Assignment 2: Graphs and plotting

1. The deflection of a cantilever beam is the distance its end moves in responce to a force applied at the end. The following table gives the deflection **x** that was produced in a particular beam by the given applied force **f**. Plot the graph of **x** vs. **f**.

Force f (Pounds)	0	100	200	300	400	500	600	700	800
Deflection x (inches)	0	0.09	0.18	0.28	0.37	0.46	0.55	0.65	0.74

TABLE I: An experiment to measure force and deflection in cantilever beam.

2. Draw a graph of the function,

$$y = \frac{\sin t}{t} \tag{1}$$

for $0 \leq t \leq 10$.

3. For the values $0 \leq x \leq 2\pi$, show the plot of,

$$\sin^2 x + \cos^2 x = 1 \tag{2}$$

4. Draw a graph of the function,

$$z = \exp(-0.5t)\cos(20t - 6) \tag{3}$$

for $0 \leq t \leq 8$.

5. Draw a graph of the function,

$$y = -x\exp(-x) \tag{4}$$

for $0 \leq x \leq 10$.

6. Biomedical engineers often design instrumentation to measure physiological processes, such as blood pressure. To do this, they must develop mathematical models of the process. The following equation is a specific case of one model used to describe the blood pressure in the aorta during systole (the period following the closure of the heart's aortic valve). The variable t represents time in seconds and the dimensionless variable y represents the pressure the aortic valve, normalized by a constant reference pressure.

$$y(t) = e^{-8t} \sin\,(9.7t + \frac{\pi}{2}). \tag{5}$$

Plot this function for,

$$t \geq 0. \tag{6}$$

7. Plot the two curves

$$y \;=\; \cos x, \quad \text{and} \tag{7}$$

$$y \;=\; x \tag{8}$$

over the range $x \in [0, 3]$ in the same figure and use the curves to find the solution of the equation $x = \cos x$.

8. Suppose the relationship between the dependent variable y and the independent variable x is given by,

$$y = ae^{-x} + b \tag{9}$$

where a and b are constants. Sketch a curve of y versus x using arbitrary values of a and b. Is it possible to obtain a straight line that represents this functional relationship? If yes, draw the graph of such a straight line.

9. Suppose a rocket is fired into the space from rest. The distance covered (in miles) by the rocket and the height gained (in miles) is given in the table below,

Distance (miles)	0	1	2	3	4	5	6	7	8	9	10	11	12
Height (miles)	0	0.53	0.75	0.92	1.07	1.20	1.31	1.41	1.51	1.60	1.69	1.77	1.85

TABLE II: Height of a rocket versus Distance.

Plot the graph of distance against height and perform curve fitting using an equation,

$$y = a\sqrt{bx} \tag{10}$$