

Figure 1 shows a plot of the function  $f(x) = 1 - 2x + 2x^2$  for  $x \in [0, 1]$ . The plot compares numerical approximations for  $N=10, 100, 1000, 10000, 100000$  against the exact solution. The x-axis ranges from 0.0 to 1.0, and the y-axis ranges from 0.0 to 1.0. The exact solution is a solid black curve. Numerical approximations are shown as dashed lines of various colors. The  $N=10$  approximation (blue) is significantly higher than the exact solution, peaking at approximately 1.2. As  $N$  increases, the numerical approximations converge to the exact solution, with  $N=100000$  (purple) being nearly indistinguishable from the exact solution.

