

Consider the following problems as a ‘warm up’. Completing these problems will ensure you have a strong background for MCS 471.

Calculus

1. Write a definition of $f'(x)$ in terms of a limit of slopes of secant lines.
2. Find the first four terms in the Taylor expansion of $\cos(x)$ near $x = \pi/4$.
3. Write a definition of $\int f(x) dx$ in terms of a limit of partial sums of areas of rectangles.
4. What does it mean for a function $f(x)$ to be continuous?

Linear Algebra

5. Write the system

$$\begin{aligned}3x + 5y &= 2 \\ x - y &= 8\end{aligned}$$

as a matrix-vector equation in the form $Ax=b$.

6. Find the determinant of A .
7. Find the eigenvalues, λ , where $\det(A - \lambda I) = 0$.
8. Find the eigenvectors, y , with $(A - \lambda I)y = 0$.

Programming

9. Write a program in the language of your choice which plots the functions e^{-x^2} and $x^2e^{-x^2}$, in the interval $[-5, 5]$. Label the axes, overlay the plots on the same graph, and add a subtitle explaining how many points were used to make the curves. If you don't have a strong preference for a programming language, I recommend MATLAB.