PASS
PEER ASSISTED STUDY SESSIONS

FACIL: Neil Douglas **WEEK:** 2

EMAIL: neildouglas@cmail.carleton.ca **OFFICE:** CSAS, 4th Floor MacOdrum Library

COURSE: ECOR 2606 **OFFICE HOURS:** Fridays 3:00 pm to 4:00 pm

Opener:

- Introduce yourself!
- Core concepts covered in this workshop:
  - Making MATLAB expressions vector-friendly
  - Root-finding
  - Other MATLAB basics

Problem 1: Making MATLAB expressions vector-friendly

When writing mathematical expressions in MATLAB you will sometimes need to place a "." before multiplication (*), division (/) and exponent (^) symbols in order to make the expression vector-friendly. Vector-friendly code evaluates vectors element-by-element.

(a) Fill in the table below by placing a dot where it is required to make an expression vector-friendly in MATLAB. (Keep in mind that for this table we are assuming that x and y are vectors of the same size; for example, x=[1 2 3] and y=[10 8 5]).

	Scalar op. Vector	**Vector op. Scalar**	**Vector op. Vector**
*	3_*x Dot required?	x_*pi Dot required?	x_*y Dot required?
/	16_/x Dot required?	x_/8 Dot required?	y_/x Dot required?
^	exp(2)_^x Dot required?	x_^99 Dot required?	x_^y Dot required?

(b) Are the following MATLAB expressions vector-friendly and without any unnecessary dots? If not, change them so that they are vector-friendly and without any unnecessary dots. Vectors x and y are still vectors of the same size.

(i) a = (9*x+2)*(x.^y+x./4-2*2);

(ii) p=(x.+y).*((y./2+(x.^2).^y).*2);

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Problem 2: Root-finding

(a) Tony Hawk makes a jump off of a 20-m high ramp and his height (h), in metres, is represented throughout his trajectory by $h = -2x^2 + 8x + 20$, where x is the horizontal distance, in metres, that he has travelled away from the ramp. This kind of jump is impossible to land, even for Tony Hawk, so we need to determine where to place a 3-m tall bouncy castle to cushion his fall.

Take a moment to draw the graph that models this problem.

Now, we will be doing a Kahoot quiz to answer some questions related to this problem.

Question 1: Which of the following is the function h in the correct root-finding form for solving this particular problem?

(a) h(x) = 0;

(b) $-2x^2 + 8x + 20 = 0$;

(c) $-2x^2 + 8x + 20 = 3$;

(d) $-2x^2 + 8x + 17 = 0$;

Question 2: Which of the following is the required anonymous function as it would appear in MATLAB?

(a) f=@(x) -2*x.^2+8*x+17;

(b) f= -2*x.^2+8*x+17;

(c) f=@(h) -2*x.^2+8*x+17;

(d) The answer to Q.1 is already structured as an anonymous function

Question 3: What does the positive root of the chosen anonymous function represent?

(a) The height which Tony Hawk will be at when he hits the bouncy castle
(b) The horizontal distance, in metres, away from the ramp that Tony Hawk will hit the ground
(c) The horizontal distance, in metres, away from the ramp that the bouncy castle needs to be placed to cushion Hawk's fall
(d) The amount of time that it will take for Tony Hawk to reach the bouncy castle

Question 4: In MATLAB, which command would you use to solve for the root of the chosen anonymous function?

(a) fzero

(b) roots

(c) The quadratic formula

(d) Either a or b

Question 5: At this point, what MATLAB code is still needed to find the root of our anonymous function?

(a) castle_dist = roots(f)

(b) castle_dist = roots(f,[0,40])

(c) coeff_f = [-2 8 17];

castle_dist = roots(coeff_f)

(d) coeff_f = [-2 8 17];

castle_dist = roots(f,[0,40])

Use the space below to write out the completed code for this problem.

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(b) Use what you learned about root-finding in Part (a) to solve the following problems.

(i) Write the MATLAB code needed to find the root between r=0 and r=1 of the following function.

$$p = r(r+1)(r-3)(r+4) + 3$$

(ii) Write the MATLAB code needed to find the lowest possible positive value of x that will make the following function equal to 2. Only use methods taught in the course so far.

$$y = 5\sin(\pi x) - \cos(x)$$

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Problem 3: Some MATLAB basics

Write the required MATLAB code for the following.

Make two vectors: vector v1 should consist of ten evenly spaced values from 1 to 100 (inclusive) and vector v2 should consist of ten evenly spaced values from 1 to 10 (inclusive). Make sure each of these vectors are created efficiently (i.e., don't manually write out a vector with 10 values in it), and use a different method to create each vector if you can.

Then evaluate the function $y = 5x^3 + 2x - 1$ at each of these vector values, and have MATLAB output the second value in each of these resulting vectors to three decimal places and in the following format:

"The second value in the vector resulting from the evaluation of y at vector v1 is ____.

The second value in the vector resulting from the evaluation of y at vector v2 is ____."

Bonus Problem: How do you find out the x values at which $y = x^2 + 3x^2 - 4$ and $y = -10x^2 - x + 2$ intersect? Only use methods taught in the course so far.

Closer:

- Did we miss anything important from this past week?
- Feedback

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