Lecture 5 Activity

Due Jan 23 at 3:10pm **Points** 1 **Questions** 8
Available Jan 23 at 1:30pm - Jan 23 at 3:10pm 1 hour and 40 minutes
Time Limit 60 Minutes **Allowed Attempts** 2

Instructions

Be sure to select the correct answer in Q1 to get the participation credit.

This quiz was locked Jan 23 at 3:10pm.

Attempt History

	Attempt	Time	Score
KEPT	Attempt 2	less than 1 minute	1 out of 1
LATEST	Attempt 2	less than 1 minute	1 out of 1
	Attempt 1	19 minutes	1 out of 1

Score for this attempt: **1** out of 1
Submitted Jan 24 at 12:01pm
This attempt took less than 1 minute.

Question 1

1 / 1 pts

Consider the sequence of functions
$\left\{ \sin(\frac{n\pi}{L}x),\ x \in [0, L],\ n = 1, 2, \dots \right\}$.

Is it true that for any piecewise smooth function $f(x), x \in [0, L]$, we can expand it as $f(x) = \sum_{n=1}^{+\infty} b_n \sin(\frac{n\pi}{L}x)$?

Correct!

True

False

Question 2

0 / 0 pts

Consider the sequence of functions

$$\left\{ \sin(\frac{2n\pi}{L}x),\ x \in [0, L],\ n = 1, 2, \ldots \right\}.$$

Is it true that for any piecewise smooth function $f(x), x \in [0, L]$, we can expand it as $f(x) = \sum_{n=1}^{+\infty} b_n \sin(\frac{2n\pi}{L}x)$?

True

Correct!

False

Question 3

0 / 0 pts

Consider the sequence of functions $\{(x - L/2)^n,\ x \in [0, L],\ n = 0, 1, 2, \ldots\}$ and consider the inner product $\langle u(x), v(x)\rangle \equiv \int_0^L u(x)v(x)dx$.

For a polynomial, $f(x)$, we can expand it as

$$f(x) = \sum_{n=0}^{+\infty} c_n (x - L/2)^n.$$

Which statement below is true regarding the coefficients?

- $c_n = \langle f(x), (x - L/2)^n\rangle$
- $c_n = \frac{2}{L}\langle f(x), (x - L/2)^n\rangle$
- $c_n = \frac{\langle f(x), (x - L/2)^n\rangle}{\langle (x - L/2)^n, (x - L/2)^n\rangle}$

Correct!

- None of the formulas listed.

Question 4

0 / 0 pts

Consider the sequence of functions $\{\cos(\frac{n\pi}{L}x),\ x \in [0, L],\ n = 0, 1, 2, \ldots\}$ and consider the inner product $\langle u(x), v(x)\rangle \equiv \int_0^L u(x)v(x)dx$.

We are given the fact that for any piecewise smooth function $f(x), x \in [0, L]$, we can expand it as $f(x) = \sum_{n=0}^{+\infty} c_n \cos(\frac{n\pi}{L}x)$.

Which statement below is true regarding the coefficients?

- $c_n = \langle f(x), \cos(\frac{n\pi}{L}x)\rangle$
- $c_n = \dfrac{\langle f(x), \cos(\frac{n\pi}{L}x)\rangle}{\langle 1, 1\rangle}$

Correct!

- $c_n = \dfrac{\langle f(x), \cos(\frac{n\pi}{L}x)\rangle}{\langle \cos(\frac{n\pi}{L}x), \cos(\frac{n\pi}{L}x)\rangle}$
- None of the formulas listed.

Question 5

0 / 0 pts

Consider the function space

$C_{BC}[a,b] \equiv \left\{ u(x) \middle| u(a)=0, u(b)=0 \right\}$ and the inner product

$\langle u(x), v(x) \rangle \equiv \int_a^b u(x)v(x)dx.$

Let $L^{(1)}[\bullet] \equiv x\frac{\partial(\bullet)}{\partial x}$.

What is the adjoint operator $L^{(1)*}$ with respect to the inner product above?

- $L^{(1)*}[\bullet] = x\frac{\partial(\bullet)}{\partial x}$
- $L^{(1)*}[\bullet] = -x\frac{\partial(\bullet)}{\partial x}$
- $L^{(1)*}[\bullet] = \frac{\partial(x\bullet)}{\partial x}$

Correct!

- $L^{(1)*}[\bullet] = -\frac{\partial(x\bullet)}{\partial x}$
- $L^{(1)*}[\bullet] = -\frac{\partial(\bullet)}{\partial x}$

Question 6

0 / 0 pts

Consider the function space $C_{BC}[a,b] \equiv \left\{u(x) \middle| u(a)=0, u(b)=0\right\}$ and the inner product $\langle u(x), v(x)\rangle \equiv \int_a^b u(x)v(x)dx$.

Let $L^{(2)}[\bullet] \equiv \dfrac{\partial^2(\bullet)}{\partial x^2} + \dfrac{\partial(\bullet)}{\partial x}$.

Is $L^{(2)}[\bullet]$ self-adjoint with respect to the inner product above?

- ( ) True
- (•) False — Correct!

Question 7

0 / 0 pts

Which of the following is true? **Select all that apply.**

- [ ] All eigenvalues of a real matrix are real.
- [x] All eigenvalues of a real symmetric matrix are real. — Correct!
- [ ] A real matrix has a complete set of eigenvectors.
- [x] A real symmetric matrix has a complete set of eigenvectors. — Correct!
- [ ] For a real matrix, eigenvectors for different eigenvalues are perpendicular to each other.

Correct!

For a real symmetric matrix, eigenvectors for different eigenvalues are perpendicular to each other.

Question 8

0 / 0 pts

Consider the function space $C_{BC}[a,b] \equiv \left\{ u(x) \middle| u(a)=0, u(b)=0 \right\}$ and the inner product $\langle u(x), v(x) \rangle \equiv \int_a^b u(x)v(x)e^x\,dx$.

Let $L^{(2)}[\bullet] \equiv \frac{\partial^2(\bullet)}{\partial x^2} + \frac{\partial(\bullet)}{\partial x}$. We rewrite it as $L^{(2)}[\bullet] \equiv e^{-x}\frac{\partial}{\partial x}\left(e^x \frac{\partial(\bullet)}{\partial x}\right)$.

Is $L^{(2)}[\bullet]$ self-adjoint with respect to the inner product above?

Correct!

- (•) True
- ( ) False

Quiz Score: **1** out of 1