Math 2C03 Practice pb set #9 (16253004)

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14

1. Question Details ZillDiffEQ9 6.2.018. [3897015] -

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

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

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

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2. Question Details ZillDiffEQ9 6.4.049. [3745048] -

Find the first three positive values of λ for which the problem

$$(1 - x^2)y'' - 2xy' + \lambda y = 0,$$
$$y(0) = 0, \quad y(x), y'(x) \text{ bounded on } [-1, 1]$$

has nontrivial solutions. (Enter your answers as a comma-separated list.)

λ =

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3. Question Details ZillDiffEQ9 6.3.001. [3744603]

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.)

$$x^3y'' + 6x^2y' + 3y = 0$$

regular singular points $x =$

irregular singular points $x =$

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4. Question Details ZillDiffEQ9 6.3.003. [3744881]

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.)

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

regular singular points $x =$

irregular singular points $x =$

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5. Question Details ZillDiffEQ9 6.3.007. [3744944]

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.)

$$(x^2 + x - 20)y'' + (x + 5)y' + (x - 4)y = 0$$

regular singular points $x =$

irregular singular points $x =$

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6. Question Details ZillDiffEQ9 6.3.013. [3744906]

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

$$x^2y'' + \left(\frac{7}{4}x + x^2\right)y' - \frac{1}{4}y = 0.$$

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

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7. Question Details ZillDiffEQ9 6.3.015.MI.SA. [4605466]

This question has several parts that must be completed sequentially. If you skip a part of the question, you will not receive any points for the skipped part, and you will not be able to come back to the skipped part.

Tutorial Exercise

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

$$6xy'' - y' + 6y = 0$$

Show that the indicial roots r of the singularity do not differ by an integer.

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

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8. Question Details ZillDiffEQ9 6.3.017. [3744754]

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

$$2xy'' + \frac{1}{2}y' + y = 0$$

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 $(0, \infty)$.

- $y = C_1\left(1 + 2x - \frac{2x^2}{3} + \frac{4x^3}{63} + \ldots\right) + C_2x^{5/4}\left(1 - \frac{2x}{9} + \frac{2x^2}{117} - \frac{4x^3}{5967} + \ldots\right)$
- $y = C_1\left(1 - \frac{x}{2} + \frac{x^2}{16} - \frac{x^3}{288} + \ldots\right) + C_2x^{3/4}\left(1 - \frac{x}{2} + \frac{x^2}{16} - \frac{x^3}{288} + \ldots\right)$
- $y = C_1\left(1 - \frac{2x}{9} + \frac{2x^2}{117} - \frac{4x^3}{5967} + \ldots\right) + C_2x^{5/4}\left(1 + 2x - \frac{2x^2}{3} + \frac{4x^3}{63} + \ldots\right)$
- $y = C_1\left(1 - 2x + \frac{2x^2}{5} - \frac{4x^3}{135} + \ldots\right) + C_2x^{3/4}\left(1 - \frac{2x}{7} + \frac{2x^2}{77} - \frac{4x^3}{3465} + \ldots\right)$
- $y = C_1\left(1 - \frac{2x}{7} + \frac{2x^2}{77} - \frac{4x^3}{3465} + \ldots\right) + C_2x^{3/4}\left(1 - 2x + \frac{2x^2}{5} - \frac{4x^3}{135} + \ldots\right)$

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9. Question Details ZillDiffEQ9 6.3.021. [3744677]

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

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

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 $(0, \infty)$.

- $y = C_1\left(1 + \frac{x}{3} + \frac{x^2}{2} - \frac{5x^3}{6} + \ldots\right) + C_2x^{5/2}\left(1 - \frac{6x}{7} + \frac{8x^2}{21} - \frac{80x^3}{693} + \ldots\right)$
- $y = C_1\left(1 + \frac{4x}{7} + \frac{4x^2}{21} + \frac{32x^3}{693} + \ldots\right) + C_2x^{5/2}\left(1 + \frac{x}{3} - \frac{x^2}{6} - \frac{x^3}{6} + \ldots\right)$
- $y = C_1\left(1 - \frac{x}{2} - \frac{x^2}{16} - \frac{x^3}{96} + \ldots\right) + C_2x^{5/2}\left(1 - \frac{x}{2} - \frac{x^2}{16} - \frac{x^3}{96} + \ldots\right)$
- $y = C_1\left(1 + \frac{x}{3} - \frac{x^2}{6} - \frac{x^3}{6} + \ldots\right) + C_2x^{5/2}\left(1 + \frac{4x}{7} + \frac{4x^2}{21} + \frac{32x^3}{693} + \ldots\right)$
- $y = C_1\left(1 - \frac{6x}{7} + \frac{8x^2}{21} - \frac{80x^3}{693} + \ldots\right) + C_2x^{5/2}\left(1 + \frac{x}{3} + \frac{x^2}{2} - \frac{5x^3}{6} + \ldots\right)$

