Name: _____

Date: _____

Collaborators: _____

(If applicable, collaborators submit their individually written assignments together)

Question:	1	2	3	Total
Points:	30	25	10	65
Score:				

Instructor/grader comments:

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.)

   Hint: the equation that determines the width of the alley is as following:

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

   where

   $$f(W, L_1, L_2, H) = \frac{1}{H} - \frac{1}{\sqrt{L_1^2 - W^2}} - \frac{1}{\sqrt{L_2^2 - W^2}}.$$

   For the reference,

   $$\frac{\mathrm{d}f}{\mathrm{d}W} = -\frac{W}{\sqrt{(L_1^2 - W^2)^3}} - \frac{W}{\sqrt{(L_2^2 - W^2)^3}}$$

   (a) (5 points) Write a matlab function, `hw08p1alley(w, l1, l2, h)`, that returns the values of $f(W, L_1, L_2, H)$. Place it in its own matlab file. Provide a help string for your function.

   (b) (5 points) Write a matlab function, `hw08p1alleyd(w, l1, l2, h)`, that returns the values of $\mathrm{d}f/\mathrm{d}W$. Place it in its own matlab file. Provide a help string for your function.

   (c) (20 points) Write a matlab script (call it e.g. **hw08p1.m**) that (a) initializes the values of the parameters L_1, L_2, and H; (b) prints the help texts for `hw08p1alley` and `hw08p1alleyd` (c) defines an anonymous functions of a single variable, `ff(w)`, that itself uses `hw08p1alley(w, l1, l2, h)` and `ffd(w)` uses `hw08p1alleyd(w, l1, l2, h)` ; (c) solves the equation $ff(w) = 0$ using the Newton's method.

   Use the code for the Newton's method that we developed in class. Place the commands `clear`, and `format compact` at the top of your script.

   Specify your initial approximation for W and your final answer in your README.md file.

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.

   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(h)`, 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) (5 points) Write a matlab function of a single variable, `sphsegmentd(h)`, that returns the derivative of $V(R,H) - V_0$ with respect to H. Include the values of the parameters V_0 and R into the code of your function.

(c) (15 points) Write a matlab script (call it e.g. **hw08p2.m**) that solves the equation using the Newton's method with the height of the water in the tank.

Gitlab

3. (10 points) Create a gitlab project called **hw08** (name it exactly as shown). Upload **all** matlab files that are required to run your code. Create README.md file - leave it empty if appropriate. Share the project with the instructor (gitlab user name `m3510_21f_in`) and the TA (gitlab user name `m3510_21f_ta`) and grant them the **Reporter** privileges.