Assignment#5

Numerical Differentiation

1. Determine y'(1) & y"(1) from following data:

x	0.5	1.0	1.5	2.0	2.5
y	6	3	2	1.2	0.8

2. Find the **velocity** and **acceleration** when t = 0.1 second.

t (sec)	0	0.1	0.2	0.3	0.4	0.5	0.6
x (cm)	30.13	31.62	32.87	33.64	33.95	33.81	33.24

3. The table gives the angle in radians (ɵ) through which a rotating rod has turned for various values of time in seconds (t), Find the **angular velocity** & **angular acceleration** at t = 0.2.

t	0	0.2	0.4	0.6	0.8
ɵ	0	0.122	0.493	0.123	2.022

4. Given sin 0º = 0.000, sin 10º = 0.1736, sin 20º = 0.3420, sin 30º = 0.500, sin 40º = 0.6428,
   a. Find the value of **sin 23º**,
   b. Find the numerical value of **cos x** at x = 10,
   c. Find the numerical value of $\mathbf{d^2y/dx^2}$ at x = 20º for y = sin x
5. Find the value of f'(8) from the table given below:

x	6	7	9	12
f(x)	1.556	1.690	1.908	2.158

Maxima & Minima

1. Find the **maximum** & **minimum** value of y from the following table:

x	0	1	2	3	4	5
y	0	0.25	0	0.25	16	56.25

2. Find the value of **x** for which **f(x) is maximum**, using the table:

x	9	10	11	12	13	14
f(x)	1330	1340	1320	1250	1120	930

   Also find the maximum value of **f(x)**?

Numerical Integration

1. Given that:

x	4.0	4.2	4.4	4.6	4.8	5.0	5.2
log x	1.3963	1.4351	1.4816	1.5261	1.5686	1.6094	1.6487

   Evaluate $\int_4^{5.2} \log x \, dx$ by

   a. **Trapezoidal** rule
   b. **Simpson's 1/3rd** rule
   c. **Simpson's 3/8th** rule & also find the error in each case

2. Write an **algorithm** to calculate the definite integral $\int_a^b f(x)dx$ using **composite Simpson's 1/3rd rule**.
3. Evaluate $\int_0^2 f(x)dx$ for the function f(x) = e^x + sin(2x) using **Simpson's 3/8th** rule taking h = **0.4**.
4. Write a pseudo-code to integrate a given function within given limits using Simpson's 3/8th rule.
5. Use **Romberg's Integration** method to compute $\int_0^{0.5} \frac{x}{sinx} dx$, correct to 3 decimal places.
6. Evaluate following using **Gaussian Quadrature 2-point & 3-point** formula:
   a. $\int_0^1 \frac{\tan^{-1} x}{x} dx$
   b. $\int_0^{\pi/2} e^{sinx} \, dx$
   c. $\int_{0.2}^{1.5} e^{-x^2} \, dx$
   d. $\int_2^3 \frac{cos2x}{1+sinx} dx$
   e. $\int_{0.2}^{1.2} (\log(x+1) + sin2x) \, dx$
7. Use **Gauss-Legendre** four-point formula to evaluate $\int_2^4 (x^4 + 1)dx$