Definition[section]

1 Bisection

2 Fixed point

$$e_n = r - x_n = g(r) - g(x_{n-1}) = (r - x_{n-1})g'(\xi) = e_{n-1}g'(\xi) \approx e_{n-1}g'(r).$$

where $\zeta \in (x_n n - 1, r)$.

$$g(r) = g(x_{n-1}) + (r - x_{n-1})g'(x_{n-1}) + \dots.$$

.

This is linear convergence.

$$\frac{e_{n+2}}{e_{n+1}} \approx \frac{e_{n+1}}{e_n}.$$

3 Secant Method

$p_{n+1} = p_n - \frac{f(_{n+1})(p_{n+1}-p_n)}{f(p_{n+1})-f(p_n)}$

"False Position"

3.1 "Sins"

- Do not subtract numbers that has very small differences
- Do not divide with a piece of "garbage"
- Do not set stopping criterion to equal 0, use ϵ

4 Newton's Method

$$p_{n+1} = p_n - \frac{f(p_n)}{f'(p_n)}.$$

Problems with this method:

- As p p*, f(p) 0 . So the convergence gets slower.
- really small slope near the r
- local minimum
- inflection point

Convergence:

$$e_n = \frac{f''(\xi)}{2f'(r)}e_{n-1}^2 \approx \frac{f''(r)}{2f'(r)}e_{n-1}^2.$$

If $e_{n+1}/e_n^{\alpha} = \lambda$, we cal $\alpha theorderofconvergence.$