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NPTEL

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Courses » Ordinary and Partial Differential Equations and Applications

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# Unit 5 - Week 4

## Course outline



# Assignment 4

**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) *Consider the differential equations* **1 point**

$$t^3y'' + (\sin t^2)y' + ty = 0 \quad (1)$$
$$t^3y'' + (\sin t)y' + ty = 0 \quad (2)$$

*Then the point* $t = 0$ *is*

- *An ordinary point for both the equations*
- *A regular singular point of* (1) *but not of* (2)
- *A irregular singular point for both the equations*
- *A regular singular point of* (2) *but not of* (1)

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*A regular singular point of* (1) *but not of* (2)

2) **1 point**

*Consider the differential equation* $t(t-1)^2(t+3)x'' + t^2x' - (t^2+t-1)x = 0$. *Then*

- *Points* $t = 0,\ t = 1$ *and* $t = -3$ *all are regular singular points*
- *Only point* $t = 0$ *is a regular singular point*
- *Only point* $t = 1$ *is a regular singular point*
- *Points* $t = 0$ *and* $t = -3$ *are regular singular points*

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Points* $t = 0$ *and* $t = -3$ *are regular singular points*

3) *The solution of the differential equation* $t^2y'' + 3ty' + y = 0$ *with* $y(1) = 0$ *and* $y(e) = 1$ *is* **1 point**

Google

$y(t) = e^2 t \ln t$

$None\ of\ these$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$y(t) = \frac{e}{t} \ln t$

4) $Consider\ the\ differential\ equation\ 2ty'' + y' + ty = 0,\ 0 < t < \infty,$ $then\ the\ recurrence\ relation\ to\ obtain\ Frobenius\ series\ solution$ $y(t) = t^r \sum_{n=0}^{\infty} a_n t^n\ is$ **1 point**

$For\ r = 0,\ n(2n+1)a_n + a_{n-2} = 0,\ n \geq 2$

$For\ r = \frac{1}{2}\ ,\ n(2n-1)a_n + a_{n-2} = 0,\ n \geq 2$

$For\ r = 1,\ n(2n-1)a_n + a_{n-2} = 0,\ n \geq 2$

$For\ r = \frac{1}{2}\ ,\ n(2n+1)a_n + a_{n-2} = 0,\ n \geq 2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$For\ r = \frac{1}{2}\ ,\ n(2n+1)a_n + a_{n-2} = 0,\ n \geq 2$

5) $Consider\ the\ differential\ equation\ 2t^2y'' + t(2t+1)y' - y = 0.$ $Then\ differential\ equation\ has$ **1 point**

$only\ one\ Frobenius\ series\ solution$

$two\ Frobenius\ series\ solutions\ and\ one\ of\ the\ Frobenius\ series\ solution\ is$ $given\ by\ y(t) = t^{-1/2}[1 - \frac{2}{5}\,t + \frac{4}{35}\,t^2 - \ldots]$

$two\ Frobenius\ series\ solutions\ and\ one\ of\ the\ Frobenius\ series$ $solution\ is\ given\ by\ y(t) = t[1 - t + \frac{1}{2}\,t^2 - \ldots]$

$two\ Frobenius\ series\ solutions\ and\ one\ of\ the\ Frobenius\ series\ solution$ $is\ given\ by\ y(t) = [t - \frac{2}{5}\,t^2 + \frac{4}{35}\,t^3 - \ldots]$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$two\ Frobenius\ series\ solutions\ and\ one\ of\ the\ Frobenius\ series\ solution$ $is\ given\ by\ y(t) = [t - \frac{2}{5}\,t^2 + \frac{4}{35}\,t^3 - \ldots]$

6) $Consider\ the\ differential\ equation\ t^2y'' + (3t - t^2)y' - ty = 0.\ Then$ **1 point**

$roots\ of\ the\ indicial\ equation\ differ\ by\ a\ positive\ integer\ and$ $only\ one\ Frobenius\ series\ solution\ exist$

$roots\ of\ the\ indicial\ equation\ differ\ by\ a\ positive\ integer\ and$ $both\ Frobenius\ series\ solutions\ exist$

$roots\ of\ the\ indicial\ equation\ differ\ by\ a\ positive\ integer\ and\ only$ $one\ Frobenius\ series\ solution\ exist\ and\ is\ given\ by$ $y(t) = t[1 - t + \frac{1}{2}\,t^2 - \ldots]$

$roots\ of\ the\ indicial\ equation\ differ\ by\ a\ positive\ integer\ and\ both\ Frobenius\ series\ solutions\ exist\ and\ one\ of\ the\ solution\ is\ given\ by$
$y(t) = t[1 - t + \frac{1}{2}t^2 - \ldots]$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$roots\ of\ the\ indicial\ equation\ differ\ by\ a\ positive\ integer\ and\ both\ Frobenius\ series\ solutions\ exist$

