If the random variable X has the following distribution:

X	0	1	2
$P(X)$	k	$2k$	$3k$

Match List-I with List-II:

List-I	List-II
(A) k	(I) $\frac{5}{6}$
(B) P($x < 2$)	(II) $\frac{4}{3}$
(C) E(X)	(III) $\frac{1}{2}$
(D) P($1 \leq X \leq 2$)	(IV) $\frac{1}{6}$

Choose the correct answer from the options given below:

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

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32. For a square matrix A_{non}:

(A) $|adj A| = |A|^{n-1}$
(B) $|A| = |a|^2 A^{n-1}$
(C) $A(adj A) = |A|$
(D) $|A^{-1}| = \frac{1}{|A|}$

Choose the correct answer from the options given below:

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

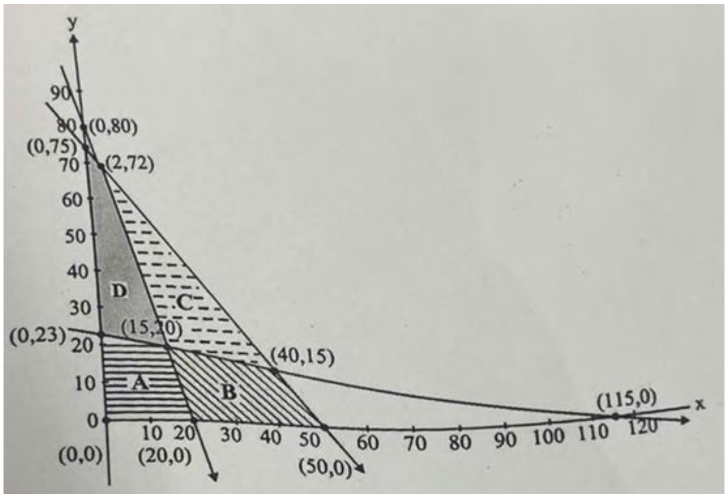
33. The matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ is a:

(A) scalar matrix
(B) diagonal matrix
(C) skew-symmetric matrix
(D) symmetric matrix

Choose the correct answer from the options given below:

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

34. The feasible region represented by the constraints $4x + y \geq 80, x + 5y \geq 115, 3x + 2y \leq 150, x, y \geq 6$ at an LPP is



(a) Region A
(b) Region B
(c) Region C
(d) Region D

35. The area of the region enclosed between the curves $4x^2 = y$ and $y = 4$ is:

(a) 16 sq. units
(b) $\frac{32}{3}$ sq. units
(c) $\frac{8}{3}$ sq. units
(d) $\frac{16}{3}$ sq. units

36.
$$\int e^x \left(\frac{2x+1}{2\sqrt{x}} \right) dx =$$

(a) $\frac{1}{2\sqrt{x}} e^x + C$
(b) $-e^x \sqrt{x} + C$
(c) $-\frac{1}{2\sqrt{x}} e^x + C$
(d) $e^x \sqrt{x} + C$

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37. If f(x), defined by
$$f(x) = \begin{cases} kx + 1 & \text{if } x \leq \pi \\ \cos x & \text{if } x > \pi \end{cases}$$
is continuous at $x = \pi$, then the value of k is:

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

38. If P = $\begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix}$ and Q = $[2 \ -4 \ 1]$ are two matrices, then $(PQ)'$ will be:

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

(b) $\begin{bmatrix} -2 & 4 & 2 \\ 4 & -8 & -4 \\ -1 & 2 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} 5 & 5 & 2 \\ 7 & 6 & 7 \\ -9 & -7 & 0 \end{bmatrix}$

(d) $\begin{bmatrix} -2 & 4 & 8 \\ 7 & 5 & 7 \\ -8 & -2 & 6 \end{bmatrix}$

39.

$$\Delta = \begin{vmatrix} 1 & \cos x & 1 \\ -\cos x & 1 & \cos x \\ -1 & -\cos x & 1 \end{vmatrix}$$

(A) $\Delta = 2(1 - \cos^2 x)$

(B) $\Delta = 2(2 - \sin^2 x)$

(C) Minimum value of Δ is 2

(D) Maximum value of Δ is 4

Choose the correct answer from the options given below:

(a) (A), (C) and (D) only

(b) (A), (B) and (C) only

(c) (A), (B), (C) and (D)

(d) (B), (C) and (D) only

40.

$$f(x) = \sin x + \frac{1}{2}\cos 2x \quad \text{in} \quad [0, \frac{\pi}{2}]$$

(A) $f'(x) = \cos x - \sin 2x$

(B) The critical points of the function are $x = \frac{\pi}{6}$ and $x = \frac{\pi}{2}$

(C) The minimum value of the function is 2

(D) The maximum value of the function is $\frac{3}{4}$

Choose the correct answer from the options given below:

