Lab 9

1. Electric circuits are described using Kirchhoff's voltage and current laws. The electric circuit under consideration is described by the following set of equations.

$$\begin{aligned} R_1 i_1 + R_2 i_2 - v_1 &= 0 \\ -R_2 i_2 + R_3 i_3 + R_5 i_5 &= 0 \\ v_2 + R_4 i_4 - R_3 i_3 &= 0 \\ -i_1 + i_2 + i_3 + i_4 &= 0 \\ -i_4 - i_3 + i_5 &= 0 \end{aligned}$$

Calculate the five unknown currents (i_i) using the following resistances and voltages as $R_1 = 470\ ohms$, $R_2 = 300\ ohms$, $R_3 = 560\ ohms$, $R_4 = 100\ ohms\ and\ R_5 = 1000\ ohms$ $v_1 = 5\ V$, $and\ v_2 = 10$ V

2. A water tank consists of a cylindrical part of radius r and height h and a hemispherical top. The tank is to be constructed to hold 500 m^3 of fluid when filled. The surface area of the cylindrical part is $2\pi rh$ and its volume is $\pi r^2 h$. The surface area of the hemispherical top is given by $2\pi r^2$ and its volume is given by $2\pi r^3 / 3$. The cost to construct the cylindrical part of the tank is \$300/m^2 and the hemispherical part costs \$400/m^2. Plot the cost versus r for $2 \le r \le 10m$ and compute the radius that results in the least cost. Compute the corresponding height h.

3. For each of the following problem, determine the best function (linear, exponential or power function) with their coefficients to describe the data. Plot the function on the same plot with the data. Label and format the plots appropriately.

a)

x	25	30	35	40	45
y	5	260	480	745	1100

b)

x	2.5	3.0	3.5	4	4.5	5	5.5	6	7	8	9	10
y	1500	1220	1050	915	810	745	690	620	520	480	410	390

4. It was suggested that one can make a pretty good prediction of how a student will do in a class based on their performance on the first two homework assignments. For 10 students from a class, the following data was given.

HW1	13.5	13.0	14.5	13.0	18.5	19.5	16.5	12.0	18.5	16.0
HW2	17.75	8.00	15.25	14.5	17.25	14.5	12.75	15.25	15.75	15.75
Final	80.60	66.3	54.3	76.5	86.0	77.6	84.1	81.4	81.9	91.2

Use a linear least squares regression to approximate the final grade in terms of the first two homework grades. In other words, if *f* is the final grade, *x* is the first homework score, and *y* is the second homework score, find *a, b*, and *c* so that *a + bx + cy* is the best fit to *f* in the sense of least squares. Use this to predict the final grade for a student who gets a 17 and a 16.75 on the first two assignments.