



Problem Set 9: Solutions

Differential Equations

Spring 2026

Higher order differential equations are natural extensions from second orders with more complicated arithmetics. As of right now, we are manipulating the case of constant coefficients, which is the most simplified case overall. As we are getting to the more complicated cases, let us also explore more to the canonicals behind them.

Clubs & Orgs Bulletin

Promote your club! <https://forms.gle/V19BipzLyuAaWMyz8>

Do you play a band instrument and want to be involved in an ensemble? Bands@JHU is the place to be! Rehearsals are Sunday evenings for the wind ensemble and Thursday evenings for the jazz bands. We welcome all musicians wanting to make some good music, so check us out at <https://tinyurl.com/ycz8zupt>.

Tip of the Week

The Life Design Lab:

JHU students have access to many discounted and free resources and events! This includes Grubhub Plus, the NYT, the Spotify Student Plan with Hulu, and more. Learn more here: <https://wellbeing.jhu.edu/blog/2022/08/19/free-and-discounted-stuff-for-students/>, and follow @jhufreestuff on Instagram to stay updated with the latest.

1. (Finding General Solutions). Find the general solution to the following differential equation.

(a) $y'''(x) - 6y''(x) + 11y'(x) - 6y(x) = 0.$

(b) $y''' = -y.$

2. (Non-homogeneous Solutions). Find the general solution to the following differential equations:

(a) $y''' - 4y' = e^{-2t}$.

(b) $y'' + 36y = e^t \sin(6t)$.

3. (Higher order IVP with Dirichlet Condition). Consider the following initial value problem:

$$\begin{cases} 2y''' - 11y'' + 17y' - 6y = 0, \\ y(0) = 3, y(\log(4)) = 82, y(\log(9)) = 813. \end{cases}$$

Find the specific solution to the IVP.

4. (Polynomials as Linearly Independent Functions). We define a set of polynomials as:

$$\{1, x, x^2, x^3, \dots\}.$$

Here, one can show that $\{1, x, x^2, \dots, x^n\}$ is linearly independent for all $n \in \mathbb{N}$ by computing the Wronskian of the equations explicitly.