(a) (A), (B) and (D) only

(b) (A), (B) and (C) only

(c) (A), (B), (C) and (D)

(d) (B), (C) and (D) only

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41. The direction cosines of the line which is perpendicular to the lines with direction ratios $1, -2, -2$ and $0, 2, 1$ are:

(a) $\frac{2}{3}, -\frac{1}{3}, \frac{2}{3}$

(b) $-\frac{2}{3}, -\frac{1}{3}, \frac{2}{3}$

(c) $\frac{2}{3}, -\frac{1}{3}, -\frac{2}{3}$

(d) $\frac{2}{3}, \frac{1}{3}, \frac{2}{3}$

42. Let X denote the number of hours you play during a randomly selected day. The probability that X can take values x has the following form, where c is some constant.

$$P(X = x) = \begin{cases} 0.1, & \text{if } x = 0 \\ cx, & \text{if } x = 1 \text{ or } x = 2 \\ c(5 - x), & \text{if } x = 3 \text{ or } x = 4 \\ 0, & \text{otherwise} \end{cases}$$

List-I	List-II
(A) c	0.75
(B) $P(X \leq 2)$	0.3
(C) $P(X = 3)$	0.55
(D) $P(X \geq 2)$	0.15

Choose the correct answer from the options given below :

(1) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)

(2) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)

(3) (A)-(I), (B)-(II), (C)-(IV), (D)-(III)

(4) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

43. If $\sin y = x\sin(a+y)$, then $\dfrac{dy}{dx}$ is :

(1) $\dfrac{\sin^2 a}{\sin(a+y)}$

(2) $\dfrac{\sin(a+y)}{\sin^2 a}$

(3) $\dfrac{\sin(a+y)}{\sin a}$

(4) $\dfrac{\sin^2(a+y)}{\sin a}$

44. The unit vector perpendicular to each of the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ where $\vec{a}=\hat{i}+\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}+2\hat{j}+3\hat{k}$, is :

(1) $\dfrac{1}{\sqrt{6}}\hat{i}+\dfrac{2}{\sqrt{6}}\hat{j}+\dfrac{1}{\sqrt{6}}\hat{k}$

(2) $-\dfrac{1}{\sqrt{6}}\hat{i}+\dfrac{1}{\sqrt{6}}\hat{j}-\dfrac{1}{\sqrt{6}}\hat{k}$

(3) $\dfrac{-1}{\sqrt{6}}\hat{i}+\dfrac{2}{\sqrt{6}}\hat{j}+\dfrac{2}{\sqrt{6}}\hat{k}$

(4) $\dfrac{-1}{\sqrt{6}}\hat{i}+\dfrac{2}{\sqrt{6}}\hat{j}-\dfrac{1}{\sqrt{6}}\hat{k}$

45. The distance between the lines

$$\vec{r}=\hat{i}-2\hat{j}+3\hat{k}+\lambda(2\hat{i}+3\hat{j}+6\hat{k}) \quad \text{and} \quad \vec{r}=3\hat{i}-2\hat{j}+\hat{k}+\mu(4\hat{i}+6\hat{j}+12\hat{k})$$

is:

(1) $\dfrac{\sqrt{28}}{7}$

(2) $\dfrac{\sqrt{199}}{7}$

(3) $\dfrac{\sqrt{328}}{7}$

(4) $\dfrac{\sqrt{421}}{7}$

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46. If $f(x)=2\left(\tan^{-1}(e^x)-\frac{\pi}{4}\right)$, then $f(x)$ is:

(1) even and is strictly increasing in $(0,\infty)$

(2) even and is strictly decreasing in $(0,\infty)$

(3) odd and is strictly increasing in $(-\infty,\infty)$

(4) odd and is strictly decreasing in $(-\infty,\infty)$

47. For the differential equation

$$(x\log_e x)\,dy=(\log_e x-y)\,dx$$

(A) Degree of the given differential equation is 1.
(B) It is a homogeneous differential equation.
(C) Solution is $2y\log_e x+A=(\log_e x)^2$, where A is an arbitrary constant.
(D) Solution is $2y\log_e x+A=\log_e(\log_e x)$, where A is an arbitrary constant.

