



CSE330 Section 20, Spring 2026

Quiz 4, 18 April 2026

Time: 15 Minutes

/15

Name:

ID:

MCQs (5 marks). Tick/circle the best answer.

1. Which condition guarantees that the bisection method can be applied on an interval $[a, b]$?

- (a) $f'(x)$ exists on $[a, b]$ (b) $\checkmark f(a)f(b) < 0$ (c) $f(a) = f(b)$ (d) f is linear

2. In the bisection method, after n iterations, the length of the interval $[a_n, b_n]$ is:

- (a) $\frac{b-a}{n}$ (b) $\checkmark \frac{b-a}{2^n}$ (c) $\frac{b-a}{n^2}$ (d) $\frac{b-a}{2n}$

3. In fixed-point iteration $x_{n+1} = g(x_n)$, a sufficient condition for convergence near a fixed point α is:

- (a) $\checkmark |g'(\alpha)| < 1$ (b) $|g'(\alpha)| > 1$ (c) $g(\alpha) = 0$ (d) $\checkmark g'(\alpha) = 0$

4. The Newton–Raphson iteration formula for solving $f(x) = 0$ is:

- (a) $\checkmark x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$ (b) $x_{n+1} = \frac{f(x_n)}{f'(x_n)}$ (c) $x_{n+1} = x_n - f(x_n)$ (d) $x_{n+1} = x_n + \frac{f'(x_n)}{f(x_n)}$

5. The secant method differs from Newton's method because it:

- (a) $\checkmark$ Uses two previous iterates instead of derivatives (c) Always converges faster
(b) Requires computation of second derivatives (d) Only works for linear functions

Question 1: (2+4+4 Marks) Consider the equation

$$f(x) = x^3 - x - 2 = 0.$$

- (a) Show that the equation has a root in the interval $[1, 2]$.
(b) Perform **two iterations** of the bisection method starting with the interval $[1, 2]$.
(c) Using $x_0 = 1.5$, perform **one iteration** of the Newton–Raphson method.

Solution. (a) $f(1) = -2$, $f(2) = 4$, and they have different signs. So the equation has a root in the interval $[1, 2]$.

(b) At the beginning, $a_0 = 1$, $b_0 = 2$.

•**First iteration:** the midpoint is 1.5. $f(1.5) = -0.125$. Since $f(1.5)f(2) < 0$, the new interval is $[1.5, 2]$.

•**Second iteration:** the midpoint is $\frac{1.5+2}{2} = 1.75$. $f(1.75) = 1.609$. Since $f(1.5)f(1.75) < 0$, the new interval is $[1.5, 1.75]$.

(c) Here, $f(x) = x^3 - x - 2$, and $f'(x) = 3x^2 - 1$.

$$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 1.521739.$$

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