Unit 7 - Week 6

Assignment 6

The due date for submitting this assignment has passed. **Due on 2018-09-12, 23:59 IST.**
As per our records you have not submitted this assignment.

1) *Consider the differential equation* **1 point**

$P(x)y'' + Q(x)y' + R(x)y = 0 \quad (1)$
and let $y(x) = c_1 \cosh(x^2 - 1) + c_2 \sinh(x^2 - 1)$ *be its general solution.*
Consider the following boundary conditions
$y(1) = 0$ *and* $y(2) = 0 \quad (2)$
$y'(1) = 0$ *and* $y'(2) = 0 \quad (3)$
Then

- (1) *with boundary condition* (2) *has a non trivial solution*
- (1) *with boundary condition* (3) *has a non trivial solution*
- (1) *with boundary condition* (2) *has a non trivial solution but with boundary condition* (3) *has only a trivial solution*
- (1) *has trivial solution with both boundary conditions* (2) *and* (3).

No, the answer is incorrect.
Score: 0

Accepted Answers:
(1) *has trivial solution with both boundary conditions* (2) *and* (3).

2) *Consider the differential equation* **1 point**

$y'' + 2y' + 5y = 0 \quad (1)$
and consider the following boundary conditions
$y(0) = 0$ *and* $y(\frac{\pi}{4}) = 0 \quad (2)$
$y(0) = 0$ *and* $y(\frac{\pi}{2}) = 0 \quad (3)$
Then

- (1) *has non trivial solution with both boundary conditions* (2) *and* (3)
- (1) *has trivial solution with both boundary conditions* (2) *and* (3)
- (1) *with boundary condition* (2) *has only a trivial solution*
- (1) *with boundary condition*(3) *has only a trivial solution*

No, the answer is incorrect.

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- only a trivial solution
- non trivial solution and is given by $\frac{\pi}{\sqrt{2}}\cos(x+\frac{\pi}{4})$
- non trivial and non unique solution
- non trivial solution and is given by $\frac{\pi}{\sqrt{2}}\sin(x-\frac{\pi}{4})$

No, the answer is incorrect.
Score: 0

Accepted Answers:
non trivial solution and is given by $\frac{\pi}{\sqrt{2}}\cos(x+\frac{\pi}{4})$

4) Consider the differential equation $xy'' + (1-x)y' + y = 0$. Then **1 point**

- Differential equation is a $self-adjoint$ differential equation
- Differential equation is not $self-$ adjoint but can be made $self$ adjoint by multiplying e^x
- Differential equation is not self adjoint but can be made self adjoint by multiplying e^{-x}
- None of these.

No, the answer is incorrect.
Score: 0

Accepted Answers:
Differential equation is not self adjoint but can be made self adjoint by multiplying e^{-x}

5) **1 point**

Consider the differential equation $xy'' + 2y' + a^2xy = 0,\ x > 0$. Then the differential equation is

- an exact equation
- not an exact equation and its adjoint equation is $x(v'' + a^2v) = 0$
- not an exact equation and its adjoint equation is $x(v'' - a^2v) = 0$
- not an exact equation and its adjoint equation is $x(v'' + av) = 0$

No, the answer is incorrect.
Score: 0

Accepted Answers:
not an exact equation and its adjoint equation is $x(v'' + a^2v) = 0$

6) **1 point**

Consider the differential equation $x^2y'' + xy' - 4y = 0,\ x > 0$. Then the differential equation is

- an exact equation
- not an exact equation and its integration factor is x^2
- not an exact equation and its integration factor is x^3
- not an exact equation and its integration factor is x

No, the answer is incorrect.
Score: 0

Accepted Answers:

not an exact equation and its integration factor is x

7) **1 point**

Consider the boundary value problem $y'' + \lambda y = 0$ *with boundary conditions* $y'(0) = 0$ *and* $y'(\beta) = 0,\ \beta > 0$. *Then the set of eigenvalues and eigenfunctions (respectively) are*

- $\{n^2\pi^2/\beta^2\}, \{\sin\left(\frac{n\pi}{\beta}\,x\right)\},\ n \geq 1$
- $\{n^2\pi^2/\beta^2\}, \{\cos\left(\frac{n\pi}{\beta}\,x\right)\},\ n \geq 1$
- $\{(n-1)^2\pi^2/\beta^2\}, \{\sin\left(\frac{(n-1)\pi}{\beta}\,x\right)\},\ n \geq 1$
- $\{(n-1)^2\pi^2/\beta^2\}, \{\cos\left(\frac{(n-1)\pi}{\beta}\,x\right)\},\ n \geq 1$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\{(n-1)^2\pi^2/\beta^2\}, \{\cos\left(\frac{(n-1)\pi}{\beta}\,x\right)\},\ n \geq 1$

8) *Consider the Sturm Liouville problem* (SLP) **1 point**

$(xy')' + \frac{\lambda}{x}\,y = 0, \quad 1 < x < e^{2\pi}, \quad y'(1) = y'(e^{2\pi}) = 0.$
Then

- *SLP has no eigenvalues*
- *SLP has eigenvalues* $\lambda_n = n^2$ *and corresponding eigenfunctions are* $\phi_n(x) = \cos(\ln x)$
- *For* $m \neq n,\ \int_1^{e^{2\pi}} \cos\left(\frac{n}{2}\ln x\right)\cos\left(\frac{m}{2}\ln x\right)dx = 0$
- *For* $m \neq n,\ \int_1^{e^{2\pi}} \frac{1}{x}\cos\left(\frac{n}{2}\ln x\right)\cos\left(\frac{m}{2}\ln x\right)dx = 0$

No, the answer is incorrect.
Score: 0

Accepted Answers:
For $m \neq n,\ \int_1^{e^{2\pi}} \frac{1}{x}\cos\left(\frac{n}{2}\ln x\right)\cos\left(\frac{m}{2}\ln x\right)dx = 0$

9) **1 point**

The Green's function for the boundary value problem $y'' = f(x, y, y'),\ y(-1) = y(1) = 0$ *is*

- $G(x,\xi) = |x-\xi| + x\xi - 1$
- $G(x,\xi) = -\frac{1}{2}\,[|x-\xi| - x\xi + 1]$
- $G(x,\xi) = -\frac{1}{2}\,[|x-\xi| + x\xi - 1]$
- $G(x,\xi) = |x-\xi| - x\xi + 1$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$G(x,\xi) = -\frac{1}{2}\,[|x-\xi| + x\xi - 1]$

10) *Let* $G(t,s)$ *be the Green's function for the boundary value problem* **1 point**

$y'' + f(t, y, y') = 0,\ y(a) = y(b) = 0.$
Then

- $0 \leq G(t,s) \leq \frac{b-a}{8}$
- $0 \leq G(t,s) \leq \frac{b-a}{4}$
- $\int_a^b G(t,s)ds = \frac{(b-t)(t-a)}{4}$
- $\int_a^b G(t,s)ds \leq \frac{(b-a)^2}{16}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$0 \leq G(t,s) \leq \frac{b-a}{4}$

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