Name: _____

Date: _____

Collaborators: _____

(Collaborators submit their individually written assignments together)

Question:	1	2	3	Total
Points:	35	20	10	65
Score:				

Instructor/grader comments:

Nonlinear equations

1. Two ladders crisscross an alley of unknown width W. Each ladder reaches from the base of one wall to some point on the opposite wall. The ladders cross at a height H above the pavement. Find W given that the lengths of the ladders are $L_1 = 20$ and $L_2 = 30$ and that $H = 8$. (Lengths are in some arbitrary units.)

   (a) (10 points) Derive the equation which root gives the value of W,

   $$f(W, L_1, L_2, H) = 0.$$

   Describe your derivation in the README.md file.

   Hints: the triangles ABE and DBC are similar; so are the triangles ABF and ADC.

   (b) (5 points) Write a matlab function of a single variable, `a11ey(w)`, that returns the values of $f(W)$. Include the values of the parameters L_1, L_2, and H into the code of your function.

   (c) (20 points) Write a matlab script (call it e.g. **hw06p1.m**) that solves the equation $F(W) = 0$ using the bisection method with $tol = 10^{-10}$.

   Use the code that we developed in class.

   Since $0 \le W \le \min(L_1, L_2)$ it is reasonable to choose exactly those boundaries for the bisection method.

2. Find the height, H, reached by $V_0 = 1.1$ m^3 of water stored in a spherical tank of radius $R = 1.0$ m. Give your answer with the tolerance of 1 mm.

   Hints: Note that the tank is less then half full, that is $0 < H < R$.

   The volume of the spherical segment of the "depth" H, $H \le R$ is

   $$V(R, H) = \pi H^2 \left(R - \frac{H}{3} \right),$$

where R is the radius of the sphere.

(a) (5 points) Write a matlab function of a single variable, `sphsegment(w)`, that returns the values of $V(R,H) - V_0$. Include the values of the parameters V_0 and R into the code of your function.

(b) (15 points) Write a matlab script (call it e.g. **hw06p2.m**) that solves the equation using the bisection method with the required precision.

Gitlab

3. (10 points) Create a gitlab project called **hw06** (name it exactly as shown). Upload **all** matlab files that are required to run your code. Share the project with the instructor and the TA and grant them **Reporter** privileges.