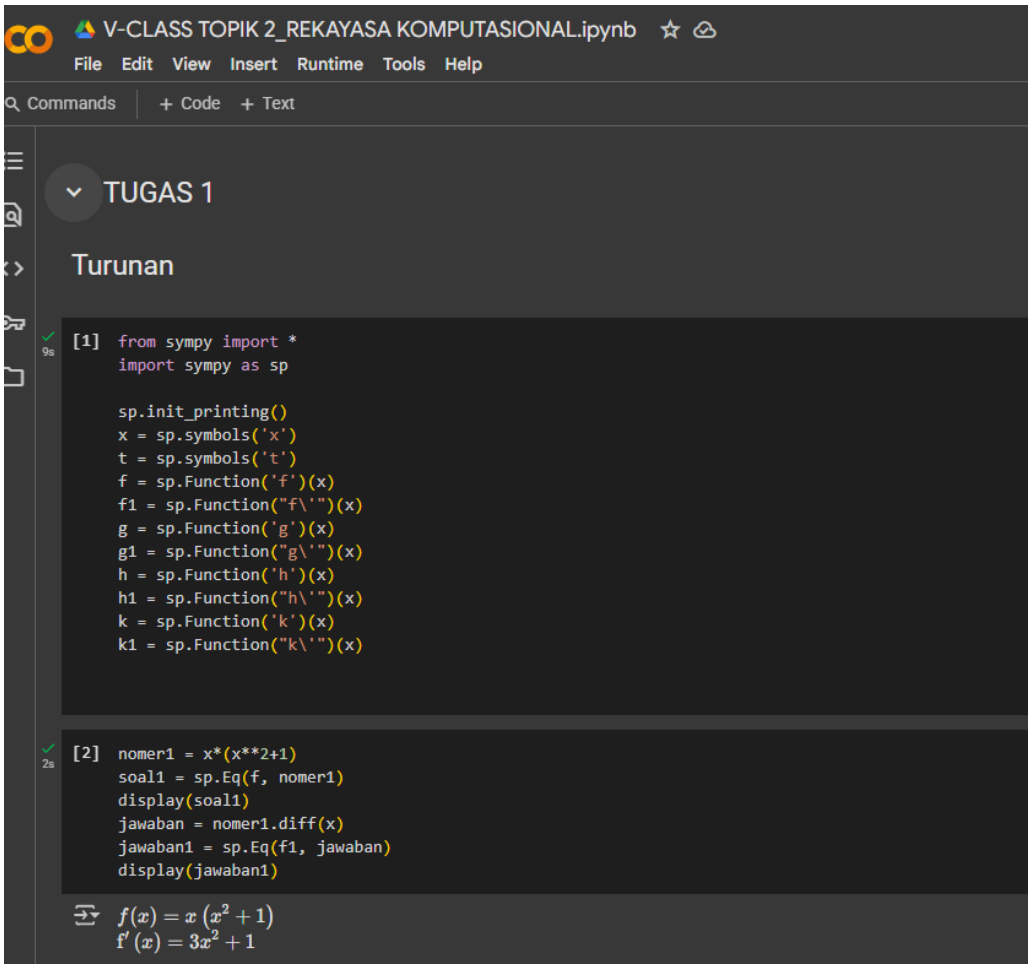
MUHAMMAD TARMIDZI BARIQ

51422161

3IA11

M9



```
[3]  nomer2 = (5*x-4)/(3*x**2+1)
     soal2 = sp.Eq(g, nomer2)
     display(soal2)
     jawaban = nomer2.diff(x)
     jawaban2 = sp.Eq(g1, jawaban)
     display(jawaban2)
```

$$g(x) = \frac{5x-4}{3x^2+1}$$

$$g'(x) = -\frac{6x\,(5x-4)}{(3x^2+1)^2} + \frac{5}{3x^2+1}$$

```
[4]  nomer3 = (x**2+1)*10
     soal3 = sp.Eq(h, nomer3)
     display(soal3)
     jawaban = nomer3.diff(x)
     jawaban3 = sp.Eq(h1, jawaban)
     display(jawaban3)
```

