Math 2C03 Last PracPb BVP (18718013)

Due: Sat, May 1, 2021 11:00 PM EDT

Question	1	2	3	4	5	6	7	8	9	10

Description

BVP

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1. Question Details ZillDiffEQ9 5.2.011. [3748753] -

Find the eigenvalues λ_n and eigenfunctions $y_n(x)$ for the given boundary-value problem. (Give your answers in terms of n, making sure that each value of n corresponds to a unique eigenvalue.)

$$y'' + \lambda y = 0, \quad y'(0) = 0, \quad y(L) = 0$$

$\lambda_n =$ ______ $n = 1, 2, 3, \ldots$

$y_n(x) =$ ______ $n = 1, 2, 3, \ldots$

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2. Question Details ZillDiffEQ9 5.2.013. [3748705] -

Find the eigenvalues λ_n and eigenfunctions $y_n(x)$ for the given boundary-value problem. (Give your answers in terms of n, making sure that each value of n corresponds to a unique eigenvalue.)

$$y'' + \lambda y = 0, \quad y'(0) = 0, \quad y'(\pi) = 0$$

$\lambda_n =$ ______ $, n = 0, 1, 2, \ldots$

$y_n(x) =$ ______ $, n = 0, 1, 2, \ldots$

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3. Question Details ZillDiffEQ9 5.2.015. [3748734] -

Find the eigenvalues λ_n and eigenfunctions $y_n(x)$ for the given boundary-value problem. (Give your answers in terms of n, making sure that each value of n corresponds to a unique eigenvalue.)

$$y'' + 2y' + (\lambda + 1)y = 0, \quad y(0) = 0, \quad y(5) = 0$$

$\lambda_n =$ ______ $n = 1, 2, 3, \ldots$

$y_n(x) =$ ______ $n = 1, 2, 3, \ldots$

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4. Question Details ZillDiffEQ9 5.2.021. [3755982]

Find the eigenvalues λ_n and eigenfunctions $y_n(x)$ for the given boundary-value problem. Consider only the case $\lambda = \alpha^4$, $\alpha > 0$. [*Hint*: Read (*ii*) in the *Remarks*.] (Give your answers in terms of n, making sure that each value of n corresponds to a unique eigenvalue.)

$$y^{(4)} - \lambda y = 0, \quad y(0) = 0, \; y''(0) = 0, \; y(1) = 0, \; y''(1) = 0$$

λ_n = ______ $n = 1, 2, 3, \ldots$

$y_n(x)$ = ______ $n = 1, 2, 3, \ldots$

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5. Question Details ZillDiffEQ9 5.2.027. [3748820]

Consider the boundary-value problem introduced in the construction of the mathematical model for the shape of a rotating string:

$$T\frac{d^2y}{dx^2} + \rho\omega^2 y = 0, \quad y(0) = 0, \quad y(L) = 0.$$

For constants T and ρ, define the critical speeds of angular rotation ω_n as the values of ω for which the boundary-value problem has nontrivial solutions. Find the critical speeds ω_n and the corresponding deflections $y_n(x)$. (Give your answers in terms of n, making sure that each value of n corresponds to a unique critical speed.)

ω_n = ______ $n = 1, 2, 3, \ldots$

$y_n(x)$ = ______ $n = 1, 2, 3, \ldots$

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6. Question Details ZillDiffEQ9 11.1.001. [3745411]

Show that the given functions are orthogonal on the indicated interval.

$f_1(x) = x,\ f_2(x) = x^6;\quad [-4, 4]$

$$\int_{-4}^{4} f_1(x)f_2(x)\,dx = \int_{-4}^{4} x\Big(\;\_\_\_\_\_\_\;\Big)\,dx$$ (give integrand in terms of x)

$$= \Big(\;\_\_\_\_\_\_\;\Big)\Big|_{-4}^{4}$$

$$= \_\_\_\_\_\_$$

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7. Question Details ZillDiffEQ9 11.1.002. [4568020]

Show that the given functions are orthogonal on the indicated interval.

$f_1(x) = x^5,\ f_2(x) = x^2 + 1;\quad [-1, 1]$

$\int_{-1}^{1} f_1(x)f_2(x)\,dx = \int_{-1}^{1} x^5\left(\boxed{}\right)dx$ (give integrand in terms of x)

$= \left(\boxed{}\right)\Big|_{-1}^{1}$

$= \boxed{}$

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8. Question Details ZillDiffEQ9 11.1.008. [3876417]

Show that the given set of functions is orthogonal on the indicated interval. Find the norm of each function in the set.

$\{\cos(x), \cos(3x), \cos(5x), \ldots\};\quad [0, \pi/2]$

For $m \neq n$

$\int_0^{\pi/2} \cos((2n+1)x)\cos((2m+1)x)\,dx = \frac{1}{2}\int_0^{\pi/2}\left(\cos(2(n-m)x) + \left(\boxed{}\right)\right)dx$

$= \left(\boxed{}\right)\Big|_0^{\pi/2}$

$= \boxed{}$.

For $m = n$

$\int_0^{\pi/2} \cos^2((2n+1)x)\,dx = \int_0^{\pi/2}\left(\frac{1}{2} + \left(\boxed{}\right)\right)dx$

$= \left(\boxed{}\right)\Big|_0^{\pi/2}$

$= \boxed{}$

so that $\|\cos((2n+1)x)\| = \boxed{}$.

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9. Question Details ZillDiffEQ9 11.1.020. [3756103]

A real-valued function f is said to be **periodic** with period $T \neq 0$ if $f(x + T) = f(x)$ for all x in the domain of f. If T is the smallest positive value for which $f(x + T) = f(x)$ holds, then T is called the **fundamental period** of f. Determine the fundamental period T of the given function.

$$f(x) = \sin\left(\frac{6}{L}x\right),\ L > 0$$

$T =$

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10. Question Details ZillDiffEQ9 11.1.021. [3756095]

A real-valued function f is said to be **periodic** with period $T \neq 0$ if $f(x + T) = f(x)$ for all x in the domain of f. If T is the smallest positive value for which $f(x + T) = f(x)$ holds, then T is called the **fundamental period** of f. Determine the fundamental period T of the given function.

$$f(x) = \sin(x) + \sin(2x)$$

$T =$

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Assignment Details

Name (AID): **Math 2C03 Last PracPb BVP (18718013)**
Submissions Allowed: **20**
Category: **Homework**
Code:
Locked: **Yes**
Author: **Lia Bronsard (bronsard@mcmaster.ca)**
Last Saved: **Apr 9, 2021 11:56 AM EDT**
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