MCQ Paper – test

Generated Question Paper

MCQ Examination

Name: ____________

Class: ____________ Section: ____________

Roll no.: ____________

Instructions:
- Fill OMR sheet with blue/black pen.
- Fill circles completely.
- No stray marks.
- Enter Name, Class, Section.

SET A

Questions: **9**
Duration: **120min**

Calculus: Differentiation and Integration

This section covers fundamental and advanced topics in differential and integral calculus.

1. *Evaluate the definite integral:* $\int_0^{\pi/2} \sin^2(x)\,dx$

A. 1 **B.** π/2
C. π/4 **D.** 0

2. *Consider the function of two variables provided below:*

Let f(x, y) be a differentiable function defined as $f(x, y) = e^{(xy)} * \cos(x^2 + y^2)$.

What is the value of the partial derivative ∂f/∂x at the point (0, 0)?

A. e **B.** -1
C. 1 **D.** 0

3. *The Fundamental Theorem of Calculus connects the concepts of differentiation and integration.*

Statement I:

If F'(x) = f(x) for all x in [a, b], then ∫ f(x) dx = F(b) - F(a).

Statement II:

If f is continuous on [a, b], then the function G(x) = $\int^x$ f(t) dt is differentiable on (a, b) and G'(x) = f(x).

Which of the statements above are considered parts of the Fundamental Theorem of Calculus?

A. Statement II only
B. Neither statement is correct
C. Statement I only
D. Both Statement I and Statement II

Linear Algebra: Matrices and Vector Spaces

This section tests knowledge of matrix properties, linear transformations, and vector spaces.

4. *Match each type of matrix in Column A with its defining property in Column B.*

Column A: Matrix Type	-	Column B: Property
1. Orthogonal	-	a. $A = A$
2. Symmetric	-	b. $A^2 = A$
3. Skew-Symmetric	-	c. $A = -A$
4. Idempotent	-	d. $A^{-1} = A$

Which option represents the correct matching?

- **A.** 1-b, 2-a, 3-d, 4-c
- **B.** 1-a, 2-d, 3-b, 4-c
- **C.** 1-d, 2-c, 3-a, 4-b
- **D.** 1-d, 2-a, 3-c, 4-b

5. *For any two $n \times n$ matrices A and B, which of the following properties is NOT always true?*

i. $\det(A) = \det(A)$
ii. $\det(AB) = \det(A)\det(B)$
iii. $\det(A + B) = \det(A) + \det(B)$
iv. If A is invertible, $\det(A^{-1}) = 1/\det(A)$

- **A.** Property iv
- **B.** Property iii
- **C.** Property ii
- **D.** Property i

6. Let $T: \mathbb{R}^3 \to \mathbb{R}^2$ be a linear transformation defined by the rule $T(x, y, z) = (x + 2y - z, 3x + y + 4z)$.

Based on the transformation T, evaluate the following statements:

Statement I:

The kernel (null space) of T has a dimension greater than zero.

Statement II:

The transformation T is surjective (onto).

Which assessment of the statements is correct?

- **A.** Both statements are false
- **B.** Statement I is true, Statement II is false
- **C.** Both statements are true
- **D.** Statement I is false, Statement II is true

Complex Analysis and Series

Questions on complex numbers, Euler's formula, and the convergence of infinite series.

7. *For a complex number $z = a + ib$, where $i^2 = -1$, consider the following statements:*

Assertion (A):

The modulus $|z|$ is given by the formula $\sqrt{(a^2 + b^2)}$.

Reason (R):

$|z|$ geometrically represents the distance of the point (a, b) from the origin in the Argand (complex) plane.

Which of the following is true regarding statements (A) and (R)?

- **A.** Both (A) and (R) are true, and (R) is the correct explanation of (A).
- **B.** (A) is false but (R) is true.
- **C.** (A) is true but (R) is false.
- **D.** Both (A) and (R) are true, but (R) is not the correct explanation of (A).

8. Consider the infinite series $S = \Sigma_{n=1 \text{ to } \infty} ((-1)^n * n) / (n^2 + 1)$.

Determine the nature of the convergence of the series S.

- **A.** Absolutely convergent
- **B.** The series does not converge or diverge
- **C.** Divergent
- **D.** Conditionally convergent

9. Euler's formula states that $e^{(i\theta)} = \cos(\theta) + i \sin(\theta)$, linking complex exponentials with trigonometric functions.

Using this formula, which step in the following simplification of $e^{(i\pi)} + 1$ contains an error?

Step 1: Substitute $\theta = \pi$ into the formula, yielding $e^{(i\pi)} = \cos(\pi) + i \sin(\pi)$.

Step 2: Evaluate the trigonometric functions: $\cos(\pi) = -1$ and $\sin(\pi) = 0$.

Step 3: Conclude that $e^{(i\pi)} = -1 + i(0) = -1$.

Step 4: Perform the final addition: $e^{(i\pi)} + 1 = 1 + 1 = 2$.

- **A.** Step 3
- **B.** Step 1
- **C.** Step 4
- **D.** Step 2

* * * * **END** * * * *