$$h(x) = 10x^2 + 10$$

$$h'(x) = 20x$$

```
[5]  nomer4 = sin(2*t)
     soal4 = sp.Eq(k, nomer4)
     display(soal4)
     jawaban = nomer4.diff(x)
     jawaban4 = sp.Eq(k1, jawaban)
     display(jawaban4)
```

$$k(x) = \sin(2t)$$

$$k'(x) = 0$$

```
[6] r = 1
    phi = [3.1, 3.14, 3.141, 3.1415, 3.14159,
    3.141592, 3.1415926, 3.14159265, 3.141592653, 3.1415926535,
    3.14159265358, 3.141592653589, 3.1415926535893, 3.14159265358932, 3.141592653589323,
    3.1415926535893238, 3.1415926535893284, 3.14159265358932846]
    phii = map(str, phi)
```

```
    AS = []
    for i in phi:
      AS.append(len(str(i))-1)
    AS
```

```
[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 17, 17]
```

```
[8] luas = phi * (r ** 2)
    luass = [str(x) for x in luas]
    AS_luas = []
    for i in luas:
      AS_luas.append(len(str(i))-1)
    AS_luas
```

```
[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 17, 17]
```

```
[9] volume = [(4/3) * x for x in phi]
    volumee = [str(x) for x in volume]
    AS_volume = []
    for i in volume:
      AS_volume.append(len(str(i))-1)
    AS_volume
```

```
[16, 17, 4, 16, 16, 16, 16, 8, 10, 16, 16, 16, 16, 15, 17, 16, 17, 17]
```

```
[10] import pandas as pd
     dict = {'Nilai Phi': phii, 'Nilai Signifikan':AS,'Luas Lingkaran': luass, 'Angka Signifikan Luas Lingkaran': AS_luas,'Volume Bola': volumee, 'Angka Signifikan Volume Bola': AS_volume}
     df = pd.DataFrame(dict)
     df
```

	Nilai Phi	Nilai Signifikan	Luas Lingkaran	Angka Signifikan Luas Lingkaran	Volume Bola	Angka Signifikan Volume Bola
0	3.1	2	3.1	2	4.133333333333333	16
1	3.14	3	3.14	3	4.1866666666666665	17
2	3.141	4	3.141	4	4.188	4
3	3.1415	5	3.1415	5	4.188666666666666	16
4	3.14159	6	3.14159	6	4.188786666666666	16
5	3.141592	7	3.141592	7	4.188789333333333	16
6	3.1415926	8	3.1415926	8	4.188790133333333	16
7	3.14159265	9	3.14159265	9	4.1887902	8
8	3.141592653	10	3.141592653	10	4.188790204	10
9	3.1415926535	11	3.1415926535	11	4.188790204666667	16
10	3.14159265358	12	3.14159265358	12	4.188790204773333	16
11	3.141592653589	13	3.141592653589	13	4.188790204785333	16
12	3.1415926535893	14	3.1415926535893	14	4.188790204785733	16
13	3.14159265358932	15	3.14159265358932	15	4.18879020478576	15
14	3.141592653589323	16	3.141592653589323	16	4.1887902047857635	17
15	3.1415926535893237	17	3.1415926535893237	17	4.188790204785764	16
16	3.1415926535893286	17	3.1415926535893286	17	4.188790204785715	17
17	3.1415926535893286	17	3.1415926535893286	17	4.188790204785715	17

Next steps: Generate code with df | View recommended plots | New interactive sheet

