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Tugas Metode Numerik

1). Diketahui $f(x) = \frac{\sin(0{,}5\sqrt{x})}{ax}$. Tentukan turunan pertama dari f di x=1 dan h=0,2. Gunakan metode :

a) Selisih maju

$$f'(x) = \frac{f(x+h) - f(x)}{h} = \frac{f(1{,}2) - f(1)}{0{,}2} = \frac{0{,}4332 - 0{,}4794}{0{,}2} = \frac{-0{,}0462}{0{,}2} = -0{,}231$$

$\rightarrow f'(x) = -0{,}231$

$$f(1) = \frac{\sin(0{,}5\sqrt{1})}{1} = \sin(0{,}5) = 0{,}4794$$

$$f(1{,}2) = \frac{\sin(0{,}5\sqrt{1{,}2})}{1{,}2} = \frac{\sin(0{,}5 \times 1{,}095)}{1{,}2} = \frac{\sin(0{,}5475)}{1{,}2} = \frac{0{,}5198}{1{,}2} = 0{,}4332$$

b) Selisih mundur

$$f'(x) = \frac{f(x) - f(x-h)}{*h} = \frac{f(1) - f(0{,}8)}{0{,}2} = \frac{0{,}4794 - 0{,}5404}{0{,}2} = \frac{-0{,}061}{0{,}2} = -0{,}305$$

$\rightarrow f'(1) = -0{,}305$

$$f(1) = \frac{\sin(0{,}5\sqrt{1})}{1} = \sin(0{,}5) = 0{,}4794$$

$$f(0{,}8) = \frac{\sin(0{,}5\sqrt{0{,}8})}{0{,}8} = \frac{\sin(0{,}5 \times 0{,}8944)}{0{,}8} = \frac{\sin(0{,}4472)}{0{,}8} = \frac{0{,}4323}{0{,}8} = 0{,}5404$$

c) Selisih Pusat

$$f'(x) = \frac{f(x+h) - f(x-h)}{2h} = \frac{f(1{,}2) - f(0{,}8)}{2h}$$

$$f(1{,}2) = \frac{\sin(0{,}5\sqrt{1{,}2})}{1{,}2} = \frac{\sin(0{,}5 \times 1{,}095)}{1{,}2} = \frac{\sin(0{,}5475)}{1{,}2} = \frac{0{,}5205}{1{,}2} = 0{,}4338$$

$$f(0{,}8) = \frac{\sin(0{,}5\sqrt{0{,}8})}{0{,}8} = \frac{\sin(0{,}5 \times 0{,}8944)}{0{,}8} = \frac{\sin(0{,}4472)}{0{,}8} = \frac{0{,}4323}{0{,}8} = 0{,}5404$$

$$f'(1) = \frac{f(1{,}2) - f(0{,}8)}{2h} = \frac{0{,}4338 - 0{,}5404}{2 \times 0{,}2} = \frac{-0{,}1066}{0{,}4} = -0{,}2665$$

2). Diketahui $f(x) = x^2 \cos x$. Tentukan turunan kedua dari f di x=0,4 dan h=0,1. Gunakan metode :

a) Selisih maju

$$f''(x) = \frac{f(x+2h) - 2f(x+h) + f(x)}{h^2} = \frac{f(0{,}4 + 0{,}2) - 2f(0{,}4 + 0{,}1) + f(0{,}4)}{0{,}1^2} = \frac{f(0{,}6) - 2f(0{,}5) + f(0{,}4)}{0{,}01}$$

$$f(0{,}4) = (0{,}4)^2 \cos(0{,}4) = 0{,}16 \cos(0{,}4) = 0{,}16 \times 0{,}9211 = 0{,}1474$$

$$f(0{,}5) = (0{,}5)^2 \cos(0{,}5) = 0{,}25 \cos(0{,}5) = 0{,}5 \times 0{,}8776 = 0{,}2194$$

$$f(0{,}6) = (0{,}6)^2 \cos(0{,}6) = 0{,}36 \cos(0{,}6) = 0{,}36 \times 0{,}8253 = 0{,}2971$$

$$f''(0{,}4) = \frac{0{,}2971 - 2 \times 0{,}2194 + 0{,}1474}{0{,}1^2} = \frac{0{,}2971 - 0{,}4388 + 0{,}1474}{0{,}01} = \frac{0{,}0057}{0{,}01} = 0{,}57$$

No.

