BRAC UNIVERSITY
Inspiring Excellence

Linear Algebra & Fourier Analysis
Assessment

October 27, 2025

Total - 0 Marks

Name:

ID:

Section:

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1 Sets

1. Let $A = \{1, 2, 3, 4\}$ and $B = \{2, 4, 6, 8\}$. Find $A \cap B$. 2 A) $\{1, 3, 5, 7\}$
   B) $\{2, 4\}$
   C) $\{6, 8\}$
   D) $\{1, 2, 3, 4, 6, 8\}$ (3 Marks)

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2. If $X = \{a, b, c\}$, how many subsets does X have? 2 A) 3
   B) 6
   C) 8
   D) 9 (3 Marks)

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3. Let $A = \{1, 2, 3, 4, 5\}$. How many subsets of A contain both 1 and 2? 2 A) 4
   B) 8

C) 16
D) 32 (4 Marks)

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2 Relations

1. Let $A = \{1, 2, 3\}$ and define $R = \{(x, y) \in A \times A : x < y\}$. Which property does R satisfy? 2 A) Reflexive
   B) Symmetric
   C) Transitive
   D) Both A and C (3 Marks)

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2. How many reflexive relations can be defined on a set with 3 elements? 2 A) 2^9
   B) 2^6
   C) 2^3
   D) 3! (3 Marks)

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3. Let $A = \{1, 2, 3, 4\}$, $R = \{(1, 2), (2, 3), (1, 3)\}$. Is R transitive? 2 A) Yes
   B) No
   C) Only if $(2, 4)$ added
   D) Insufficient data (4 Marks)

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3 Functions

1. Which of the following is a function from $A = \{1, 2, 3\}$ to $B = \{4, 5, 6\}$? 2 A) $\{(1, 4), (2, 5), (3, 6)\}$
   B) $\{(1, 4), (1, 5), (3, 6)\}$
   C) $\{(2, 4), (3, 4)\}$
   D) $\{(1, 5), (2, 5), (3, 5), (2, 6)\}$ (3 Marks)

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2. Let $f(x) = 2x + 3$. Find $f^{-1}(x)$. 2 A) $\dfrac{x-3}{2}$
   B) $\dfrac{x+3}{2}$
   C) $2x - 3$
   D) $\dfrac{3x-1}{2}$ (3 Marks)

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3. Let $f(x) = |x|$. Which of the following is true? 2 A) One-one but not onto
   B) Onto but not one-one
   C) Both one-one and onto
   D) Neither one-one nor onto (3 Marks)

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4. If $f(x) = 3x + 2$ and $g(x) = x^2$, find $(g \circ f)(x)$. 2 A) $3x^2 + 2x$
   B) $9x^2 + 12x + 4$
   C) $x^2 + 3x + 2$
   D) $x^2 + 9x + 4$ (4 Marks)

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5. Let

$$A = \{a, b, c\}, \quad B = \{1, 2, 3, 4\}, \quad C = \{x, y, z\}$$

and define:

$$f : A \to B, \quad \begin{cases} f(a) = 1, \\ f(b) = 2, \\ f(c) = 3 \end{cases} \qquad g : B \to C, \quad \begin{cases} g(1) = x, \\ g(2) = x, \\ g(3) = y, \\ g(4) = z \end{cases}$$

Consider the composition $g \circ f : A \to C$.

(i) Determine $(g \circ f)(a)$, $(g \circ f)(b)$, and $(g \circ f)(c)$.

(ii) Is $g \circ f$ **injective**? Justify your answer.

(iii) Is $g \circ f$ **surjective**? Justify your answer.

(5 Marks)

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6. Let $f : A \to B$, $g : B \to C$. If $g \circ f$ is injective, which must hold? 2 A) f is injective
B) g is injective
C) Both are injective
D) None necessarily (5 Marks)

Best of Luck!