Remember to adequately label all plots and include any MATLAB scripts and functions with your solutions. A clear and complete presentation of your solutions is required for full credit.

1. Write a MATLAB function with the declaration `function cobweb(g,a,b,x0,kmax)` that plots the function `g` on the interval [`a`, `b`] along with the cobweb diagram showing `kmax` fixed point iterations of `g` starting at `x0`. Examples of the function output are shown in Figures 2 and 3. Turn in the code for your function and perform or answer the following.
   (a) Use your function to plot the cobweb diagrams for $g_1(x) = \cos(x)$ and $g_2(x) = \cos(x) + 2$ starting with any points of your choice.
   (b) Explain why both iterations must converge if x_0 is sufficiently close to the fixed point.
   (c) Do you observe a difference between the convergence rates for g_1 and g_2? Explain.
   (d) Do you expect the iterations for g_1 and g_2 to be globally convergent? Explain.
2. Sauer, Section 1.4, Exercise 8.
3. Sauer, Section 1.4, Computer Problem 9.
4. Consider the four-bar planar linkage $ABCD$ shown in the Figure 1, where the four rods have lengths $AB = a_1 = 10$, $BC = a_2 = 2$, $CD = a_3 = 7$, and $DA = a_4 = 6$. This is a planar linkage system, and it can exist in various shapes. Variation of the angle α results in variation of the angle β, with the two angles related by

$$\frac{a_1}{a_2}\cos\beta - \frac{a_1}{a_4}\cos\alpha - \cos(\beta - \alpha) = -\frac{a_1^2 + a_2^2 - a_3^2 + a_4^2}{2\,a_2 a_4}.$$

   Use the Newton iteration to solve this problem for $\alpha \in [0, 2\pi]$ to a tolerance of 10^{-6}. For this arrangement and for each value of α in the given range, there are two possible values of β. Use an initial value $\beta_0 = -\pi/2$ for β to ensure that you get β in the same contiguous range. Plot the position-dependent midpoint of rod a_3 as α takes values in the interval $[0, 2\pi]$.

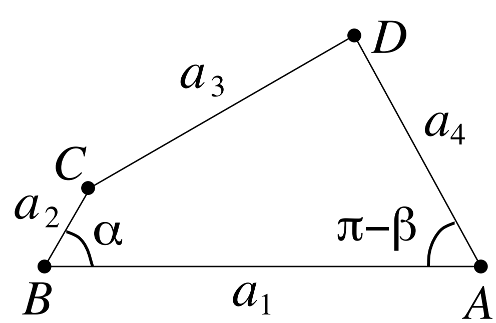

Figure 1: A four-bar planar linkage. The bottom bar a_1 remains fixed, but all joints are flexible.

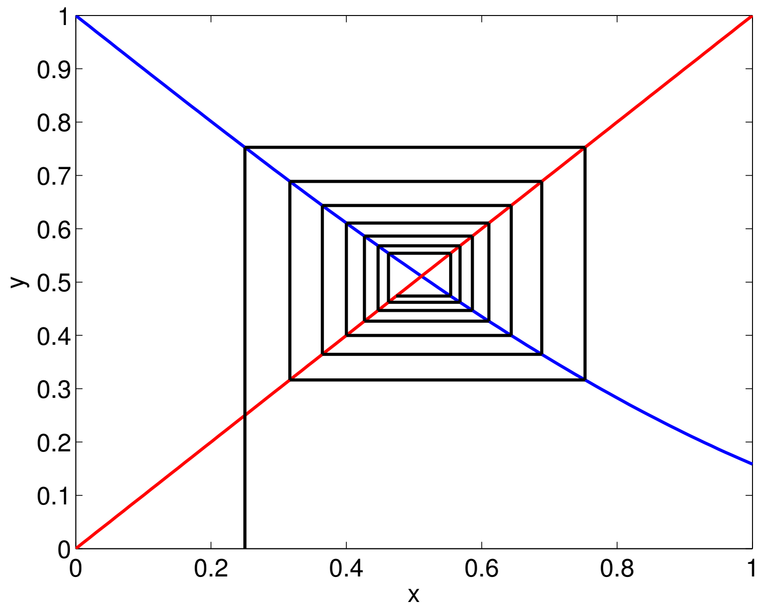

Figure 2: Example output of `cobweb` with $g(x) = 1 - \sin(x)$ and $x_0 = 0.25$.

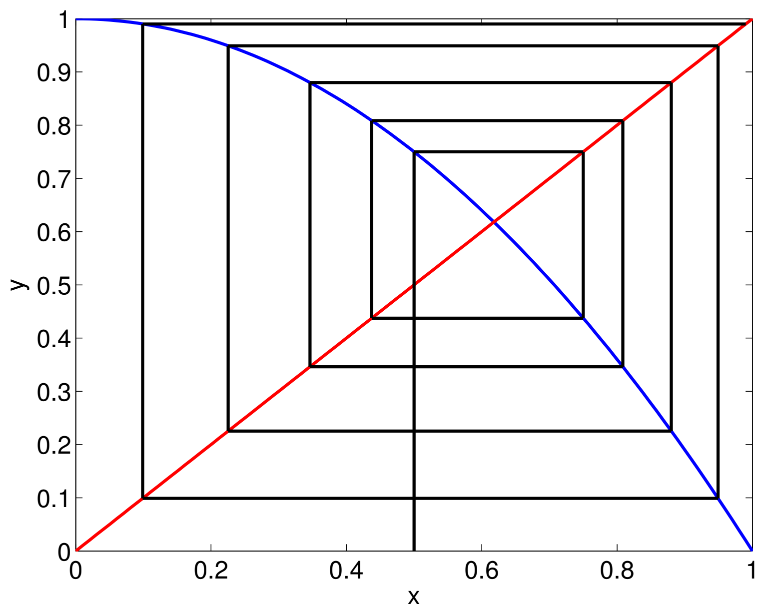

Figure 3: Example output of `cobweb` with $g(x) = 1 - x^2$ and $x_0 = 0.5$.