



Class Quiz 2
 Ph. D. Coursework, NAS-MUNA
Mathematical Methods of Physics
 (NWTP 501)
 Instructor: Kumar Abhinav
 Date: May 14th, 2026
 Time 11:00 - 12:00 hrs

Name: _____
 Student ID: _____

Total time: 60 minutes

Semester 2/2025

Total marks: 25

Instructions

- I. Attempt **All** question. Each carry equal marks.
- II. This is a **CLOSED NOTEBOOK** examination and strictly **NO INTERNET**.
- III. Tick the correct boxes. Multiple options can be correct, and in that case you need to tick **ALL** correct options to get full marks.
- IV. Do *NOT* write or derive your answers. Just tick the boxes you deem correct.

Questions:

1. Consider the function,

$$f(x) = \begin{cases} 1, & \text{for } 0 < x < L \\ -1, & \text{for } -L < x < 0 \end{cases}.$$

What would be the form of the corresponding Fourier series?

- | | |
|---|--|
| <input type="checkbox"/> Exponential series | <input type="checkbox"/> cos-series |
| <input type="checkbox"/> sin-series | <input type="checkbox"/> None of the above |

2. What will be the value of the following expression?

$$I = \int_{-\infty}^{\infty} f(x)\delta(x+2)\theta(x) dx - \int_0^{10} g(x)\frac{d}{dx}\delta(x-2).$$

- | | |
|--|----------------------------------|
| <input type="checkbox"/> $f(-2) + g'(2)$ | <input type="checkbox"/> 0 |
| <input type="checkbox"/> $f(2) + g(0)$ | <input type="checkbox"/> $g'(2)$ |

3. What will be the value of

$$\frac{d^6}{dx^6} (x^5 \sinh(2x))$$

at $x = 0$?

☐ $2 \times 6!$

☐ 2^5

☐ 0

☐ $2^6 \times 5!$

4. Consider the Legendre series,

$$y(x) = a_0 \left[1 - \frac{l(l+1)}{2!} x^2 + \frac{l(l+1)(l-2)(l+3)}{4!} x^4 - \dots \right] \\ a_1 + \left[x - \frac{(l-1)(l+2)}{3!} x^3 + \frac{(l-1)(l+2)(l-3)(l+4)}{5!} x^5 - \dots \right].$$

Then what will be the value of,

$$F(x, h) = \sum_{n=0}^{\infty} [P_n(x) - P_n(-x)] \frac{h^n}{n!} \times \left(\sum_{m=0}^{\infty} [P_m(x) + P_m(-x)] \frac{h^m}{m!} \right)^{-1}$$

at $x = 1$.

☐ $\exp(-h)$

☐ $\tanh(h)$

☐ 0

☐ $\coth(h)$

5. Obtain the value for the integral,

$$\int_{-\infty}^{\infty} x^2 \exp(-x^2) dx.$$

☐ $\sqrt{\pi}$

☐ $\sqrt{2\pi}$

☐ $\sqrt{\pi}/2$

☐ $1/\sqrt{\pi}$

Best wishes