Choose the correct answer from the options given below:

(1) (A) and (C) only

(2) (A), (B) and (C) only

(3) (A), (B) and (D) only

(4) (A) and (D) only

48. There are two bags. Bag-1 contains 4 white and 6 black balls and Bag-2 contains 5 white and 5 black balls. A die is rolled, if it shows a number divisible by 3, a ball is drawn from Bag-1, else a ball is drawn from Bag-2. If the ball drawn is not black in colour, the probability that it was not drawn from Bag-2 is:

(1) $\frac{4}{9}$

(2) $\frac{3}{8}$

(3) $\frac{2}{7}$

(4) $\frac{4}{19}$

49. Which of the following **cannot** be the direction ratios of the straight line

$$\frac{x-3}{2}=\frac{2-y}{3}=\frac{z+4}{-1}?$$

(1) 2, -3, -1

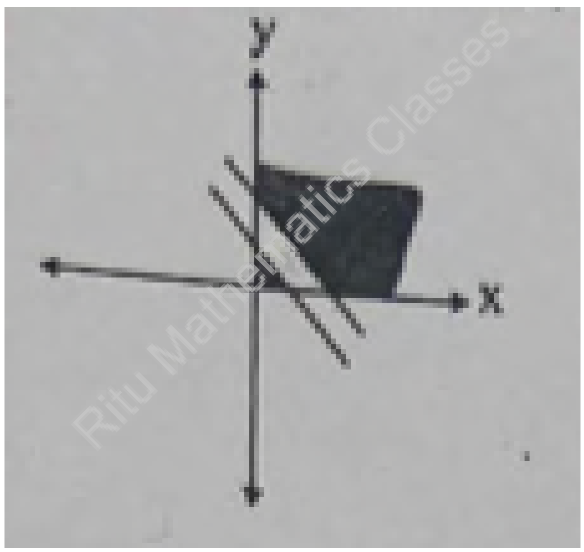
(2) -2, 3, 1

(3) 2, 3, -1

(4) 6, -9, -3

50. Which one of the following represents the correct feasible region determined by the following constraints of an LPP?

$$x+y\geq 10,\quad 2x+2y\leq 25,\quad x\geq 0,\quad y\geq 0$$



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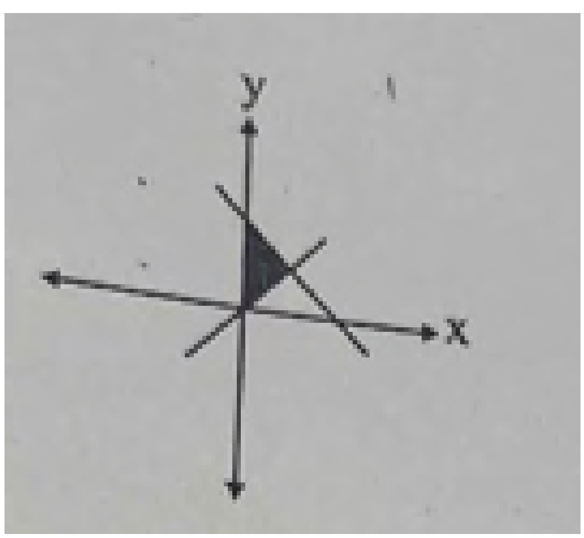

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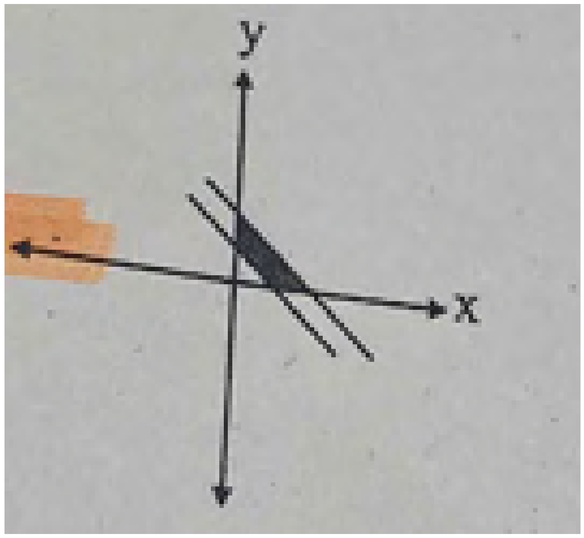

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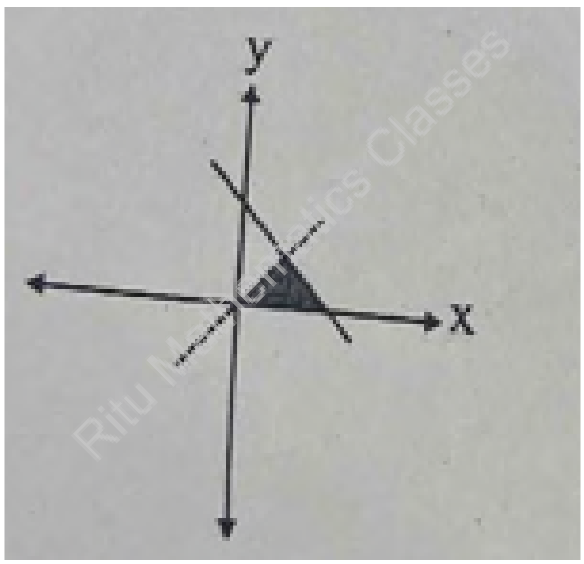

(d)