MATH 3511	HW 7	Due: Thu Apr 23, 2020
Name:		
Date:		
Collaborators:		

(Collaborators submit their individually written assignments together)

- Do not submit a paper copy (or a scan of it) of your assignment
- Share your gitlab submission with the instructor and the grader
- No late homework will be accepted

Question:	1	2	3	Total
Points:	30	20	10	60
Score:				

Instructor/grader comments:

Finite elements

1. (a) (15 points) (pen and paper problem) You want to solve the differential equation

$$-(c(x)u'(x))' + s(x)u(x) = f(x), \qquad a \le x \le b,$$

with the boundary conditions

$$u(a) = \alpha$$
, $u(b) = \beta$.

Find constants p and q such that the function

$$v(x) = u(x) + px + q$$

satisfies the BVP above except that v(a) = v(b) = 0 and f(x) is replaced by a different function.

Write your answer for *p*, *q*, and f(x) in the README.md file.

(b) (15 points) Use finite elements method and the results of Part (a) of this problem to solve the following BVP:

$$-u'' + u = -8 + 16x^2 - x^4, \quad u(0) = 0, u(1) = 3.$$

Plot your solution for n = 100 nodes along with the exact solution $u(x) = x^2(4-x^2)$. Plot the error of your solution on another graph. Place the code you wrote for this part of the homework into a matlab file **hw07p1b.m**

Finite difference

2. (20 points) Use finite differences to solve the following boundary value problem:

 $x u'' + u' + x u = -x[4\sin(x) + 5x\cos(x)], \quad u(0) = 0, \quad u(\pi/2) = -\pi^2/4.$

Plot the solution and its error as a function of *x*. The exact solution of the BVP is $u(x) = -x^2 \sin(x)$.

Place the code you wrote for this part of the homework into a matlab file hw07p2.m

Gitlab

3. (10 points) Create a gitlab project called **hw07** (name it exactly as shown). Upload **all** required matlab code and create your README.md file. **Chose a suitable license.** Share the project with the instructor and the grader.