Beam deflection curves via superposition
ME345 – Modeling and Simulation

Problem Statement.
In Figure 1 you are given beam deflections and slopes for a variety of cantilevered loading conditions. Taking advantage of the principle of superposition, develop a MATLAB code that will allow the user to enter in an arbitrary number of point and distributed loads for a cantilevered beam (Case 1 and 2 in the Figure) and plot the elastic curve and the curve for the unloaded beam.

Note that point loads do NOT necessarily need to be located at the end of the beam, and that distributed loads do NOT need to extend the length of the beam (as discussed in class). Also, output the location and magnitude of the maximum deflection in the beam. You should assume sensible beam parameters.

You are **strongly** recommended to proceed by breaking the problem into smaller bits and incrementally enhancing the capability of the program.

To eventually be turned in:

- Your Matlab code, which should have sufficient comment lines so that someone can understand how you are solving the problem.
- Discuss the parameters you chose for the beam and why they were selected.
- A short (2 page max) report showing representative plots from your program. Discuss briefly how you solved the problem, **and more importantly, test cases that you ran to ensure that your program was working properly**.
- Include in your discussion what, if any, assumptions are incorporated into the development of the expressions given in Figure 1. (Consult your Strength of Materials text if necessary.)

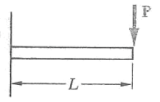
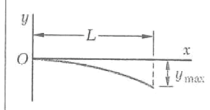
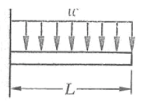
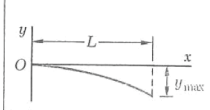
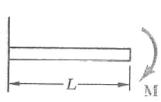
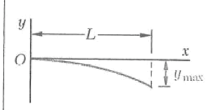
Beam and Loading	Elastic Curve	Maximum Deflection	Slope at End	Equation of Elastic Curve
1 		$-\frac{PL^3}{3EI}$	$-\frac{PL^2}{2EI}$	$y = \frac{P}{6EI}(x^3 - 3Lx^2)$
2 		$-\frac{wL^4}{8EI}$	$-\frac{wL^3}{6EI}$	$y = -\frac{w}{24EI}(x^4 - 4Lx^3 + 6L^2x^2)$
3 		$-\frac{ML^2}{2EI}$	$-\frac{ML}{EI}$	$y = -\frac{M}{2EI}x^2$

Figure 1. Beam deflections and slopes for a cantilever beam.