TUGAS 2

PERSAMAAN KUADRAT

```
[11] ## Menghitung Nilai D
     import math
     def akarkuadrat(a, b, c):
       d = b * b - 4 * a * c
       akar = math.sqrt(abs(d))
       if d > 0:
         print('akar nyata dan berbeda, yaitu', (-b + akar)/(2 * a)), 'dan', ((-b - akar)/(2* a))
       elif d == 0:
         print('akar nyata dan sama, yaitu', (-b)/(2 * a))
       else:
         print("Akar Kompleks, yaitu")
         print(- b / (2 * a), akar, " + i")
         print(- b / (2 * a), akar, " - i")
```

```
[12] ##Menemukan Solusi

     a = float(input('Masukkan nilai a: '))
     b = float(input('Masukkan nilai b: '))
     c = float(input('Masukkan nilai c: '))
     print('')
     if a == 0:
       print("Masukkan persamaan kuadrat yang benar")
     else:
       akarkuadrat(a, b, c)
```

```
Masukkan nilai a: 2
Masukkan nilai b: 1
Masukkan nilai c: 2

Akar Kompleks, yaitu
-0.25 3.872983346207417  + i
-0.25 3.872983346207417  - i
```

Persamaan Kubik

```
[13] def bisection(f,a,b,N):
       if f(a)*f(b) >= 0:
         print("Metode bisection gagal.")
         return None
       a_n = a
       b_n = b
       for n in range(1,N+1):
         m_n = (a_n + b_n)/2
         f_m_n = f(m_n)
         if f(a_n)*f_m_n < 0:
           a_n = a_n
           b_n = m_n
         elif f(b_n)*f_m_n < 0:
           a_n = m_n
           b_n = b_n
         elif f_m_n == 0:
           print("Menemukan solusi yang tepat.")
           return m_n
         else:
           print("Metode bisection gagal.")
           return None
       return (a_n + b_n)/2
```

```
[14] f = lambda x: x**2 - x - 1
     hasil = bisection(f,1,2,25)
     print(hasil)
```

```
1.618033990263939
```

Metode Newton-Raphson

```python
def newton(f, Df, x0, epsilon, max_iter):
    xn = x0
    for n in range(0, max_iter):
        fxn = f(xn)
        if abs(fxn) < epsilon:
            print('Solusi ditemukan setelah', n, 'iterasi.')
            return xn
        Dfxn = Df(xn)
        if Dfxn == 0:
            print('Turunan nol. Tidak ada solusi yang ditemukan.')
            return None
        xn = xn - fxn / Dfxn
    print('Melebihi iterasi maksimum. Tidak ada solusi yang ditemukan.')
    return None
```

```python
[16] f = lambda x: x**2 - x - 1
     Df = lambda x: 2*x - 1
     newton(f,Df,1,1e-8,10)
```

```
Solusi ditemukan setelah 5 iterasi.
1.61803398874999
```

Metode Sekan

```python
[17] def sekan(f, a, b, N):
        if f(a) * f(b) >= 0:
            print("Metode Sekan Gagal: f(a) dan f(b) harus memiliki tanda yang berlawanan.")
            return None

        a_n = a
        b_n = b

        for n in range(1, N + 1):
            try:
                m_n = a_n - f(a_n) * (b_n - a_n) / (f(b_n) - f(a_n))
            except ZeroDivisionError:
                print("Terjadi pembagian dengan nol.")
                return None

            f_m_n = f(m_n)

            if f(a_n) * f_m_n < 0:
                a_n = a_n
                b_n = m_n
            elif f(b_n) * f_m_n < 0:
                a_n = m_n
                b_n = b_n
            elif f_m_n == 0:
                print("Menemukan solusi yang tepat.")
                return m_n
            else:
                print("Metode Sekan Gagal.")
                return None

        return a_n - f(a_n) * (b_n - a_n) / (f(b_n) - f(a_n))
```

```python
[18] p = lambda x: x**3 - x**2 - 1
     hasil = sekan(p,1,2,20)
     print(hasil)
```

```
1.4655712311394433
```

TUGAS 3

Penjumlahan Matriks

```
[19] import numpy as np
     A = np.array([[2, 3, 5], [4, 1, 2]])
     B = np.array([[1, 2, 6], [3, 2, 1]])
     C = A + B
     print(C)
```

```
[[ 3  5 11]
 [ 7  3  3]]
```

