

1. Solving equations and inequality

a. $3^x = 8$

b.
$$\begin{aligned} 2x - y &= 5 \\ x + 3y &= 4 \end{aligned}$$

c. $|2x + 3| \leq 1$

d. $\frac{7-2x}{x-2} \geq 0$

e. Find all real and complex solutions to the system of equations

$$2x^2 - y = 1$$

$$x + 3y^3 = 4$$

2. Taylor series

Find the Taylor series of order 5 for $\sinh x$ about $x = 0$

3. Optimization

Find extreme values of the following functions:

a. $f(x) = 2x^3 - 3x + 1, x \in [-3, 3]$

b. $f(x) = \cos 2x + \sin 3x, x \in [-1, 1]$

c. on the surface $z = x^3 - 3xy + y^3$

4. Differential Equations

a. Find the general solution of the equation $y' = \sin x + t$

b. Find the solution of the IVP

$$y'' + y = x^2, \quad y(0) = 1, \quad y'(0) = 1$$

c. Find the Exact and the Laplace solutions of the system of ODEs

$$y' = x, \quad x' = -y, \quad x(0) = 0, \quad y(0) = 1$$

d. Solve using series: $D_{xx}y - y = 0, \quad y(0) = 1, \quad y'(0) = 0$