

Math 155B - Spring 2020 - Quiz #5 - May 12-13, 2020 - 15 minutes

**Instructions:** Read completely before starting!

- You will hand in your answer to the question on the next page as the answer to problem 1 on Gradescope.
- You will hand in this cover page (or other statement of Academic Integrity along with the start and stop time) as the answer to problem 2 on Gradescope.
- You may (1) print out the quiz and write answers on the printed sheet, or (2) use a tablet to write on the PDF file, or (3) write answers on a blank sheet of paper (preferably white, unlined printer paper). You have 15 minutes after you start.
- **BEFORE YOU START:** Write the start time in the space below. (Do this after you have printed out the quiz, but before you start thinking about or working on the question.)
- **WHEN YOU STOP:** Write the stop time in the space below. The total time should be at most 15 minutes. If it is over 18 minutes, explain in the comments below.
- **AFTER YOU STOP:** Sign the Academic Integrity Acknowledgement below.
- Convert your written answers to a PDF file.
- **UPLOAD TO GRADESCOPE – IMMEDIATELY AFTER THE STOP TIME:** Upload the answer to problem 1, and then this signed cover page as the answer to problem 2. If there are problems uploading, please explain in the comment section.
- If you modify any answers after the “STOP TIME”, that is, while preparing to upload, please explain in the comments below.

Academic Integrity Guidelines: **You must work this quiz on your own. There is NO “cheat sheet”. You may not use any notes, textbook, online resources, or resources of any kind. You may neither receive help nor provide help on this quiz.**

START TIME:

STOP TIME:

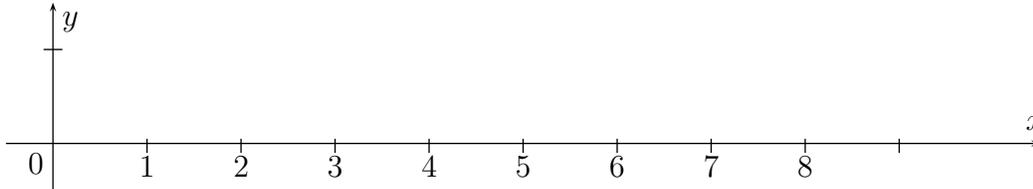
ACADEMIC INTEGRITY: I understood and abided by the academic integrity guidelines.

SIGNED: \_\_\_\_\_

Comments (optional):

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1. Consider the knot vector  $[0, 0, 0, 0, 1, 2, 3, 4, 5, 5, 5, 6, 6, 7, 8, 8, 8, 8]$  with 18 knots  $u_0, \dots, u_{17}$ . E.g.,  $u_5 = 2$  and  $u_7 = 4$  and  $u_{13} = 7$ . Let this define a **degree three** (order four) B-spline curve  $\mathbf{q}(u)$  with  $n + 1$  control points  $\mathbf{p}_0, \dots, \mathbf{p}_{13}$ .



- a. For what values  $i$  and  $j$  must  $\mathbf{q}(u_i) = \mathbf{p}_j$ ?
- b. At what values  $u_i$  might  $\mathbf{q}'(u_i)$  be discontinuous?
- c. At what values  $u_i$  might  $\mathbf{q}''(u_i)$  be discontinuous?
- d. Give the general formula for the control points  $\mathbf{p}_j^*$  of the B-spline representation of  $\mathbf{q}'(u)$ .
- e. What is the value of  $\mathbf{q}'(6)$ ? Express your answer in terms of the  $\mathbf{p}_j$ 's.