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10. Question Details ZillDiffEQ9 6.3.023. [3744590]

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

$$9x^2y'' + 9x^2y' + 2y = 0$$

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 $(0, \infty)$.

- $y = C_1x^{1/3}\left(1 + \frac{x}{2} + \frac{x^2}{5} + \frac{7x^3}{120} + \ldots\right) + C_2x^{2/3}\left(1 + \frac{x}{2} + \frac{5x^2}{28} + \frac{x^3}{21} + \ldots\right)$
- $y = C_1\left(1 - \frac{x}{3} + \frac{x^2}{9} - \frac{7x^3}{243} + \ldots\right) + C_2x^{1/3}\left(1 - \frac{x}{3} + \frac{x^2}{9} - \frac{7x^3}{243} + \ldots\right)$
- $y = C_1x^{1/3}\left(1 + \frac{x}{2} + \frac{5x^2}{28} + \frac{x^3}{21} + \ldots\right) + C_2x^{2/3}\left(1 + \frac{x}{2} + \frac{x^2}{5} + \frac{7x^3}{120} + \ldots\right)$
- $y = C_1x^{1/3}\left(1 - \frac{x}{2} + \frac{5x^2}{28} - \frac{x^3}{21} + \ldots\right) + C_2x^{2/3}\left(1 - \frac{x}{2} + \frac{x^2}{5} - \frac{7x^3}{120} + \ldots\right)$
- $y = C_1x^{1/3}\left(1 - \frac{x}{2} + \frac{x^2}{5} - \frac{7x^3}{120} + \ldots\right) + C_2x^{2/3}\left(1 - \frac{x}{2} + \frac{5x^2}{28} - \frac{x^3}{21} + \ldots\right)$

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11. Question Details ZillDiffEQ9 6.R.003. [3745092]

Both power series solutions of $y'' + \ln(x + 1)y' + y = 0$ centered at the ordinary point $x = 0$ are guaranteed to converge for all x in which *one* of the following intervals?

- $(-1, \infty)$
- $[-1, 1]$
- $(-\infty, \infty)$
- $\left[-\frac{1}{2}, \frac{1}{2}\right]$

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12. Question Details ZillDiffEQ9 6.R.005. [3744991]

Suppose the powers series $\sum_{k=0}^{\infty} c_k(x-3)^k$ is known to converge at -2 and diverge at -6. Discuss whether the series converges at -9, -1, 2, 8, 10. Possible answers are *does*, *does not*, or *might*.

At -9 the series ---Select--- converge.

At -1 the series ---Select--- converge.

At 2 the series ---Select--- converge.

At 8 the series ---Select--- converge.

At 10 the series ---Select--- converge.

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13. Question Details ZillDiffEQ9 6.R.009. [3744705]

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. In each case, the first term has been provided for you.)

$$2xy'' + y' + y = 0$$

$y_1 = 1 +$ ____ $+ \cdots$

$y_2 = x^{1/2} +$ ____ $+ \cdots$

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14. Question Details ZillDiffEQ9 6.R.017. [3744829]

Without actually solving the differential equation $(1 - 2\sin x)y'' + xy = 0$, find a lower bound for the radius of convergence of power series solutions about the ordinary point $x = 0$.

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Assignment Details

Name (AID): **Math 2C03 Practice pb set #9 (16253004)**
Submissions Allowed: **20**
Category: **Homework**
Code:
Locked: **Yes**
Author: **Lia Bronsard (** bronsard@mcmaster.ca **)**
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