Pengurangan Matriks

```
[20] A = np.array([[2, 6], [-4, 1], [3, 2]])
     B = np.array([[6, -2], [4, 1], [0, 3]])
     C = A - B
     print(C)
```

```
[[-4  8]
 [-8  0]
 [ 3 -1]]
```

Perkalian Skalar pada Matriks

```
[21] A = np.array([[2, 6], [-4, 1], [3, 2]])
     C = 2 * A
     print(C)
```

```
[[ 4 12]
 [-8  2]
 [ 6  4]]
```

Perkalian Matriks dengan Matriks

```
[22] A = np.array([[2, 1, -6], [1, -3, 2]])
     B = np.array([[1, 0, -3], [0, 4, 2], [-2, 1, 1]])
     C = A.dot(B)
     print(C)
```

```
[[ 14  -2 -10]
 [ -3 -10  -7]]
```

Determinan

```
[23] A = np.array([[3, -7], [-9, 5]])
     determinan = np.linalg.det(A)
     print(round(determinan))
```

```
-48
```

```
[24] A = np.array([[3, 0, -2], [6, -8, 1], [0, 3, 4]])
     determinan = np.linalg.det(A)
     print(round(determinan))
```

```
-141
```

Invers

```
[25] A = np.array([[1, 2, 3], [2, 4, 3], [6, 1, 4]])
     invers = np.linalg.inv(A)
     print(invers)
```

```
[[-0.39393939  0.15151515  0.18181818]
 [-0.3030303   0.42424242 -0.09090909]
 [ 0.66666667 -0.33333333  0.        ]]
```

Metode Eliminasi Gauss

```
[26] import sys
     n = int(input('Masukkan jumlah variabel yang tidak diketahui: '))
     a = np.zeros((n,n+1))
     x = np.zeros(n)
```

```
Masukkan jumlah variabel yang tidak diketahui: 2
```

```
import sys

print('Masukkan Koefisien Augmented Matriks:')
n = int(input("Masukkan jumlah variabel: "))
a = [[0.0 for j in range(n + 1)] for i in range(n)]

for i in range(n):
    for j in range(n + 1):
        a[i][j] = float(input(f'a[{i}][{j}] = '))

# Eliminasi Gauss
for i in range(n):
    if a[i][i] == 0.0:
        sys.exit('Terdeteksi pembagian dengan nol')

    for j in range(i + 1, n):
        ratio = a[j][i] / a[i][i]
        for k in range(n + 1):
            a[j][k] = a[j][k] - ratio * a[i][k]
```

```
Masukkan Koefisien Augmented Matriks:
Masukkan jumlah variabel: 2
a[0][0] = 3
a[0][1] = 4
a[0][2] = 5
a[1][0] = 6
a[1][1] = 7
a[1][2] = 5
```

Proses Substitusi Mundur

```
# Inisialisasi solusi x dengan nol
x = [0 for _ in range(n)]

# Substitusi Balik
x[n-1] = a[n-1][n] / a[n-1][n-1]

for i in range(n-2, -1, -1):
    x[i] = a[i][n]
    for j in range(i+1, n):
        x[i] -= a[i][j] * x[j]
    x[i] /= a[i][i]
```

```
[29] print('\nSolusinya adalah: ')
     for i in range(n):
       print('X%d = %f' %(i,x[i]), end = '\t')
```

```
Solusinya adalah:
X0 = -5.000000  X1 = 5.000000
```

