

**Birzeit University**  
**Mathematics Department**  
**Math332**  
**Quiz 1**

**Instructor:** Dr. Ala Talahmeh  
**Name:**.....

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**Question I [10 points].** A function  $f$  is said to be **odd-harmonic** if

$$f(x + \ell) = -f(x), \quad \forall x \in D_f.$$

- a. Prove that such a function is  $2\ell$ -periodic.
- b. Show that the Fourier series for an odd-harmonic function takes the form

$$f(x) = \sum_{n=1}^{\infty} \left[ a_{2n-1} \cos \left( \frac{(2n-1)\pi x}{\ell} \right) + b_{2n-1} \sin \left( \frac{(2n-1)\pi x}{\ell} \right) \right],$$

where

$$a_{2n-1} = \frac{2}{\ell} \int_0^{\ell} f(x) \cos \left( \frac{(2n-1)\pi x}{\ell} \right) dx,$$

and

$$b_{2n-1} = \frac{2}{\ell} \int_0^{\ell} f(x) \sin \left( \frac{(2n-1)\pi x}{\ell} \right) dx.$$

**Good Luck**