Quiz: Scientific Computing

LB20 - LAB

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Quis Lab Scientific Computing

1	x	0.1	0.2	0.3	0.4	0.5	0.6
	f(x)	0.09327	0.08435	0.07591	0.06894	0.05971	0.04362

Dengan menggunkan metode finite difference approximation dengan O(h^2), tentukan nilai f ''''(x) jika nilai x= 0.1 dan tentukan f'''(x) jika nilai x = 0.5. Selesaikan permasalahan tersebut menggunkan script python.

2 Diketahui sebuah persamaan y' +8y=2x^2 dan y (0) = 2

 a Tentukan y (0.2) dengan deret taylor orde 4

 b Hitung juga estimasi error dan bandingkan dgn error sesunguhnya, dimana solusi analitiknya

$$y = \frac{31}{32}e^{-4x} + \frac{1}{4}x^2 - \frac{1}{8}x + \frac{1}{32}$$

Selesaikan permasalahan tersebut menggunkan script python

JAWABAN

No. 1

```
# Ahmad Naufal A.A - 2502014652
# Soal 1

# insert x
x = [0.1, 0.2, 0.3, 0.4, 0.5, 0.6]

# insert y
y = [0.09327, 0.08435, 0.07591, 0.06894, 0.05971, 0.04362]

# insert h
h = 0.1

# insert difference
div = 2*(h**3)

# define formula
f1 = ((3 * y[0]) - (14 * y[1]) + (26 * y[2]) -
            (24 * y[3]) + (11 * y[4]) - (2 * y[5])) / h**4
f2 = ((3 * y[0]) - (14 * y[1]) + (24 * y[2]) - (18*y[3]) + (5*y[4]))/div

# Print F1 and F2
print("\nJawaban No.1: \n")
print(f"F''''(0.1)  = {f1}")
print(f"F'''(0.5)   = {f2}\n")
```

Output:

```
PS C:\Users\naufa> python -u "c:\Users\naufa\OneDrive

 Jawaban No.1:

 F''''(0.1)  = -124.19999999999776
 F'''(0.5)   = -10.809999999999873

 PS C:\Users\naufa>
```

No. 2a

```
# Ahmad Naufal A.A - 2502014652
# Soal 2a

# define library
import numpy as np

# define each variable value
x0 = 0
y0 = 2
yx = 0.2
delX = 0.2
orde = 4

# calculate x
x = np.linspace(x0, yx, orde)
```

```python
# define f(x) formula
def f(x, y):
    return 2*x**2-8*y  # from y'+8y=2x^2

# calculate y
y = np.zeros([orde])

# define y[0]
y[0] = y0

# for loop to calculate each x[] and y[]
for i in range(1, orde):
    k1 = delX * f(x[i-1], y0)
    k2 = delX * f(x[i-1] + delX/2, y0 + k1/2)
    k3 = delX * f(x[i-1] + delX/2, y0 + k2/2)
    k4 = delX * f(x[i-1] + delX, y0 + k3)
    y[i] = y0 + (k1 + 2 * k2 + 2 * k3 + k4)/6
    y0 = y[i]

# print result
print("\nHasil Taylor 4 Orde: ")
print("\nx\t| y")
print("----------------")

# for loop to print each x[] and y[] value from calculation
for i in range(orde):
    print(round(x[i], 4), "\t|", round(y[i], 4))

print("\n")
```

Output:

```
PS C:\Users\naufa> python -u "c:\Users\naufa\OneDrive

 Hasil Taylor 4 Orde:

 x          | y
 ----------------
 0.0        | 2.0
 0.0667     | 0.5449
 0.1333     | 0.1558
 0.2        | 0.0567


 PS C:\Users\naufa>
```

No. 2b