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Courses » Integral Equations,calculus of variations and its applications

Announcements **Course** Ask a Question Progress Mentor FAQ

Unit 4 - Week 3

Course outline

How to access the portal

Week-1

Week 2

Week 3

Fredholm integral equations with symmetric kernels: Properties of eigenvalues and eigenfunctions

Fredholm integral equations with symmetric kernels: Hilbert Schmidt theory

Fredholm integral equations with symmetric kernels: Examples

Construction of Green's function-I

Construction of Green's function-II

Quiz : Assignment 3

Solution of Assignment 3

Week 4

Week 5

Week 6

Week 7

Assignment 3

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

Due on 2018-09-05, 23:59 IST.

1) 0 points

The symmetric Fredholm integral equation $y(x) = f(x) + \lambda \int_{-1}^1 x^3 t^3 y(t) dt$, has

no solution for $\lambda = \frac{7}{2}$ and $f(x) = x$

a unique solution for $\lambda = \frac{2}{7}$ and $f(x) = x$

a unique solution for $\lambda = \frac{7}{2}$ and $f(x) = x^2$

no solution for $\lambda = \frac{2}{7}$ and $f(x) = x^2$.

No, the answer is incorrect.

Score: 0

Accepted Answers:

a unique solution for $\lambda = \frac{2}{7}$ and $f(x) = x$

2) 1 point

The symmetric Fredholm integral equation $y(x) = e^x + \lambda \int_{-1}^1 (xt + 2t + 2x + 4)y(t) dt$, has

no solution for $\lambda = \frac{1}{9}$

a unique solution for $\lambda = \frac{1}{9}$

infinitely many solutions for $\lambda = \frac{3}{26}$

a unique solution for $\lambda = \frac{3}{26}$.

No, the answer is incorrect.

Score: 0

Accepted Answers:

a unique solution for $\lambda = \frac{1}{9}$

3) 1 point

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infinitely many solutions for $\lambda = 1$ and $f(x) = \cos x$ *unique solution for $\lambda = \pi$ and $f(x) = \sin x$.***No, the answer is incorrect.****Score: 0****Accepted Answers:***unique solution for $\lambda = \pi$ and $f(x) = \sin x$.*

4)

1 pointConsider the Fredholm integral equation $y(x) = f(x) + \lambda \int_0^{2\pi} (\sin x + \sin t)y(t)dt$.

Then it has

no solution for $\lambda = \frac{1}{\pi}$, $f(x) = \sin x$ *unique solution for $\lambda = \frac{1}{\pi\sqrt{2}}$, $f(x) = \sin x$* *unique solution for $\lambda = 1$, $f(x) = \cos x$* *infinitely many solutions for $\lambda = \frac{1}{\pi\sqrt{2}}$, $f(x) = \sin x$.***No, the answer is incorrect.****Score: 0****Accepted Answers:***unique solution for $\lambda = 1$, $f(x) = \cos x$*

5) Consider the following symmetric Fredholm integral equation

1 point $\sin 4x = \lambda \int_0^{\pi/2} K(x,t)y(t)dt$, where

$$K(x,t) = \begin{cases} \sin x \cos t, & 0 \leq x \leq t; \\ \sin t \cos x, & t \leq x \leq \pi/2. \end{cases}$$

Then it has

no solution for all value of λ *unique solution $y(x) = \sin 4x$ for only one value of λ* *unique solution $y(x) = \sin 4x$ for only two value of λ* *None of these.***No, the answer is incorrect.****Score: 0****Accepted Answers:***unique solution $y(x) = \sin 4x$ for only one value of λ*

6)

0 pointsConsider the following Fredholm integral equation $y(x) = f(x) + \lambda \int_0^{2\pi} \sin(x+t)y(t)dt$. Th using Hilbert Schmidt theorem we obtain *$y(x) = x + \frac{4}{3} (2 \cos x + \sin x)$ for $\lambda = \frac{2}{\pi}$ and $f(x) = x$.* *$y(x) = x + 2 \cos x + \sin x$ for $\lambda = \frac{1}{\pi}$ and $f(x) = x$.* *$y(x) = 1 + \sin x + \cos x$ for $\lambda = -\frac{1}{\pi}$ and $f(x) = 1$.*

$$y(x) = 1 + \sin x - \cos x \text{ for } \lambda = -\frac{1}{\pi} \text{ and } f(x) = 1.$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$y(x) = x + \frac{4}{3} (2 \cos x + \sin x) \text{ for } \lambda = \frac{2}{\pi} \text{ and } f(x) = x.$$

7) Consider the differential equation $2y''(x) + y'(x) + xy(x) = 0$, and let the function $v(x)$ be defined as 1 point

$$v(x)[2y''(x) + y'(x) + xy(x)] = [A(x)y'(x) + B(x)y(x)]'$$

for some twice differentiable functions $A(x)$ and $B(x)$. Then

$$v(x) \text{ is a solution of the equation } 2y''(x) + y'(x) + xy(x) = 0$$

$$v(x) \text{ is a solution of the equation } 2y''(x) - y'(x) + xy(x) = 0$$

$$v(x) \text{ is a solution of the equation } 2y''(x) + xy(x) = 0$$

none of the above.

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$v(x) \text{ is a solution of the equation } 2y''(x) - y'(x) + xy(x) = 0$$

8) 1 point

Consider the Fredholm integral equation $y(x) = x + \lambda \int_0^1 e^{x+t} y(t) dt$. Then it has a solution

$$y(x) = x + \frac{2e^x}{3-e^2} \text{ for } \lambda = \frac{1}{e^2-1}$$

$$y(x) = x + \frac{2e^x}{e^2-1} \text{ for } \lambda = 1$$

$$y(x) = x + \frac{2e^x}{3-e^2} \text{ for } \lambda = 1$$

$$y(x) = x + \frac{2e^x}{e^2-1} \text{ for } \lambda = -1.$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$y(x) = x + \frac{2e^x}{3-e^2} \text{ for } \lambda = 1$$

9) 1 point

Consider the differential equation $x^2 y'' + xy' - 4y = 0$ with appropriate boundary conditions. Then the adjoint equation is given by

$$x^2 v'' + 3xv' - 3v = 0$$

$$x^2 v'' - 3xv' - 4v = 0$$

$$x^2 v'' - xv' - 4v = 0$$

None of these.

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$x^2 v'' + 3xv' - 3v = 0$$

10)

1 point

Consider the boundary value problem $y''(x) + 2y'(x) + y(x) = f(x)$ with the boundary conditions $y(0) = 0 = y(1)$. Then the Green's function $G(\xi, x)$ for the given boundary value problem is

$$G(\xi, x) = \begin{cases} \xi(x-1)e^{\xi-x}, & 0 \leq \xi \leq x; \\ xe^{\xi-x}(\xi-1), & x < \xi \leq 1. \end{cases}$$

$$G(\xi, x) = \begin{cases} (\xi-1)xe^{\xi-x}, & 0 \leq \xi \leq x; \\ \xi e^{\xi-x}(x-1), & x < \xi \leq 1. \end{cases}$$

$$G(\xi, x) = \begin{cases} (\xi-1)\xi e^{\xi-x}, & 0 \leq \xi \leq x; \\ \xi(\xi-1)e^{x-\xi}, & x < \xi \leq 1. \end{cases}$$

None of these.

No, the answer is incorrect.

Score: 0

Accepted Answers:

None of these.

[Previous Page](#)
[End](#)