

Part A (60%): In-Class Exam

1. (15%) Solve the system with initial conditions by Laplace Transform:

$$X'' - 2X' + 3Y' + 2Y = 4,$$

$$2Y' - X' + 3Y = 0, \quad X(0) = X'(0) = Y(0) = 0.$$

2. (15%) Solve $X' = AX$ when $A = \begin{bmatrix} -2 & -1 & -5 \\ 25 & -7 & 0 \\ 0 & 1 & 3 \end{bmatrix}$ and $X'(0)=0$. Find the corresponding fundamental matrix.
3. (15%) Find the general solution of $X' = \begin{bmatrix} 1 & -4 \\ 1 & 5 \end{bmatrix} X + \begin{bmatrix} e^{2t} \\ t \end{bmatrix}$.
4. (15%)
- (a) (3%) Show Zero is a regular singular point of $x^2 y'' + 5xy' + (x+4)y = 0$.
- (b) (12%) Solve $y(x)$ by the series solution. Make sure the series will converge for all nonzero x .

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Part B (30%): Take Home Exam. Due on Jan. 15 13PM. Upload to eclass.

5. (15%) Watch <https://www.youtube.com/watch?v=r6sGWTCMz2k&t=82s>.



Generate the 2-D movie in matlab to generate the Fourier Series movie for $n=1, 2, \dots, 10$ for the letter "C" which is located in the unit square.

6. (15%) Download the book: <https://www.mathworks.com/content/dam/mathworks/mathworks-dot-com/moler/odes.pdf>



Read Ch 7.9. Reproduce Fig. 7.4 and 7.5. Discuss the stiffness.