7) $Consider\ the\ differential\ equation\ t^2y'' + (t^2 - 3t)y' + 3y = 0.\ Then$ **1 point**

- $roots\ of\ the\ indicial\ equation\ are\ 1\ and\ 2$
- $roots\ of\ the\ indicial\ equation\ are\ 0\ and\ 3$
- $roots\ of\ the\ indicial\ equation\ differ\ by\ a\ positive\ integer\ and\ has\ only\ one\ Frobenius\ series\ solution\ exist\ and\ is\ given\ by\ y(t) = t^3e^{-t}$
- $roots\ of\ the\ indicial\ equation\ differ\ by\ a\ positive\ integer\ and\ has\ two\ Frobenius\ series\ solutions\ and\ one\ of\ the\ solution\ is\ given\ by\ y(t) = te^{-t}$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$roots\ of\ the\ indicial\ equation\ differ\ by\ a\ positive\ integer\ and\ has\ only\ one\ Frobenius\ series\ solution\ exist\ and\ is\ given\ by\ y(t) = t^3e^{-t}$

8) $Consider\ the\ differential\ equation\ (t - t^2)y'' + (1 - 5t)y' - 4y = 0.\ Then$ **1 point**

- $Roots\ of\ the\ indicial\ equation\ are\ unequal$
- $Roots\ of\ the\ indicial\ equation\ are\ equal\ and\ one\ of\ the\ solution\ is\ given\ as\ y(t) = \sum_{n=0}^{\infty} n^2t^n$
- $Recurrence\ relation\ to\ find\ the\ coefficients\ \{a_n\}'s\ is\ a_n = \frac{(k+n)^2}{(k+1)^2}a_{n-1}$
- $The\ general\ solution\ of\ the\ differential\ equation\ is\ given\ by$ $y(t) = c_1y_1 + c_2(y_1 \ln t - 2(2x + 6x^2 + 12x^3 + \ldots)),$ $where\ y_1\ is\ Frobenius\ series\ solution\ of\ the\ given\ equation$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$The\ general\ solution\ of\ the\ differential\ equation\ is\ given\ by$
$y(t) = c_1y_1 + c_2(y_1 \ln t - 2(2x + 6x^2 + 12x^3 + \ldots)),$
$where\ y_1\ is\ Frobenius\ series\ solution\ of\ the\ given\ equation$

9) **1 point**
$Consider\ the\ differential\ equation\ (x - x^2)y'' + (1 - x)y' - y = 0\ near\ 0\ and\ let\ its\ Frobenius\ solution\ is\ given\ as\ y(x) = \sum_{n=0}^{\infty} a_nx^{n+r}.\ Then$

- $Roots\ of\ the\ indicial\ equation\ are\ unequal\ and\ one\ of\ the\ solution\ is\ given\ by$ $y(x) = a\left(1 + x + \frac{1}{3}x^2 + \frac{10}{36}x^3 + \ldots\right),\ where\ a\ is\ constant.$

$Roots\ of\ the\ indicial\ equation\ differs\ by\ a\ positive\ integer.$

$it\ has\ only\ one\ Frobenius\ series\ solution\ and\ is\ given\ by$

$y(x) = a\left(1 + x + \frac{1}{2}\,x^2 + \frac{1}{15}\,x^3 + \ldots\right)$

$The\ general\ solution\ of\ the\ differential\ equation\ is\ given\ by$

$y(x) = a\ln x\left(1 + x + \frac{1}{2}\,x^2 + \frac{10}{36}\,x^3 + \ldots\right) + b(-2x - x^2 - \ldots),\ where\ a\ and\ b\ are\ constants$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$The\ general\ solution\ of\ the\ differential\ equation\ is\ given\ by$

$y(x) = a\ln x\left(1 + x + \frac{1}{2}\,x^2 + \frac{10}{36}\,x^3 + \ldots\right) + b(-2x - x^2 - \ldots),\ where\ a\ and\ b\ are\ constants.$

10) $The\ solution\ of\ the\ initial\ value\ problem\ t^2y'' - ty' - 2y = 0,\ y(1) = 0\ and$ *1 point*
$y'(1) = 1\ on\ the\ interval\ 0 < t < \infty\ is$

$\frac{t}{2\sqrt{3}}\left(t^{\sqrt{3}} + \frac{1}{t^{\sqrt{3}}} - 2\right)$

$\frac{t}{2\sqrt{3}}\left(t^{\sqrt{3}} - \frac{1}{t^{\sqrt{3}}}\right)$

$\frac{1}{2\sqrt{3}}\left(t^{\sqrt{3}} - \frac{1}{t^{\sqrt{3}}}\right)$

$\frac{1}{2\sqrt{3}}\left(t^{\sqrt{3}} + \frac{1}{t^{\sqrt{3}}} - 2\right)$

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
$\frac{t}{2\sqrt{3}}\left(t^{\sqrt{3}} - \frac{1}{t^{\sqrt{3}}}\right)$

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