Date

b). Selisih mundur

$$f''(x) = \frac{f(x) - 2f(x-h) + f(x-2h)}{h^2} = \frac{f(0,4) - 2f(0,3) + f(0,2)}{0,1^2}$$

$f(0,3) = (0,3)^2 \cos(0,3) = 0,09 \times \cos(0,3) = 0,09 \times 0,9553 = 0,08\,\text{[illegible]}60$

$f(0,2) = (0,2)^2 \cos(0,2) = 0,04 \cos(0,2) = 0,04 \times 0,9801 = 0,0392$

$$f''(0,4) = \frac{0,1474 - 2 \times 0,0860 + 0,\text{[illegible]}0392}{0,1^2} = \frac{0,1474 - 0,172 + 0,0392}{0,01} = \frac{0,0146}{0,01} = 1,46$$

c) selisih pusat

$$f''(x) = \frac{f(x+h) - 2f(x) + f(x-h)}{h^2} = \frac{f(0,5) - 2f(0,4) + f(0,3)}{0,1^2}$$

$$f''(0,4) = \frac{0,2194 - 2(\text{[illegible]}\,0,1474) + 0,0860}{0,01} = \frac{0,2194 - 0,2948 - 0,0860}{0,01} = \frac{0,0106}{0,01} = 1,06$$

3). Diketahui data jarak tempuh suatu kendaraan sebagai berikut : Gunakan turunan numerik utk mengestimasi kecepatan dan percepatan kendaraan tsb setiap waktu

t(s)	0	25	50	75	100	125
y(km)	0	32	58	78	92	100

rumus kecptn

$v(t) = \frac{y_{i+1} - y_i}{t_{i+1} - t_i}$

$a(t) = \frac{v_{i+1} - v_i}{t_{i+1} - t_i}$

→ • Kecepatan

- Selisih maju ($t=0$) : $v(0) = \frac{y(25) - y(0)}{t(25) - t(0)} = \frac{32-0}{25-0} = \frac{32}{25} = 1,28 \text{ km/s}$

- Selisih pusat ($t = 25, 50, 75, 100$) : $v(25) = \frac{y(50) - y(0)}{50-25} = \frac{58-32}{50-25} = \frac{26}{25} = 1,04 \text{ km/s}$

$$v(50) = \frac{78-58}{75-50} = \frac{20}{25} = 0,8 \text{ km/s}$$

$$v(75) = \frac{\text{[illegible]}\,92-78}{100-75} = \frac{14}{25} = 0,56 \text{ km/s}$$

$$v(100) = \frac{\text{[illegible]}\,100-92}{125-100} = \frac{8}{25} = 0,32 \text{ km/s}$$

• Percepatan

$$a(0) = \frac{1,04-1,28}{25-0} = \frac{-0,24}{25} = -0,0096 \text{ km/s}^2$$

$$a(25) = \frac{0,8-1,04}{50-25} = \frac{-0,24}{25} = -0,0096 \text{ km/s}^2$$

$$a(50) = \frac{0,56-0,8}{75-50} = \frac{-0,24}{25} = -0,0096 \text{ km/s}^2$$

$$a(75) = \frac{0,32-0,56}{\text{[illegible]}\,100-75} = \frac{-0,24}{25} = -0,0096 \text{ km/s}^2$$

$$a(100) = \frac{0-0,32}{125-100} = \frac{-0,32}{25} = -0,0128 \text{ km/s}^2$$