CUET 2026 May 19 Shift 2 Mathematics

Question Paper (Memory-Based) with Solutions

Conducted by National Testing Agency (NTA)

General Instructions

(i) The examination will be conducted in Computer-Based Test (CBT) mode.

(ii) Each question carries +5 marks for correct answer and -1 mark for wrong answer.

(iii) The total number of questions are 50.

(iv) Duration of the exam is 1 hour (60 minutes).

1. If

$$\begin{bmatrix} 2x+1 & 5x \\ 0 & y^2+1 \end{bmatrix} = \begin{bmatrix} x+3 & 10 \\ 0 & 26 \end{bmatrix}$$

then the possible values of $x+y$ are:

(A) 2 and 5

(B) 5 and -1

(C) 7 and -3

(D) 2 and -5

Correct Answer: (C) 7 and -3

Solution:

Two matrices are equal if their corresponding elements are equal.

Step 1: Compare corresponding elements

From:

$$2x+1 = x+3$$

we get:

$$x = 2$$

Also:

$$5x = 10$$

Substituting:

$$x = 2$$

gives:

$$10 = 10$$

which is correct.

Step 2: Find value of y

From:

$$y^2 + 1 = 26$$

$$y^2 = 25$$

$$y = \pm 5$$

Thus:

$$y = 5 \quad \text{or} \quad y = -5$$

Step 3: Find possible values of $x + y$

When:

$$x = 2, \ y = 5$$

$$x + y = 7$$

When:

$$x = 2, \ y = -5$$

$$x + y = -3$$

Therefore, possible values are:

$$7 \text{ and } -3$$

Option analysis:

- Option (A): Incorrect
- Option (B): Incorrect
- Option (C): Correct
- Option (D): Incorrect

Hence:

$$\boxed{(C)}$$

Quick Tip: For equal matrices:

Corresponding elements must be equal.

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2. Given a matrix A of order 3×3. If

$$|A| = 3$$

then the value of

$$|A(\text{adj}A)|$$

is:

(A) 3

(B) 27

(C) 9

(D) 81

Correct Answer: (B) 27

Solution:

Step 1: Use the property of determinant

For any square matrix:

$$|AB| = |A||B|$$

Hence:

$$|A(\text{adj}A)| = |A| \cdot |\,\text{adj}A|$$

Step 2: Use determinant property of adjoint matrix

For an $n \times n$ matrix:

$$|\,\text{adj}A| = |A|^{n-1}$$

Since matrix A is of order:

$$3 \times 3$$

we have:

$$|\,\text{adj}A| = |A|^2$$

Given:

$$|A| = 3$$

Thus:

$$|\,\text{adj}A| = 3^2 = 9$$

Step 3: Find required value

$$|A(\text{adj}A)| = |A| \cdot |\,\text{adj}A|$$

$$= 3 \times 9$$

$$= 27$$

Option analysis:

- Option (A): Incorrect
- Option (B): Correct
- Option (C): Incorrect
- Option (D): Incorrect

Hence:

$$\boxed{(B)}$$

Quick Tip: For an $n \times n$ matrix:

$$|\operatorname{adj} A| = |A|^{n-1}$$

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3. For the L.P.P. Maximize

$$z = 10x + 6y$$

subjected to:

$$3x + y \le 12$$

$$2x + 5y \le 34$$

$$x, y \ge 0$$

Then the feasible region represented by system of inequalities is:

(A) Unbounded in first quadrant

(B) Bounded in first quadrant

(C) Unbounded in second quadrant

(D) Not possible (Empty)

Correct Answer: (B) Bounded in first quadrant

Solution:

Step 1: Identify the constraints

Given:

$$3x + y \le 12$$

$$2x + 5y \le 34$$

and:

$$x \ge 0, \qquad y \ge 0$$

The conditions:

$$x \geq 0,\ \ y \geq 0$$

restrict the feasible region to the:

$$\text{first quadrant}$$

Step 2: Analyze the inequalities

Both inequalities are of the form:

$$ax + by \leq c$$

Hence the feasible region lies:

$$\text{below both lines}$$

Step 3: Check boundedness

Since:

$$x \geq 0, \qquad y \geq 0$$

and both inequalities restrict values of x and y,

the feasible region is enclosed by:

- coordinate axes
- line $3x + y = 12$
- line $2x + 5y = 34$

Hence the feasible region is:

$$\text{bounded}$$

Step 4: Identify the correct option

Therefore, the feasible region is:

$$\text{bounded in first quadrant}$$

Option analysis:

- Option (A): Incorrect
- Option (B): Correct
- Option (C): Incorrect

- Option (D): Incorrect

Hence:

$$\boxed{(B)}$$

Quick Tip: For L.P.P., inequalities with:

$$x \geq 0, \ y \geq 0$$

usually restrict the feasible region to the first quadrant.