Metode Eliminasi Gauss Seidell

inisialisasi matrik A

```
[30] from numpy import array,zeros


     A = array([
         [10., -1.,  2.,  0.],
         [-1., 11., -1.,  3.],
         [ 2., -1., 10., -1.],
         [ 0.,  3., -1.,  8.]
     ])

     print("Matriks A:")
     print(A)
```

```
Matriks A:
[[10. -1.  2.  0.]
 [-1. 11. -1.  3.]
 [ 2. -1. 10. -1.]
 [ 0.  3. -1.  8.]]
```

inisialisasi vektor b

```
[31] from numpy import array

     b = array([
         [6.],
         [25.],
         [-11.],
         [15.]
     ])

     print("Vektor b:")
     print(b)
```

```
Vektor b:
[[  6.]
 [ 25.]
 [-11.]
 [ 15.]]
```

```
[32] # Parameter
     n = len(A)               # Ukuran sistem
     iterasi = 500            # Maksimal iterasi
     toleransi = 0.0001       # Ambang konvergensi

     # Inisialisasi variabel
     xlama = zeros((n, 1))    # x^(k)
     xbaru = zeros((n, 1))    # x^(k+1)
     c = zeros((n, 1))        # Konstanta vektor dalam bentuk iteratif
     T = zeros((n, n))        # Matriks transformasi iteratif
```

Menghitung matrik T dan vektor c

```
[33] # Hitung matriks T dan vektor c untuk metode Jacobi
     for j in range(n):
         for i in range(n):
             if i != j:
                 T[j][i] = -A[j][i] / A[j][j]
             else:
                 T[j][i] = 0.0  # diagonal dibuat nol agar tidak dipakai dalam iterasi
         c[j][0] = b[j][0] / A[j][j]
```

Metode Gauss-Seidel

```
[34] for m in range(1, iterasi + 1):
         for i in range(n):
             sum1 = 0
             for j in range(n):
                 if j < i:
                     sum1 += T[i][j] * xbaru[j][0]  # gunakan nilai yang baru diupdate
                 elif j > i:
                     sum1 += T[i][j] * xlama[j][0]  # gunakan nilai dari iterasi sebelumnya
             xbaru[i][0] = sum1 + c[i][0]

         # Cek konvergensi (berhenti jika perubahan sangat kecil)
         selisih = abs(xbaru - xlama)
         if all(selisih[i][0] < toleransi for i in range(n)):
             print(f"Konvergen pada iterasi ke-{m}")
             break

         xlama = xbaru.copy()
```

```
Konvergen pada iterasi ke-6
```

Mencetak hasil perhitungan

```
[35] print('iterasi ke', m)
     print(xbaru)
```

```
iterasi ke 6
[[ 1.00000836]
 [ 2.00000117]
 [-1.00000275]
 [ 0.99999922]]
```

Metode Dekomposisi LU

inisialisasi matrik augment

```
[48] from numpy import array,zeros


     A = array([
         [1,  0, -2, 7],
         [2, -1,  3, 4],
         [3, -3,  1, 5],
         [2,  1,  4, 4]
     ])

     print("Matriks A:")
     print(A)
```

```
Matriks A:
[[ 1  0 -2  7]
 [ 2 -1  3  4]
 [ 3 -3  1  5]
 [ 2  1  4  4]]
```

```
[49] b = array([[11],
                [9],
                [8],
                [10]])
     print(b)
```

```
[[11]
 [ 9]
 [ 8]
 [10]]
```

```
[50] n = len(A)
     L = zeros((n,n))
     for i in range(0,n):
       L[i][i]=1
```

Proses Triangularisasi

```
[51] for k in range(0, n-1):
         # pivot
         if A[k][k] == 0:
             for s in range(0, n):
                 v = A[k][s]
                 u = A[k+1][s]
                 A[k][s] = u
                 A[k+1][s] = v

         for j in range(k+1, n):
             m = A[j][k] / A[k][k]
             L[j][k] = m
             for i in range(0, n):
                 A[j][i] = A[j][i] - m * A[k][i]

     U = zeros((n, n))
     for i in range(0, n):
         for j in range(0, n):
             U[i][j] = A[i][j]
```

Proses Substitusi Maju

```
[52] y = zeros((n,1))
     y[0][0]=b[0][0]/L[0][0]
     for j in range(1,n):
       S=0
       for i in range(0,j):
         S=S+y[i][0]*L[j][i]
       y[j][0]=b[j][0]-S
```

