BRAC UNIVERSITY
Inspiring Excellence

Linear Algebra & Fourier Analysis Assessment

October 29, 2025

Total - 20 Marks

Name:

ID:

Section:

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1 Sets

1. Let

$$f : \mathbb{R} \longrightarrow \mathbb{R}, \qquad f(x) = x^2 - 4x + 3.$$

- Is f **onto** (surjective) as a function from $\mathbb{R}$ to $\mathbb{R}$? If not, justify your answer and find the **range** of f.

- Find a restriction of the **codomain** (say $B \subset \mathbb{R}$) such that

$$f : \mathbb{R} \to B$$

becomes **onto**. Explain why your chosen B works.

- Now restrict both the **domain and codomain** so that f becomes a **bijection**. Find such subsets $A \subset \mathbb{R}$ and $B \subset \mathbb{R}$ and justify your answer with reasoning or a sketch.

(10 Marks)

2. Let
$$A = \{1, 2, 3\}, \qquad R = \{(1, 2), (2, 3)\}.$$

3. List all ordered pairs that must be **added** to R to make it **reflexive** on A.

4. List all ordered pairs that must be **added** to R to make it **symmetric**.

5. List all ordered pairs that must be **added** to R to make it **transitive**.

6. Find the **smallest relation** on A that is simultaneously **reflexive, symmetric, and transitive** (i.e. the equivalence closure of R).

Best of Luck!