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 B

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. π/4 **B.** 0
   C. π/2 **D.** 1

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

3. *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

Linear Algebra: Matrices and Vector Spaces

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

4. 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

5. *For any two n × 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 ii
- **B.** Property iv
- **C.** Property i
- **D.** Property iii

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

Complex Analysis and Series

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

7. Consider the infinite series S = Σ_{n=1 to ∞} ($(-1)^n$ * n) / (n^2 + 1).

Determine the nature of the convergence of the series S.

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

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

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

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