Proses Substitusi Mundur

```
[53] x=zeros((n,1))
     x[n-1][0]=y[n-1][0]/U[n-1][n-1]
     for j in range(n-2,-1,-1):
       S=0
       for i in range(j+1,n):
         S=S+U[j][i]*x[i][0]
         x[j][0]=(y[j][0]-S)/U[j][j]
     print(x)
```

```
[[-1.]
 [-0.]
 [ 1.]
 [ 2.]]
```

TUGAS 4

DIRECT METHOD

```
[54] def terdekat(t, vt, tcari, jml):
       tt = t[:]
       selindex = []
       closestvt = []
       for i in range(jml):
         daftar = []
         for j in range(len(tt)):
           daftar.append(abs(tt[j]-tcari))
         n = daftar.index(min(daftar))
         selindex.append(tt[n])
         tt.remove(tt[n])
       selindex.sort()
       for k in selindex : closestvt.append(vt[t.index(k)])
       return[selindex, closestvt]
```

```
[55] t = [0, 10, 15, 20, 22.5, 30]
     vt = [0, 227.04, 362.78, 517.35, 602.97, 901.67]
     tcari = 16
     points = [2, 3, 4, 5]
     vtcari0 = 0
```

```
[60] import numpy
     matrixnya = numpy.zeros((len(t), len(t)+1))
     for i in range(len(t)):
       matrixnya[i, len(t)] = vt[i]
       for j in range(len(t)):
         matrixnya[i,j] = t[i]**j
```

```
def GaussJordan(A):
      n = len(A)
      x = numpy.zeros(n)
      for k in range(n):
        pivot = A[k][k]
        A[k] = A[k]/pivot
        for i in range(n):
          if i == k: continue
          factor = A[i][k]
          for j in range(k, n+1):
            A[i][j]-factor*A[k][j]
      x = A[:,n]
      return(x)
```

```
[62] def interpdirect(t, vt, tcari):
       matrixnya = numpy.zeros((len(t), len(t)+1))
       for i in range(len(t)):
         matrixnya[i, len(t)] = vt[i]
         for j in range(len(t)):
           matrixnya[i,j]=t[i]**j
       a= GaussJordan(matrixnya)
       vtcari = 0
       for i in range(len(a)):
         vtcari += a[i]*tcari**i
       return[a, vtcari]
```

```
for i in points:
  [tx, vtx] = terdekat(t, vt, tcari, i)
  [a, vtcari] = interpdirect(tx, vtx, tcari)
  print("Orde ", i-1, " Nilai Kecepatan jatuh pada t ke ", tcari, " = ", "%.2f"%vtcari)
  if vtcari0 == 0:
    print("Error = -")
  else:
    print("Error = ", "%.5f"%abs((vtcari-vtcari0)/vtcari*100), "%")
  vtcari0 = vtcari
```

```
Orde  1  Nilai Kecepatan jatuh pada t ke  16  =  776.66
Error =  58.99964 %
Orde  2  Nilai Kecepatan jatuh pada t ke  16  =  945.11
Error =  17.82326 %
Orde  3  Nilai Kecepatan jatuh pada t ke  16  =  1161.93
Error =  18.66065 %
Orde  4  Nilai Kecepatan jatuh pada t ke  16  =  1234.89
Error =  5.90766 %
```

```
[67] tcari = 16
     vtcari = 0
     for i in range(len(a)):
       vtcari += a[i] * tcari ** i
     print("Orde 3. Nilai v(16) adalah : ", vtcari)
```

```
Orde 3. Nilai v(16) adalah :  1234.886601218107
```