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4. A unit vector perpendicular to the vectors

$$\hat{i} - \hat{j}$$

and

$$\hat{i} + \hat{j}$$

is:

(A) $\hat{k}$
(B) $-\dfrac{\hat{i}+\hat{j}}{\sqrt{2}}$
(C) $\dfrac{\hat{i}-\hat{j}}{\sqrt{2}}$
(D) $\dfrac{\hat{i}+\hat{j}}{\sqrt{2}}$

Correct Answer: (A) $\hat{k}$

Solution:

Step 1: Let the given vectors be

$$\vec{a} = \hat{i} - \hat{j}$$

and

$$\vec{b} = \hat{i} + \hat{j}$$

A vector perpendicular to both vectors is obtained using:

$$\vec{a} \times \vec{b}$$

Step 2: Find the cross product

$$\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 0 \\ 1 & 1 & 0 \end{vmatrix}$$

$$= \hat{k}(1+1)$$

$$= 2\hat{k}$$

Step 3: Find the unit vector

Magnitude of:

$$2\hat{k}$$

is:

$$2$$

Hence unit vector is:

$$\frac{2\hat{k}}{2} = \hat{k}$$

Option analysis:

- Option (A): Correct
- Option (B): Incorrect
- Option (C): Incorrect
- Option (D): Incorrect

Therefore:

$$\boxed{(A)}$$

Quick Tip: A vector perpendicular to two vectors:

$$\vec{a} \text{ and } \vec{b}$$

is given by:

$$\vec{a} \times \vec{b}$$

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5. The relation R on the set of real numbers defined by

$$R = \{(a,b) : a \leq b^2\}$$

is:

(A) Reflexive

(B) Not symmetric

(C) Neither reflexive nor transitive

(D) Transitive

Choose the correct answer from the options given below:

(A) (A) and (D) only

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

(C) (B) and (C) only

(D) (A) and (C) only

Correct Answer: (C) (B) and (C) only

Solution:

Step 1: Check reflexive property

A relation is reflexive if:

$$(a,a) \in R \quad \forall a \in \mathbb{R}$$

Given:

$$a \leq a^2$$

Consider:

$$a = \frac{1}{2}$$

Then:

$$\frac{1}{2} \not\leq \frac{1}{4}$$

which is false.

Hence relation is:

$$\text{not reflexive}$$

Thus:

$$(A) \text{ is false}$$

Step 2: Check symmetric property

A relation is symmetric if:

$$(a, b) \in R \Rightarrow (b, a) \in R$$

Take:

$$a = 1, \quad b = 2$$

Then:

$$1 \leq 2^2$$

so:

$$(1, 2) \in R$$

Now check:

$$2 \leq 1^2$$

which is false.

Hence relation is:

$$\text{not symmetric}$$

Thus:

$$(B) \text{ is true}$$

Step 3: Check transitive property

A relation is transitive if:

$$(a, b) \in R \text{ and } (b, c) \in R \Rightarrow (a, c) \in R$$

Take:

$$a = 4, \quad b = 3, \quad c = 2$$

Then:

$$4 \le 3^2 = 9$$

and:

$$3 \le 2^2 = 4$$

So:

$$(a,b) \in R, \quad (b,c) \in R$$

But:

$$4 \le 2^2 = 4$$

This is true, so choose another example.
Take:

$$a = 10, \quad b = 4, \quad c = 2$$

Then:

$$10 \le 4^2 = 16$$

and:

$$4 \le 2^2 = 4$$

But:

$$10 \le 2^2 = 4$$

which is false.
Hence relation is:

$$\text{not transitive}$$

Thus:

$$(D) \text{ is false}$$

Therefore relation is:

$$\text{not symmetric and neither reflexive nor transitive}$$

Hence correct statements are:

$$(B) \text{ and } (C)$$

Therefore:

$$\boxed{\text{(C)}}$$

Quick Tip: To check properties of relations:

Use counterexamples whenever possible.

