Chapter 4

Farward / Backward difference formula:

Forward: h>0 Backward: h<0

$$f'(x_0) = \frac{f(x_0 + h) - f(x_0)}{h} - \frac{h}{2}f''(\xi).$$

Three_Point Formulas

Find point:
$$f'(x_0) = \frac{1}{2h}[-3f(x_0) + 4f(x_0 + h) - f(x_0 + 2h)] + \frac{h^2}{3}f^{(3)}(\xi_0),$$

Find point: $f'(x_0) = \frac{1}{2h}[-3f(x_0) + 4f(x_0 + h) - f(x_0 + 2h)] - \frac{h^2}{6}f^{(3)}(\xi_1),$

Find point: $f'(x_0) = \frac{1}{2h}[-3f(x_0) + 4f(x_0 + h) - f(x_0 + 2h)] - \frac{h^2}{6}f^{(3)}(\xi_1),$

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Find point: f'

$$egin{align*} egin{align*} egin{align*} egin{align*} egin{align*} egin{align*} f'(x_0) = rac{1}{2h}[f(x_0+h)-f(x_0-h)] - rac{h^2}{6}f^{(3)}(\xi_1) \end{array} \end{bmatrix} egin{align*} egin{align$$

Five - Point Formula:

Find point:
$$f'(x_0) = \frac{1}{12h} [-25f(x_0) + 48f(x_0 + h) - 36f(x_0 + 2h) + 16f(x_0 + 3h) - 3f(x_0 + 4h)] + \frac{h^4}{5} f^{(5)}(\xi),$$
From

$$f'(x_0) = \frac{1}{12h}[f(x_0 - 2h) - 8f(x_0 - h) + 8f(x_0 + h) - f(x_0 + 2h)] + \frac{h^4}{30}f^{(5)}(\xi),$$

Second Derivative Midpoint Formulas

$$f''(x_0) = \frac{1}{h^2} [f(x_0 - h) - 2f(x_0) + f(x_0 + h)] - \frac{h^2}{12} f^{(4)}(\xi),$$

error
$$\leq \frac{\epsilon}{h} + \frac{h^2}{6} M \rightarrow M = f''(\epsilon)$$

Actual Error

Bound Error

الله وأعوض بالنقطة

2. find approximate error أوتد فيمة المشقق السخنام القانون عند النقطة

3_ AE = Ex _Apl

يد أعوض بالقوانن الخامة لكل لمربقة موضعة بمربعات:)

> M_ P(n) (6) تعنى قعة المشقة عند أكبر قيمة

The Trapezoidal Rule:

$$\int_{a}^{b} f(x) dx = \frac{h}{2} [f(x_0) + f(x_1)] - \frac{h^3}{12} f''(\xi).$$

$$h = \frac{b-a}{n}$$
, $n =$ The sum and $\frac{b-a}{n}$

The Simpson's Rule:

$$\int_{x_0}^{x_2} f(x) \, dx = \frac{h}{3} [f(x_0) + 4f(x_1) + f(x_2)] - \frac{h^5}{90} f^{(4)}(\xi).$$

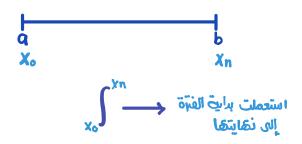
$$h = \frac{b-a}{2}$$

Measuring Precision: "def 41"

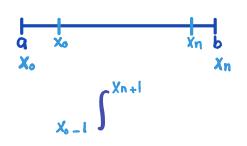
The degree of accuracy, or precision, of a quadrature formula is the largest positive integer *n* such that the formula is exact for x^k , for each k = 0, 1, ...أقل من المشتقة بواحد 🕊

تسبقا حمقا = صعقعا حميقا

Closed Newton-Costes Formula:



Open Newton-Costes Formula:



Actual Error

Bound Error

1. find exact error أوحد قيمة التكامل باستحمال الآلة

2- find approximate error

أوجد فيمة المشقق باستغنام القاؤن عند النقطة

3_ AE = | Ex _ Apl

Composite Simpson's Rule:

$$M = f^{(n)}(6)$$
 *

1. $f^{(n)}(x)$

2. $f^{(n)}(a)$, $f^{(n)}(b)$ Max JI, $f^{(n)}(a)$

$$\int_{a}^{b} f(x) \, dx = \frac{h}{3} \left[\int_{j=1}^{\frac{n}{2}} \frac{dy}{dx} + 2 \int_{j=1}^{(n/2)-1} f(x_{2j}) + 4 \int_{j=1}^{n/2} f(x_{2j-1}) + \frac{n}{2} \int_{j=1}^{n/2} \frac{dy}{dx} + 2 \int_{j=1}^{n/2} f(x_{2j-1}) + \frac{n}{2} \int_{j=1}^{n/2} \frac{dy}{dx} + 2 \int_{j=1}^{n/2} \frac{dy}{dx} + 2$$

Composite Trapezoidal Rule:

$$\int_{a}^{b} f(x) \, dx = \frac{h}{2} \left[\underbrace{\int_{j=1}^{c} \frac{dy}{f(a)} + 2 \sum_{j=1}^{n-1} f(x_{j}) + \int_{j=1}^{n-1} \frac{dy}{f(b)}}_{\text{elc2}} - \frac{b-a}{12} h^{2} f''(\mu). \right]$$