

1. For a shell with an external diameter $r_1=3, 4, 5, 6, 7, 8, 9$ and 10 and internal diameter $r_2=2$ find the values for volume $V = \frac{4}{3}\pi(r_1^3 - r_2^3)$. Calculate and plot a nonlinear function $V = f(r_1)$ for the given r_1 .
2. Express the i_n term in the following series in indicial notation and then write an interactive program **SinePgrm** allowing input of the x value to calculate $\sin(x)$ by terminating the series when additional term contributes less than 0.001% of the partial sum of series in magnitude:

$$\sin x = \frac{x^1}{1!} - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots$$

3. Write an m-file to solve the following sets of linear algebraic equations

$$\begin{array}{rclcl} 6x & - & 3y & + & 4z & = & 41 & & 12x & - & 5y & = & 11 \\ \text{a) } 12x & + & 5y & - & 7z & = & -26 & & \text{b) } 3x & + & 4y & + & 7z & = & -3 \\ -5x & + & 2y & + & 6z & = & 14 & & 6x & + & 2y & + & 3z & = & 22 \end{array}$$

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

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

Calculate the five unknown currents (i_i) using the following resistances and voltages as

$R_1 = 470 \text{ ohms}$, $R_2 = 300 \text{ ohms}$, $R_3 = 560 \text{ ohms}$, $R_4 = 100 \text{ ohms}$ and $R_5 = 1000 \text{ ohms}$

$v_1 = 5V$ and $v_2 = 10V$.