Math 2C03 2021 Assignment #8 (18621855)

Question	1	2	3	4	5	6	7	8	9	10	11

Description

Power series, Frobenius method

1. Question Details ZillDiffEQ9 6.1.026.EP. [4903649]

Proceed as in this example to rewrite each power series as a power series whose general term involves x^k.

$$\sum_{n=1}^{\infty} nc_n x^{n-1} = \boxed{} + \sum_{k=2}^{\infty}\left(\boxed{}\right)x^k$$

$$2\sum_{n=0}^{\infty} c_n x^{n+2} = \sum_{k=2}^{\infty}\left(\boxed{}\right)x^k$$

Rewrite the given expression using a single power series whose general term involves x^k.

$$\sum_{n=1}^{\infty} nc_n x^{n-1} + 2\sum_{n=0}^{\infty} c_n x^{n+2}$$

$$\boxed{} + \sum_{k=2}^{\infty}\left(\boxed{}\right)$$

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2. Question Details ZillDiffEQ9 6.2.002. [3897019]

Without actually solving the given differential equation, find the minimum radius of convergence R of power series solutions about the ordinary point $x = 0$. About the ordinary point $x = 1$.

$$(x^2 - 2x + 10)y'' + xy' - 4y = 0$$

$R = \boxed{}$ $(x = 0)$

$R = \boxed{}$ $(x = 1)$

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3. Question Details ZillDiffEQ9 6.2.016. [3897007]

Find two power series solutions of the given differential equation about the ordinary point $x = 0$.

$$(x^2 + 1)y'' - 6y = 0$$

- $y_1 = 1 + 3x^2 + x^4 + \frac{1}{5}x^6 + \ldots$ and $y_2 = x - x^3$
- $y_1 = 1 - 3x^2 + 5x^4 - 7x^6 + \ldots$ and $y_2 = x - 2x^3 + 3x^5 - 4x^7 + \ldots$
- $y_1 = 1 + 3x^2 + 5x^4 + 7x^6 + \ldots$ and $y_2 = x + 2x^3 + 3x^5 + 4x^7 + \ldots$
- $y_1 = 1 + \frac{3}{2}x^2 + \frac{3}{8}x^4 - \frac{1}{16}x^6 + \ldots$ and $y_2 = x + \frac{2}{3}x^3$
- $y_1 = 1 + 3x^2 + x^4 - \frac{1}{5}x^6 + \ldots$ and $y_2 = x + x^3$

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4. Question Details ZillDiffEQ9 6.3.006. [3744805]

Determine the singular points of the given differential equation. Classify each singular point as regular or irregular. (Enter your answers as a comma-separated list. Include both real and complex singular points. If there are no singular points in a certain category, enter NONE.)

$$x^2(x - 5)^2y'' + 9xy' + (x^2 - 25)y = 0$$

regular singular points $x =$

irregular singular points $x =$

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5. Question Details ZillDiffEQ9 6.3.010. [4568233]

Determine the singular points of the given differential equation. Classify each singular point as regular or irregular. (Enter your answers as a comma-separated list. Include both real and complex singular points. If there are no singular points in a certain category, enter NONE.)

$$(x^3 - 8x^2 - 9x)^2y'' + x(x - 9)^2y' - (x + 1)y = 0$$

regular singular points $x =$

irregular singular points $x =$

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6. Question Details ZillDiffEQ9 6.3.014. [4568183]

The point $x = 0$ is a regular singular point of the differential equation.

$$xy'' + y' + 13y = 0$$

Use the general form of the indicial equation (14) in Section 6.3

$$r(r - 1) + a_0 r + b_0 = 0 \quad (14)$$

to find the indicial roots of the singularity. (List the indicial roots below as a comma-separated list.)

$r =$

Without solving, discuss the number of series solutions you would expect to find using the method of Frobenius.

- Since these are equal we expect to find two series solutions using the method of Frobenius.
- Since these do not differ by an integer we expect to find one series solution using the method of Frobenius.
- Since these differ by an integer we expect to find one series solution using the method of Frobenius.
- Since these are equal we expect to find one series solution using the method of Frobenius.
- Since these differ by an integer we expect to find two series solutions using the method of Frobenius.

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7. Question Details ZillDiffEQ9 6.3.016. [4568087]

The point $x = 0$ is a regular singular point of the given differential equation.

$$4xy'' + 9y' + xy = 0$$

Show that the indicial roots r of the singularity do not differ by an integer. (List the indicial roots below as a comma-separated list.)

