Numerical Methods – Q2: Convergence [Practice/M]

(12/6/21)

Complete the following table, where $e_r \approx k e_{r-1}$

$X_{4n} \approx X_{2n} + k(X_{2n} - X_n)$

$X_\infty \approx X_{2n} + \frac{1}{\frac{1}{k}-1}(X_{2n} - X_n)$

(where $X = T, M \text{ or } S$)

	Xth order method	Yth order convergence	k	$\frac{1}{\frac{1}{k}-1}$
Fixed Point	n/a		$g'(\alpha)$	n/a
Newton Raphson	n/a		n/a	n/a
Forward Difference				
Central Difference				
Trapezium rule				
Midpoint rule				
Simpson's rule				

Solution

	Xth order method	Yth order convergence	k	$\frac{1}{\frac{1}{k}-1}$
Fixed Point	n/a	1 (or 2 if $g'(\alpha)=0$)	$g'(\alpha)$	n/a
Newton Raphson	n/a	2	n/a	n/a
Forward Difference	1	1	$\frac{1}{2}$	1
Central Difference	2	1	$\frac{1}{4}$	$\frac{1}{3}$
Trapezium rule	2	1	$\frac{1}{4}$	$\frac{1}{3}$
Midpoint rule	2	1	$\frac{1}{4}$	$\frac{1}{3}$
Simpson's rule	4	1	$\frac{1}{16}$	$\frac{1}{15}$