CHEAT SHEET

Numerical Methods

Key Formulae

Newton Raphson

- The Newton Raphson iteration for solving $f(x)=0$ is

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

Key Concepts

Locating Roots

- If the function $f(x)$ is continuous on the interval $[a,b]$ & $f(a)$ & $f(b)$ have opposite signs, the $f(x)$ has at least one root on (a,b).
- $f(a)$ & $f(b)$ have different signs $\Rightarrow$ odd number of roots
- $f(a)$ & $f(b)$ have the same sign $\Rightarrow$ no roots or an even number of roots

Iteration

- The roots to $f(x)=0$ could be estimated by rearranging to the form $x_{n+1} = g(x_n)$.
- Convergent Iterative Formula - x_{n+1} approaches a limit as $n \to \infty$.
- Divergent Iterative Formula - x_{n+1} is unbounded as $n \to \infty$.

Newton Raphson Iterative Formula

- $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$ may approximate the solution to $f(x)=0$.
- The formula does not work if $f'(x_n)=0$.
- The formula takes a long time to converge if $f'(x_n)$ is close to 0.