TUGAS 5

Linear Regression Using Least Squares

```
[68] import pandas as pd
     data = pd.read_csv('/content/headbrain.csv')
     data.head()
```

```
---------------------------------------------------------------------------
FileNotFoundError                         Traceback (most recent call last)
<ipython-input-68-19bb0418b448> in <cell line: 0>()
      1 import pandas as pd
----> 2 data = pd.read_csv('/content/headbrain.csv')
      3 data.head()

                                 4 frames
/usr/local/lib/python3.11/dist-packages/pandas/io/common.py in get_handle(path_or
    871         if ioargs.encoding and "b" not in ioargs.mode:
    872             # Encoding
--> 873             handle = open(
    874                 handle,
    875                 ioargs.mode,

FileNotFoundError: [Errno 2] No such file or directory: '/content/headbrain.csv'
```

Next steps: Explain error

Generate | print hello world using rot13

```
[69] X = data['Head Size(cm^3)'].values
     Y = data['Brain Weight(grams)'].values
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
```

```
[ ]  def mean(values):
       return sum(values) / float(len(values))
     mean_x = mean(X)
     mean_y = mean(Y)
     n = len(X)
```

```
     num = 0
     den = 0
     for i in range(n):
       num += (X[i] - mean_x) * (Y[i] - mean_y)
       den += (X[i] - mean_x) ** 2
```

```
     m = num / den
     print("nilai m : ", m)
```

```
[ ]  c = mean_y - (m * mean_x)
     print("nilai c : ", c)
```

```
[ ]  Y_pred = m * X + c
```

```
[ ]  import matplotlib.pyplot as plt
     plt.figure(figsize=(18,8))
     plt.scatter(X, Y, label='Actual')
     plt.plot([min(X), max(X)], [min(Y_pred), max(Y_pred)], color='red', label='Predicted')
     import matplotlib.pyplot as plt
     plt.figure(figsize=(18,8))
     plt.scatter(X, Y, label='Actual')
     plt.plot([min(X), max(X)], [min(Y_pred), max(Y_pred)], color='red', label='Predicted')
     plt.xlabel('Head Size in cm3')
     plt.ylabel('Brain Weight in grams')
     plt.legend()
     plt.show()
```

```
[ ]  import numpy as np
     rmse = 0
     for i in range(n):
       predictions = list()
       y_pred = c + m * X[i]
       rmse += (Y[i] - y_pred) ** 2
     rmse = np.sqrt(rmse/n)
     print("RMSE : ", rmse)
```

TUGAS 6

Trapezium Rule

```
[71] def trapesium(x0,xn,n):
       h = (xn - x0) / n
       integral = f(x0) + f(xn)
       for i in range(1,n):
         k = x0 + i*h
         integral = integral + 2 * f(k)
       integral = integral * h/2
       return integral
     batas_bawah = float(input("Masukkan batas bawah integral: "))
     batas_atas = float(input("Masukkan batas atas integral: "))
     interval = int(input("Masukkan jumlah interval: "))
     hasil = trapesium(batas_bawah, batas_atas, interval)
     print("Integral hasil dengan aturan trapeium: %0.1f" % (hasil) )
```

```
Masukkan batas bawah integral: 0
Masukkan batas atas integral: 1
Masukkan jumlah interval: 10
Integral hasil dengan aturan trapeium: -1.2
```

```
[72] def f(x):
       return 1/(1 + x**2)

     def simpson(x0,xn,n):
       h = (xn - x0) / n
       integral= f(x0) + f(xn)
       for i in range(1,n):
         k = x0 + i*h
         if i%2 == 0:
           integral = integral + 2 * f(k)
         else:
           integral = integral + 4 * f(k)
       integral =integral * h/3
       return integral

     batas_bawah = float(input("Masukkan batas bawah integral: "))
     batas_atas = float(input("Masukkan batas atas integral: "))
     interval = int(input("Masukkan jumlah interval: "))
     hasil = simpson(batas_bawah, batas_atas, interval)
     print("Integral hasil dengan aturan simpson 1/3: %0.6f" % (hasil) )
```

```
Masukkan batas bawah integral: 0
Masukkan batas atas integral: 1
Masukkan jumlah interval: 10
Integral hasil dengan aturan simpson 1/3: 0.785398
```