$r =$

Use the method of Frobenius to obtain two linearly independent series solutions about $x = 0$. Form the general solution on $(0, \infty)$.

- $y = C_1 x^{-5/4}\left(1 - \frac{1}{26}x^2 + \frac{1}{2184}x^4 + \ldots\right) + C_2\left(1 - \frac{1}{6}x^2 + \frac{1}{264}x^4 + \ldots\right)$
- $y = C_1 x^{-5/4}\left(1 - \frac{1}{26}x^2 + \frac{1}{2184}x^4 + \ldots\right) + C_2\left(1 - \frac{1}{12}x^2 + \frac{1}{768}x^4 + \ldots\right)$
- $y = C_1 x^{-5/4}\left(1 - \frac{1}{12}x^2 + \frac{1}{768}x^4 + \ldots\right) + C_2\left(1 - \frac{1}{28}x^2 + \frac{1}{2688}x^4 + \ldots\right)$
- $y = C_1 x^{-5/4}\left(1 - \frac{1}{6}x^2 + \frac{1}{264}x^4 + \ldots\right) + C_2\left(1 - \frac{1}{26}x^2 + \frac{1}{2184}x^4 + \ldots\right)$
- $y = C_1 x^{-5/4}\left(1 - \frac{1}{28}x^2 + \frac{1}{2688}x^4 + \ldots\right) + C_2\left(1 - \frac{1}{12}x^2 + \frac{1}{768}x^4 + \ldots\right)$

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8. Question Details ZillDiffEQ9 6.3.018. [4568308]

The point $x = 0$ is a regular singular point of the given differential equation.

$$3x^2y'' - xy' + (x^2 + 1)y = 0$$

Show that the indicial roots r of the singularity do not differ by an integer. (List the indicial roots below as a comma-separated list.)

r =

Use the method of Frobenius to obtain two linearly independent series solutions about $x = 0$. Form the general solution on $(0, \infty)$.

- $y = C_1x^{1/3}\left(1 - \frac{1}{10}x^2 + \frac{1}{440}x^4 + \dots\right) + C_2x\left(1 - \frac{1}{14}x^2 + \frac{1}{392}x^4 + \dots\right)$
- $y = C_1x^{1/3}\left(1 - \frac{1}{14}x^2 + \frac{1}{392}x^4 + \dots\right) + C_2x\left(1 - \frac{1}{10}x^2 + \frac{1}{440}x^4 + \dots\right)$
- $y = C_1x^{1/3}\left(1 - \frac{1}{8}x^2 + \frac{1}{320}x^4 + \dots\right) + C_2x\left(1 - \frac{1}{10}x^2 + \frac{1}{440}x^4 + \dots\right)$
- $y = C_1x^{1/3}\left(1 - \frac{1}{16}x^2 + \frac{1}{896}x^4 + \dots\right) + C_2x\left(1 - \frac{1}{8}x^2 + \frac{1}{320}x^4 + \dots\right)$
- $y = C_1x^{1/3}\left(1 - \frac{1}{8}x^2 + \frac{1}{320}x^4 + \dots\right) + C_2x\left(1 - \frac{1}{16}x^2 + \frac{1}{896}x^4 + \dots\right)$

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9. Question Details ZillDiffEQ9 6.R.002. [3744780]

Answer true or false without referring back to the text.

Since $x = 0$ is an irregular singular point of $x^3y'' - xy' + y = 0$, the DE possesses no solution that is analytic at $x = 0$.

- True
- False

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10. Question Details ZillDiffEQ9 6.R.010. [3744789]

Use an appropriate infinite series method about $x = 0$ to find two solutions of the given differential equation. (Enter the first four nonzero terms for each linearly independent solution, if there are fewer than four nonzero terms then enter all terms. Some beginning terms have been provided for you.)

$$y'' - 3xy' - 3y = 0$$

$y_1 = 1 + \frac{3}{2}x^2 +$ ______ $+ \cdots$

$y_2 = x +$ ______ $+ \cdots$

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11. Question Details ZillDiffEQ9 6.R.020. [3744848]

Investigate whether $x = 0$ is an ordinary point, singular point, or irregular singular point of the given differential equation. [*Hint*: Recall the Maclaurin series for e^x.]

$$(e^x - 1 - x)y'' + y = 0$$

- ordinary point
- singular point
- irregular singular point

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Assignment Details

Name (AID): **Math 2C03 2021 Assignment #8 (18621855)**
Submissions Allowed: **5**
Category: **Homework**
Code:
Locked: **Yes**
Author: **Lia Bronsard (bronsard@mcmaster.ca)**
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