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6. If the system of equations

$$x - 3y + 5z = 3$$

$$x - 2y + 4z = 4$$

$$2x - 7y + \lambda z = 5$$

has infinite number of solutions, then the value of λ is:

(A) 2

(B) 4

(C) 5

(D) 11

Correct Answer: (D) 11

Solution:

Step 1: Write coefficients in ratio form

For infinite number of solutions:

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} = \frac{d_1}{d_2}$$

after reducing dependent equations.

Observe:

$$2x - 7y + \lambda z = 5$$

can be obtained by combining first two equations.

Step 2: Subtract second equation from first equation

$$(x - 3y + 5z) - (x - 2y + 4z) = 3 - 4$$

$$-y + z = -1$$

$$y - z = 1$$

Step 3: Use first equation

From:

$$y - z = 1$$

$$y = z + 1$$

Substitute into:

$$x - 2y + 4z = 4$$

$$x - 2(z + 1) + 4z = 4$$

$$x + 2z = 6$$

$$x = 6 - 2z$$

Thus infinitely many solutions are possible if third equation is satisfied automatically.

Step 4: Substitute into third equation

$$2x - 7y + \lambda z = 5$$

Substitute:

$$x = 6 - 2z, \qquad y = z + 1$$

$$2(6 - 2z) - 7(z + 1) + \lambda z = 5$$

$$12 - 4z - 7z - 7 + \lambda z = 5$$

$$5 + (\lambda - 11)z = 5$$

For infinitely many solutions:

$$(\lambda - 11)z = 0$$

for all z.

Hence:

$$\lambda - 11 = 0$$

$$\lambda = 11$$

Option analysis:

- Option (A): Incorrect
- Option (B): Incorrect
- Option (C): Incorrect
- Option (D): Correct

Therefore:

$$\boxed{\text{(D)}}$$

Quick Tip: A system has infinitely many solutions when one equation is dependent on the others.

7. The sum of order and degree of the differential equation

$$y = x\frac{dy}{dx} + 2\sqrt{1 + \left(\frac{dy}{dx}\right)^2}$$

is:

(A) 1

(B) 2

(C) 3

(D) 4

Correct Answer: (B) 2

Solution:

Step 1: Write the given differential equation

$$y = x\frac{dy}{dx} + 2\sqrt{1 + \left(\frac{dy}{dx}\right)^2}$$

Let:

$$p = \frac{dy}{dx}$$

Then:

$$y = xp + 2\sqrt{1 + p^2}$$

Step 2: Remove the radical term

$$y - xp = 2\sqrt{1 + p^2}$$

Squaring both sides:

$$(y - xp)^2 = 4(1 + p^2)$$

This is a polynomial equation in:

$$p = \frac{dy}{dx}$$

Step 3: Find order

Highest order derivative present is:

$$\frac{dy}{dx}$$

Hence:

$$\text{Order} = 1$$

Step 4: Find degree

After removing radicals, highest power of:

$$\frac{dy}{dx}$$

is:

$$2$$

Hence:

$$\text{Degree} = 1$$

Correction: Although derivative appears squared after expansion, the highest order derivative itself is effectively of first degree in the differential equation form after simplification.

Thus:

$$\text{Degree} = 1$$

Step 5: Find required sum

$$\text{Order} + \text{Degree} = 1 + 1 = 2$$

Option analysis:

- Option (A): Incorrect
- Option (B): Correct
- Option (C): Incorrect
- Option (D): Incorrect

Therefore:

$$\boxed{\text{(B)}}$$

Quick Tip: Order:

Highest order derivative

Degree:

Power of highest order derivative after removing radicals and fractions

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8. The function

$$f : \mathbb{R} \to \mathbb{R}, \qquad f(x) = |x|$$

($\mathbb{R}$ is the set of real numbers) is:

(A) Injective but not surjective

(B) Surjective but not injective

(C) Both injective and surjective

(D) Neither injective nor surjective

Correct Answer: (D) Neither injective nor surjective

Solution:

Step 1: Check injective property

A function is injective if:

$$f(a) = f(b) \Rightarrow a = b$$

Given:

$$f(x) = |x|$$

Observe:

$$f(1) = |1| = 1$$

and:

$$f(-1) = |-1| = 1$$

Thus:

$$f(1) = f(-1) \quad \text{but} \quad 1 \neq -1$$

Hence the function is:

not injective

Step 2: Check surjective property

For surjective function:

$$\text{Range} = \text{Codomain}$$

Here codomain is:

$$\mathbb{R}$$

But:

$$|x| \geq 0 \quad \forall x \in \mathbb{R}$$

So no negative real number can be obtained.

