MXB103 Exam Notes

Ordinary Differential Equations

Second Order Taylor Method

Euler's Method

Modified Euler's Method

Runge-Kutta 4th Order (RK4)

Polynomial Interpolation

Lagrange Interpolating Polynomial

1. sub abscissas into given function to get y values.
2. find the Polynomial for the amount of abscissas. Ex: $(x_0, y_0), (x_1, y_1), (x_2, y_2)$
   $\frac{(x-x_1)(x-x_2)}{(x_0-x_1)(x_0-x_2)} \cdot y_0$ + same thing for y_1 and y_2

Newton's Divided Difference

$a_0 = y_0$, $a_1 = \frac{y_1-y_0}{x_1-x_0}$, $a_2 = \frac{\frac{y_2-y_1}{x_2-x_0} - \frac{y_1-y_0}{x_1-x_0}}{x_2-x_0}$
Example:

x_i	zeroth	first	second	third
x_0	$f[x_0]$	$f[x_0, x_1]$	$f[x_0, x_1, x_2]$	$f[x_0, x_1, x_2, x_3]$
x_1	$f[x_1]$	$f[x_1, x_2]$	$f[x_1, x_2, x_3]$	
x_2	$f[x_2]$	$f[x_2, x_3]$		
x_3	$f[x_3]$			

$P_3(x) = f[x_0] = f[x_0, x_1](x - x_0) + f[x_0, x_1, x_2](x - x_0)(x - x_1) + f[x_0, x_1, x_2, x_3](x - x_0)(x - x_1)(x - x_2)$

Newton's Forward Difference