# CS 450-HW#3-Q5

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## Comparing Fixed-Point Problems

For the equation

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

Each of the following functions yields an equivalent fixed-point problem.

Analyze the convergence properties of each of the corresponding fixed-point iteration schemes for the root $x = 2$ by considering $|g_i'(2)|$.

**1.**

$$g_1(x) = (x^2 + 2)/3$$
$$g_1'(x) = \frac{2}{3}x$$
$$|g_1'(2)| = 4/3 > 1$$

$\therefore$ Divergent.

**2**

$$g_2(x) = \sqrt{3x - 2}$$
$$g_2'(x) = \frac{3}{2\sqrt{3x - 2}}$$
$$|g_2'(2)| = \frac{3}{4} < 1$$

$\therefore$ Linear Convergent with rate $\frac{3}{4}$.

**3.**

$$g_3(x) = 3 - \frac{2}{x}$$
$$g_3'(x) = \frac{2}{x^2}$$
$$|g_3'(x)| = \frac{1}{2} < 1$$

∴Linear Convergent with rate $\frac{1}{2}$.

**4.**

$$g_4(x) = \frac{x^2 - 2}{2x - 3}$$
$$g_4'(x) = \frac{2(x^2 - 3x + 2)}{(2x - 3)^2}$$
$$g_4'(2) = 0$$

∴Rapid Convergent with rate at least quadratic.