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NPTEL

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Courses » Ordinary and Partial Differential Equations and Applications

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

Unit 3 - Week 2

Course outline

How to access the portal

Week 1

Week 2

- Existence and uniqueness of solutions of a system of differential equations
- Linear System
- Properties of Homogeneous Systems
- Solution of Homogeneous Linear System with Constant Coefficients-I
- Solution of Homogeneous Linear System with Constant Coefficients-II
- Quiz : Assignment 2
- Solution of assignment 2

Week 3

Week 4

Week 5

Assignment 2

The due date for submitting this assignment has passed. **Due on 2018-08-15, 23:59 IST.**
As per our records you have not submitted this assignment.

1) *Consider the differential equation* $\frac{d^4y}{dt^4} + \frac{d^2y}{dt^2} = 1$ *and let* $X' = AX + B$ *be the corresponding system of first order equations then* **1 point**

- $A = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{pmatrix},\ b = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \end{pmatrix}$
- $A = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & -1 & 0 \end{pmatrix},\ b = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \end{pmatrix}$
- $A = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & -1 \end{pmatrix},\ b = \begin{pmatrix} 0 \\ 1 \\ 0 \\ 0 \end{pmatrix}$
- $A = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & -1 & 0 & 0 \end{pmatrix},\ b = \begin{pmatrix} 0 \\ 1 \\ 0 \\ 0 \end{pmatrix}$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$A = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & -1 & 0 \end{pmatrix},\ b = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \end{pmatrix}$

Week 10
Week 11
Week 12
WEEKLY FEEDBACK
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$[1, 1 + \frac{8}{\sqrt{e}}]$

$[1, 1 + \frac{2}{\sqrt{e}}]$

None of these

No, the answer is incorrect.
Score: 0

Accepted Answers:
$[1, 1 + \frac{\sqrt{e}}{2}]$

3) **1 point**

The second order linear differential equation

$$(t^2+1)\frac{d^2x}{dt^2} + 2t\frac{dx}{dt} + 3x = \sin t$$

can be expressed as system of first order differential equations in the form

$$\frac{dx_1}{dt} = x_2, \frac{dx_2}{dt} = \frac{1}{(t^2+1)}\sin t - \frac{2t}{(t^2+1)}x_2 - \frac{3}{(t^2+1)}x_1$$

$$\frac{dx_1}{dt} = x_2, \frac{dx_2}{dt} = \frac{1}{(t^2+1)}\sin t + \frac{2t}{(t^2+1)}x_2 - \frac{3}{(t^2+1)}x_1$$

$$\frac{dx_1}{dt} = x_2, \frac{dx_2}{dt} = \frac{1}{(t^2+1)}\sin t - \frac{2t}{(t^2+1)}x_2 + \frac{3}{(t^2+1)}x_1$$

$$\frac{dx_1}{dt} = x_2, \frac{dx_2}{dt} = -\frac{1}{(t^2+1)}\sin t + \frac{2t}{(t^2+1)}x_2 - \frac{3}{(t^2+1)}x_1$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$\frac{dx_1}{dt} = x_2, \frac{dx_2}{dt} = \frac{1}{(t^2+1)}\sin t - \frac{2t}{(t^2+1)}x_2 - \frac{3}{(t^2+1)}x_1$$

4) *If the initial value problem* **0 points**

$$\frac{d^3x}{dt^3} - 4\frac{d^2x}{dt^2} + 5\frac{dx}{dt} - 2x = 0$$

$$x(0) = 1, x'(0) = 1, x''(0) = 1$$

is expressed as a vector differential equation

$$\dot{x}(t) = Ax, x(0) = x^0$$

then A and x^0 are given by

$$\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 4 & -5 & 2 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

$$\begin{pmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 4 & -5 & 2 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

$$\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -4 & 5 & -2 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

$$\begin{pmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ -4 & 5 & -2 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 4 & -5 & 2 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

5) ***1 point***

Consider the equation

$$\frac{d^2x}{dt^2} - 4\frac{dx}{dt} + 5x = 0$$

then the general solution of the associated linear system $\dot{x} = Ax$ *is given by*

$$x = \begin{pmatrix} (c_1 \sin t + c_2 \cos t)e^{2t} \\ (c_1 \cos t - c_2 \sin t)e^{2t} \end{pmatrix}$$

$$x = \begin{pmatrix} e^{2t}(c_1 \cos t + c_2 \sin t) \\ 2e^{2t}(c_1 \cos t + c_2 \sin t) + e^{2t}(-c_1 \sin t + c_2 \cos t) \end{pmatrix}$$

$$x = \begin{pmatrix} e^{2t}(c_1 \cos t + c_2 \sin t) \\ e^{2t}(c_1 \cos t + c_2 \sin t) + 2e^{2t}(-c_1 \sin t + c_2 \cos t) \end{pmatrix}$$

$$x = \begin{pmatrix} e^{2t}(c_1 \cos t + c_2 \sin t) \\ 2e^{2t}(c_1 \cos t + c_2 \sin t) + e^{2t}(c_1 \sin t + c_2 \cos t) \end{pmatrix}$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$x = \begin{pmatrix} e^{2t}(c_1 \cos t + c_2 \sin t) \\ 2e^{2t}(c_1 \cos t + c_2 \sin t) + e^{2t}(-c_1 \sin t + c_2 \cos t) \end{pmatrix}$$