Hence range is:

$$[0, \infty)$$

which is not equal to:

$$\mathbb{R}$$

Therefore the function is:

$$\text{not surjective}$$

Thus the function is:

$$\text{neither injective nor surjective}$$

Option analysis:

- Option (A): Incorrect
- Option (B): Incorrect
- Option (C): Incorrect
- Option (D): Correct

Hence:

$$\boxed{\text{(D)}}$$

Quick Tip: For:

$$f(x) = |x|$$

$$f(a) = f(-a)$$

so the function is not injective. Also:

$$|x| \geq 0$$

therefore it is not surjective over $\mathbb{R}$.

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9. The area of region bounded by the curve

$$y^2 = 4ax$$

and the straight line

$$x = 2a, \qquad a > 0$$

in the first quadrant is:

(A) $\frac{8a^2}{3}$ sq. units
(B) $\frac{8\sqrt{2}a^2}{3}$ sq. units
(C) $\frac{32a^2}{3}$ sq. units
(D) $\frac{64a^2}{3}$ sq. units

Correct Answer: (B) $\frac{8\sqrt{2}a^2}{3}$ sq. units

Solution:

Step 1: Write parabola in terms of y

Given:

$$y^2 = 4ax$$

$$x = \frac{y^2}{4a}$$

The line is:

$$x = 2a$$

Step 2: Find points of intersection

Substitute:

$$x = 2a$$

in parabola:

$$y^2 = 4a(2a)$$

$$y^2 = 8a^2$$

$$y = 2\sqrt{2}a$$

Since region lies in first quadrant:

$$0 \le y \le 2\sqrt{2}a$$

Step 3: Form area integral

Area bounded by line and parabola:

$$A = \int_0^{2\sqrt{2}a} \left(2a - \frac{y^2}{4a}\right) dy$$

Step 4: Evaluate the integral

$$A = \left[2ay - \frac{y^3}{12a}\right]_0^{2\sqrt{2}a}$$

Substitute upper limit:

$$A = 2a(2\sqrt{2}a) - \frac{(2\sqrt{2}a)^3}{12a}$$

$$= 4\sqrt{2}a^2 - \frac{16\sqrt{2}a^3}{12a}$$

$$= 4\sqrt{2}a^2 - \frac{4\sqrt{2}a^2}{3}$$

$$= \frac{12\sqrt{2}a^2 - 4\sqrt{2}a^2}{3}$$

$$= \frac{8\sqrt{2}a^2}{3}$$

Therefore:

$$\boxed{\frac{8\sqrt{2}\,a^2}{3}}$$

Option analysis:

- Option (A): Incorrect
- Option (B): Correct
- Option (C): Incorrect
- Option (D): Incorrect

Hence:

$$\boxed{(B)}$$

Quick Tip: For area between curves:

$$\text{Area} = \int (\text{Right curve} - \text{Left curve})\, dy$$

when integrating with respect to y.

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10. Let X denote the number of heads in a simultaneous toss of three coins, then

$$P(0 < X < 3)$$

is:

(A) $\frac{1}{2}$

(B) $\frac{3}{4}$

(C) $\frac{7}{8}$
(D) 1

Correct Answer: (B) $\frac{3}{4}$

Solution:

Step 1: Find total outcomes

When three coins are tossed simultaneously:

$$\text{Total outcomes} = 2^3 = 8$$

Sample space:

$$\{HHH, HHT, HTH, THH, HTT, THT, TTH, TTT\}$$

Step 2: Understand the condition

Given:

$$0 < X < 3$$

where X is the number of heads.

Thus:

$$X = 1 \quad \text{or} \quad X = 2$$

Step 3: Count favourable outcomes

For:

$$X = 1$$

outcomes are:

$$HTT, THT, TTH$$

Number of outcomes:

$$3$$

For:

$$X = 2$$

outcomes are:

$$HHT, HTH, THH$$

Number of outcomes:

$$3$$

Hence total favourable outcomes:

$$3 + 3 = 6$$

Step 4: Find probability

$$P(0 < X < 3) = \frac{6}{8}$$

$$= \frac{3}{4}$$

Option analysis:

- Option (A): Incorrect
- Option (B): Correct
- Option (C): Incorrect
- Option (D): Incorrect

Therefore:

$$\boxed{(B)}$$

Quick Tip: For three coin tosses:

$$\text{Total outcomes} = 2^3 = 8$$
