

### Problem Definition:

**Table 1:** Vehicle speed and CO<sub>2</sub> factors.

$X_i$ (Vehicle Speed [km/h])	$Y_i$ (CO <sub>2</sub> Emission Factor [g/km])
20	190
30	170
40	155
50	140
60	118
70	130
80	132
90	140
100	150
110	170
120	180

- 1) Average speed and CO<sub>2</sub> emission factors of a passenger vehicle are given in Table 1. Using this data matrix;
  - a) Obtain the best-fitting curve coefficients using the second-order polynomial regression method. **(20 points)**
  - b) Calculate the standard deviation and correlation coefficient ( $R^2$ ) for the regression curve you created. **(15 points)**
- 2)
  - a) For the regression curve obtained in the first question; write a computer program (in any language) which
    - Finding the numerical solution according to the Multiple Trapezoidal Rule method for the number of steps from  $n=10$  to  $n=20$  by interval 2 in the speed range of 20 – 120 km/h, **(20 points)**
    - Finding the numerical solution according to the Multiple Simpson's 1/3 Rule method for the number of steps from  $n=10$  to  $n=20$  by interval 2 in the speed range of 20 – 120 km/h, **(20 points)**
    - According to both methods, finding the total error for real average (the mean of the values given in the Table 1) and the regression curve, **(15 points)**
  - b) Write your comments according to the total error obtained (compared to the real values and compared to the regression curve for both methods). **(10 points)**

*Note: Be careful about unit when you make numerical and analytical solution.*