6) *Solution of IVP* ***1 point***

$$\frac{d^2x}{dt^2} - 4x = 0, \; x(0) = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

is given by

$$x(t) = \begin{pmatrix} \frac{1}{2}\left(e^{2t} + e^{-2t}\right) \\ \frac{1}{2}\left(e^{2t} - 3e^{-2t}\right) \end{pmatrix}$$

$$x(t) = \begin{pmatrix} \frac{1}{2}\left(-e^{2t} + 3e^{-2t}\right) \\ -\frac{1}{4}\left(e^{2t} + 3e^{-2t}\right) \end{pmatrix}$$

$$x(t) = \begin{pmatrix} \frac{1}{4}\left(e^{2t} + 3e^{-2t}\right) \\ \frac{1}{2}\left(e^{2t} - 3e^{-2t}\right) \end{pmatrix}$$

$$x(t) = \begin{pmatrix} \frac{1}{4}\left(3e^{2t} + e^{-2t}\right) \\ -\frac{1}{4}\left(e^{2t} + 3e^{-2t}\right) \end{pmatrix}$$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$$x(t) = \begin{pmatrix} \frac{1}{4}\left(e^{2t} + 3e^{-2t}\right) \\ \frac{1}{2}\left(e^{2t} - 3e^{-2t}\right) \end{pmatrix}$$

7) *The general solution of the linear system* **1 point**

$$\frac{dx}{dt} = 6x - 3y, \quad \frac{dy}{dt} = 2x + y,$$
is

$x = c_1 e^{2t} + 3c_2 e^{4t}$
$y = c_1 e^{2t} + c_2 e^{4t}$

$x = c_1 e^{3t} + 3c_2 e^{4t}$
$y = c_1 e^{3t} + 2c_2 e^{4t}$

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$x = c_1 e^{3t} + 3c_2 e^{4t}$
$y = c_1 e^{3t} + c_2 e^{4t}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$x = c_1 e^{3t} + 3c_2 e^{4t}$
$y = c_1 e^{3t} + 2c_2 e^{4t}$

8) *The general solution of the linear system* **1 point**

$$\frac{dx}{dt} = 5x - 2y, \quad \frac{dy}{dt} = 4x - y,$$
is

$x = c_1 e^{t} + c_2 e^{3t}$
$y = 2c_1 e^{t} + c_2 e^{3t}$

$x = c_1 e^{t} + c_2 e^{3t}$
$y = c_1 e^{t} + 2c_2 e^{3t}$

$x = c_1 e^{t} + 2c_2 e^{3t}$
$y = c_1 e^{t} + c_2 e^{3t}$

$x = 2c_1 e^{t} + c_2 e^{3t}$
$y = c_1 e^{t} + c_2 e^{3t}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$x = c_1 e^t + c_2 e^{3t}$
$y = 2c_1 e^t + c_2 e^{3t}$

9) *The general solution of the linear system* **1 point**

$$\frac{dx}{dt} = x - 4y, \quad \frac{dy}{dt} = x + y,$$

is

- $x = e^t(-c_1 \sin\, 2t + c_2 \cos\, 2t)$
  $y = e^t(c_1 \cos\, 2t + c_2 \sin\, 2t)$
- $x = 2e^t(c_1 \sin\, 2t - c_2 \cos\, 2t)$
  $y = e^t(-c_1 \cos\, 2t + c_2 \sin\, 2t)$
- $x = 2e^t(-c_1 \sin\, 2t + c_2 \cos\, 2t)$
  $y = e^t(c_1 \cos\, 2t + c_2 \sin\, 2t)$
- $x = 2e^t(-c_1 \sin\, 2t + c_2 \cos\, 2t)$
  $y = e^t(c_1 \cos\, 2t - c_2 \sin\, 2t)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$x = 2e^t(-c_1 \sin\, 2t + c_2 \cos\, 2t)$
$y = e^t(c_1 \cos\, 2t + c_2 \sin\, 2t)$

10) *The general solution of the linear system* **1 point**

$$\frac{dx}{dt} = 4x - 2y, \quad \frac{dy}{dt} = 5x + 2y,$$

is

- $x = 2e^{3t}(c_1 \cos\, 3t + c_2 \sin\, 3t)$
  $y = e^{3t}(c_1(\cos\, 3t + 3\sin\, 3t) + c_2(\sin\, 3t - 3\cos\, 3t))$
- $x = 2e^{3t}(c_1 \cos\, 3t - c_2 \sin\, 3t)$
  $y = e^{-3t}(c_1(\cos\, 3t + 3\sin\, 3t) + c_2(\sin\, 3t - 3\cos\, 3t))$
- $x = e^{3t}(c_1 \cos\, 3t + c_2 \sin\, 3t)$
  $y = e^{3t}(c_1(\cos\, 3t - 3\sin\, 3t) + c_2(\sin\, 3t - 3\cos\, 3t))$
- $x = e^{3t}(c_1 \cos\, 3t - c_2 \sin\, 3t)$
  $y = 2e^{3t}(c_1(\cos\, 3t + 3\sin\, 3t) + c_2(\sin\, 3t - 3\cos\, 3t))$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$x = 2e^{3t}(c_1 \cos\, 3t + c_2 \sin\, 3t)$
$y = e^{3t}(c_1(\cos\, 3t + 3\sin\, 3t) + c_2(\sin\, 3t - 3\cos\, 3t))$

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