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Kelas : IF3A
MK : Analisis Numerik
UAS

1. Selesaikan sistem persamaan linier berikut dengan metode eliminasi Gaus ?

$$x_1 + 2x_2 + x_3 = 2$$
$$3x_1 + 6x_2 = 9$$
$$2x_1 + 8x_2 + 4x_3 = 6$$

2. Jika $\log(10) = 1$ dan $\log(100) = 2$, maka carilah
   a. $\log(75) =$
   b. $\log(25) =$
   c. persamaan interpolasinya.

3. Carilah akar pendekatan fungsi : $f(x) = x^3 - x - 1$, $a = 0{,}1$ dan $x_0 = 2$

4. Gunakan aturan trapesium dan simpson untuk mencari suatu nilai hampiran untuk : $y = x^4$ dengan mengambil batas $x = 1$ dan $x = 4$, serta subinterval $(n = 8)$

5. Tentukan deret Taylor dan deret Maclaurent dari fungsi :
   a. $f(x) = \cos(x)$
   $f(x) = \ln(x+1)$

Jawab :

1. $$\left[\begin{array}{ccc|c} 1 & 2 & 3 & 2 \\ 3 & 6 & 0 & 9 \\ 2 & 8 & 4 & 6 \end{array}\right]$$

$$\left[\begin{array}{ccc|c} 1 & 2 & 3 & 2 \\ 0 & 0 & -9 & 3 \\ 0 & 4 & -2 & 2 \end{array}\right]$$

$$\left[\begin{array}{ccc|c} 1 & 2 & 3 & 2 \\ 0 & 4 & -2 & 2 \\ 0 & 0 & -9 & 3 \end{array}\right]$$

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$$\left[\begin{array}{ccc|c} 1 & 2 & 3 & 2 \\ 0 & 1 & -0{,}5 & 0{,}5 \\ 0 & 0 & -9 & 3 \end{array}\right]$$

$x_1 = \frac{7}{3}$

$x_2 = \frac{1}{3}$

$$\left[\begin{array}{ccc|c} 1 & 0 & 4 & 1 \\ 0 & 1 & -0{,}5 & 0{,}5 \\ 0 & 0 & -9 & -3 \end{array}\right]$$

$x_3 = -\frac{1}{3}$

$$\left[\begin{array}{ccc|c} 1 & 0 & 4 & 1 \\ 0 & 1 & -0{,}5 & 0{,}5 \\ 0 & 0 & 1 & -1/5 \end{array}\right]$$

a)

2. Log (75) =

$y = 1 + \frac{(75-10)(2-1)}{(100-10)}$

$= 1 + 0{,}72 = 1{,}72$

b) Log (25)

$y = 1 + \frac{(25-10)(2-1)}{(100-10)}$

$= 1 + 0{,}16 = 1{,}16$

c) Persamaan interpolasi

Log (75) = 1,87 galat = $\frac{1{,}87 - 1{,}72}{1{,}87} \times 100\% = 8{,}6$

Log (25) = 1,39 galat = $\frac{1{,}39 - 1{,}16}{1{,}39} \times 100\% = 16$

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3.

Iterasi	x_0	x_1	x_2	$f(x_2)$	$f(x_0) \cdot f(x_2)$	$(x_0 - x_1)$
1	1	2	1,5	0,875	-0,875	1
2	1	1,5	1,25	-0,791	0,299	0.5

4. $Fx = x^{x4}$

$x_4 = 4$

$x_0 = 1$

$n = 8$

$h = 0,375$

x	$f(x)$
1	1
1,375	3,574
2	16
2	16
3	81
3	81
4	256

Jadi luas = 122,2779

5. a) $f(2) = \cos(2)$

$= \cos(2) + \frac{d}{dx}(\cos(x))(2)(x-2) + \frac{d2}{dx^2}(\cos(x))(2)(x-2)^2 + \frac{d3}{dx^3}(\cos(x))(2)$
$(x-2)^3 + \dots$

$= \cos(2) + -\sin(2)(x-2) + \frac{-\cos(2)(x-2)^2}{2!} + \frac{\sin(2)(x-2)^3}{3!} + \frac{\cos(2)}{4!}(x-2)^4$

$= \cos(2) - \sin(2)(x-2) - \frac{\cos(2)}{2}(x-2)^2 + \frac{\sin(2)}{6}(x-2)^3 + \frac{\cos(2)}{24}(x-2)^4 + \dots$

Maclaurens :

$a = 0$

$= 1 + \frac{\frac{d}{4x}(\cos(x))(0)}{1!}x + \frac{\frac{d2}{4x^2}(\cos(x))(0)x^2}{21} + \frac{\frac{d3}{dx^3}(\cos(x))(0)}{3!} + \dots$

$= 1 + \frac{0}{1!}x + \frac{-1}{2!}x^2 + \frac{0}{3!}x^3 + \frac{1}{4!}x^4 + \frac{0}{5!}x^5 + \frac{-1}{6!}x^6 + \frac{0}{7!}x^7 + \frac{1}{8}x^8 +$

$= 1 \frac{-1}{2!}x^2 + \frac{1}{4!}x^4 + \frac{1}{6!}x^6 + \frac{1}{8!}x^8 + \dots$

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$$= \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n}}{(2n)!}$$

b) Taylor $a=2$

$f(2) = \ln(3)$

$$= \ln(3) = \frac{\frac{d}{dx}(\ln(1+x)(2))}{1!} + \frac{\frac{d^2}{dx^2}(\ln(1+x)(2))}{2!}(x-2)^2$$

$$+ \frac{\frac{d^3}{dx^3}(\ln(1+x)(2))}{3!}(x-2)^3 + \dots$$

$$= \frac{d}{dx}(\ln(1+x))(2) = \frac{1}{3}$$

$$\frac{d^2}{dx^2}(\ln(1+x))(2) - \frac{1}{9}$$

$$\frac{d^3}{dx^3}(\ln(1+x))(2) = \frac{2}{27}$$

$$\frac{d^4}{dx^4}[\ln(1+x))(2) = -\frac{2}{27}$$

$$= \ln(3) + \frac{\frac{1}{3}}{1!}(x-2) + \frac{\frac{-1}{9}}{2!}(x-2)^2 + \frac{\frac{2}{27}}{3!}(x-2)^3 + \frac{\frac{-2}{27}}{4!}(x-2)^4 + \dots$$

Maclaurens :

$f(0) > 0$

$$= 0 + \frac{\frac{d}{dx}(\ln(1+x)(0)}{1!}x + \frac{\frac{d^2}{dx^2}(\ln(1+x))(0)x^2}{2!} + \frac{\frac{d^3}{dx^3}(\ln(1+x))x^3}{3!} + \dots$$

$$\frac{d}{dx}(\ln(1+x))(0) = 1$$

$$\frac{d^2}{dx^2}(\ln(1+x))(0) = -1$$

$$\frac{d^3}{dx^3}(\ln(1+x))(0) = 2$$

$$\frac{d^4}{dx^4}(\ln(1+x))(0) = -6$$

$$\frac{d^5}{dx^5}(\ln(1+x))(0) = 24$$

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$$= 0 + \frac{1}{1!}x + \frac{-1}{2!}x^2 + \frac{2}{3!}x^3 + \frac{-6}{4!}x \frac{24}{5!}x \cdots$$

$$= x - \frac{1}{2}x^2 + \frac{1}{3}x^3 \frac{-1}{4}x^4 + \frac{1}{5}x^5 + \cdots$$

$$= \sum_{n}^{\infty} = 1^{(-1)} n + \frac{1 \times n}{n}$$