

## Homework Assignment for Week 05

**Goal:** Study both theoretical and practical aspects of Newton's method and its extensions.

1. Section 2.3: Problems 13(a), 17(c), 18

Hint for problem 18: The expression can be simplified. Apply trigonometric identity to  $\frac{1}{2} - \frac{1}{2} \cos 2x$  and combine with the remaining terms. Can you accelerate the convergence?

2. Section 2.4: Problems 7(a), 8, 9, 10, 12, 13, 14.

Remark: Problem 13 can be derived from quadratic approximation of  $x = f^{-1}(y)$  at  $(y, x) = (f(x_n), x_n)$  (as shown in the slides for the linear approximation, Newton's method). Try to derive it this way.

3. Section 2.4: If  $f(x) = (x - x^*)^m q(x)$ ,  $m > 1$  and  $q$  is smooth with  $q(x^*) \neq 0$ . Let  $\mu(x) = \frac{f(x)}{f'(x)}$ . Show that  $f'(x) = (x - x^*)^{m-1} q_1(x)$  with  $q_1(x^*) \neq 0$  and  $\mu(x) = (x - x^*) q_2(x)$  with  $q_2(x^*) \neq 0$ .