Assignment 2

Instructions: Attempt all questions. Select your functions based on the ID column, which you can calculate by using your AAiT ID No. Example: If your ID is ATR/2353/09, then divide 2353 by 6 and the ID is going to be the remainder you get from the division. If the remainder is 0, choose ID = 5.

The functions f(x), g(x) and h(x) are defined as:

$$\begin{cases} f(x) = k/y^z \\ g(x) = k * z \\ h(x) = k * (b * x^3 + a * x^2) \end{cases}$$

where:

ID	k	y	z	a	b	c
1	$\sqrt{1+2x^2}$	2	x	3	5	4.5
2	$3x^2 + x$	3	$sin(x)$	-1	2	0
3	$ln(x+1)$	4	$cos(x)$	2	4	3
4	$1/(sin(2x)+3)$	e	$x^2 + x$	-3	3	1
5	10^{3x-5}	$2e$	$1/(5+x)$	-2	1	0

1. **[NUMERICAL DIFFERENTIATION AND INTEGRATION]**

a. Numerically evaluate the integral of $f(x)$ for the given interval **[a,b]** using (i) The trapezoidal rule with n=10 (ii) Simpson's 1/3 rule with n=12.

b. Numerically evaluate the first derivative of $g(x)$ at x= 1 and x=3 using all three divided difference formula.

2. **[DIFFERENTIAL EQUATIONS]** Given the differential equation $y' = h(x)$:

a. Use Euler's method to to numerically integrate between a and b. Compare your results to 1(a).

b. Use fourth order *Runge-Kutta* method to numerically integrate between a and b. Compare your results to 1(a) and 2(a).

3. **[INTERPOLATION]** For both $f(x)$ and $g(x)$, interpolate the value at **x=c**:

a. Using third order Newton's divided difference.

b. Using the fourth Lagrangian interpolation polynomial.

Take the initial values to be points located at equal intervals between **a** and **b**.

4. **[REGRESSION]** For the following data, find the best fit linear/non-linear regression equation with the highest correlation coefficient. The equation doesn't need to be linear.

ID=1	ID=2	ID=3	ID=4	ID=5	
$x_{ID=1}$	$x_{ID=2}$	$x_{ID=3}$	$x_{ID=4}$	$x_{ID=5}$	y
7.8	4.3	11.5	6.3	5.2	14.8
6.9	3.9	14.3	7.4	6.7	12.1
9.3	8.4	9.4	5.9	8.3	19.0
6.8	10.3	15.2	8.7	11.4	14.5
11.7	6.4	8.8	9.1	5.5	16.6
8.5	5.7	9.8	5.6	7.5	17.2
12.6	6.8	11.2	6.8	8.1	17.5
7.5	4.2	10.9	7.4	15.4	14.1
8.4	7.3	14.7	8.2	9.5	13.8
11.3	8.8	15.1	9.2	10.4	14.7
10.7	3.6	8.7	4.7	5.6	17.7
7.3	4.9	8.6	5.5	7.4	17.0
8.4	7.3	9.3	6.6	9.0	17.6
6.7	9.7	10.8	8.7	4.6	16.3