MATH 2173 – Engineering Calculus B – Practice Midterm 1 Version 1

Name:____ February 17, 2021

Procedures for the exam: Please log on to the Main Lecture Zoom room by **10:15 am ET**. You will be split into a breakout room with one of the moderators.
`https://osu.zoom.us/j/96249977566?pwd=Wk5jN1k5c2JmZkZEUTRVOHNhOUJDdz09`
Zoom Meeting ID: 962 4997 7566, Password: 650807

At **10:20 am ET**, the exam will be made available on the Carmen Homepage. At this time, you may download the exam and immediately begin working. You may download, complete, and submit the assignment using an ipad or other tablet device. You may also do your work on paper and then scan and submit your work. If you choose the first option, please use the exam template for your work. If you choose the second option, be sure to clearly label your work. If you have questions throughout the exam, you can direct message your moderator using the chat feature in Zoom.

When you have completed the exam, you should send a message to your moderator letting them know that you are no longer writing and are beginning to submit. You may then submit to Gradescope. You must submit the exam to Gradescope by **11:15 am ET**. If you have not finished by 11:10 am ET, an announcement will be made letting you know that you must now begin submitting. In other words, you should spend approximately 50 minutes working on the exam with the remaining five minutes left for submitting the exam.

Exam rules: In order to get credit for the exam, you must be in the Main Lecture Zoom room for the duration of the exam with your webcam on. No books, no notes, no calculators, and no internet resources may be used to complete the exam.

You must show your work. Work on the scrap work page will not be graded unless you indicate otherwise. Your work must be legible, and your final answers must be reasonably simplified.

On some problems, you are asked to use a specific method to solve the problem. On all other problems, you may use any method we've covered. You may not use methods we have not covered.

If at any point you experience technical difficulties, you must immediately e-mail both Dr. Skipper and your recitation instructor. Your email **must** include a complete copy of your exam, even if that is just in the form of photographs taken on your phone.

Unlike the recitation handouts, you are permitted to append additional pages directly after the problem they are for instead of following the template. The template formatting is optional for this exam.

Good luck!

Problem 1 (6 points): Below is a contour plot of some function $z = f(x, y)$ along with 4 vectors.

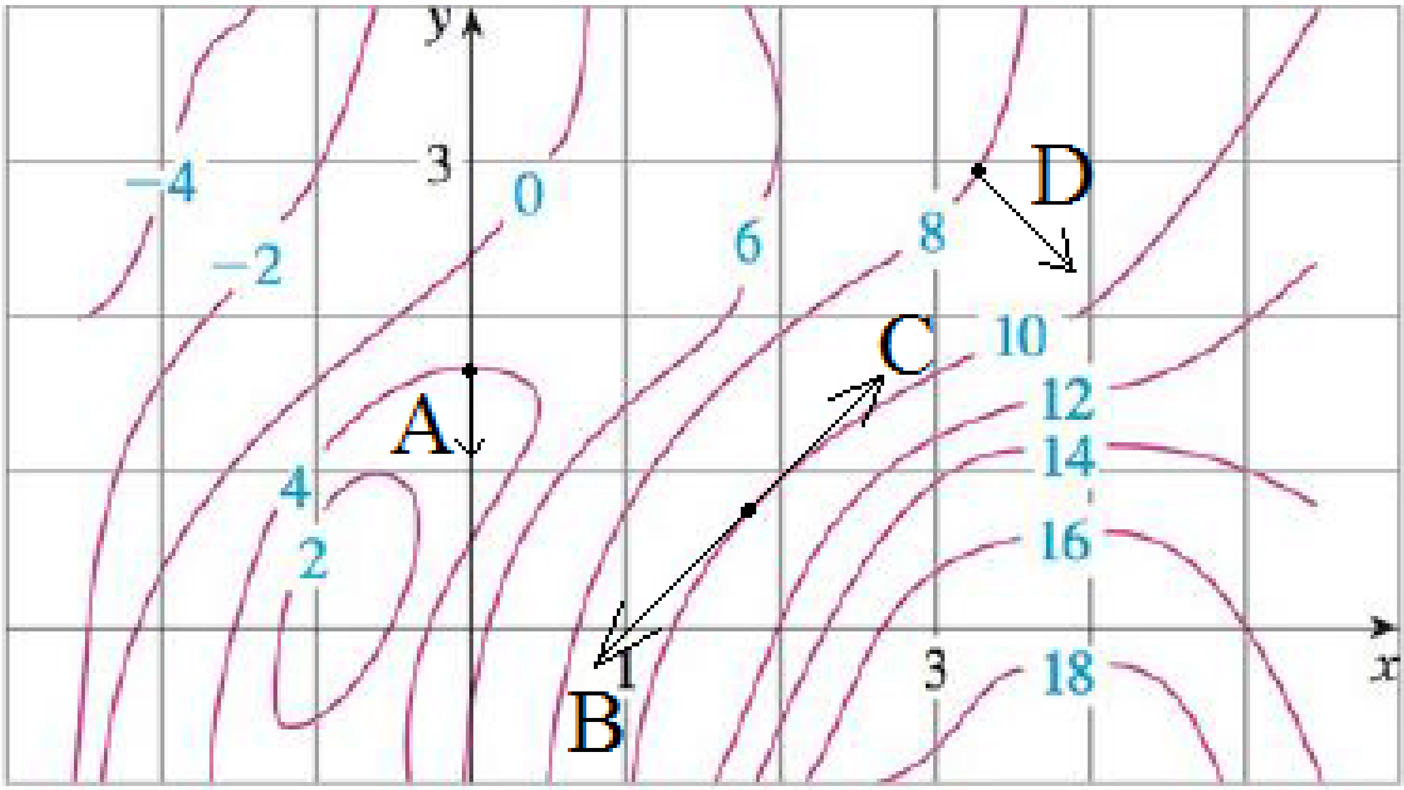

FIGURE 1. Contour plot of $z = f(x, y)$.

Which of the vectors in the above plot could possibly be a gradient vector of the function $f(x, y)$? Please circle all that apply.

(A)

(B)

(C)

(D)

None of the vectors could possibly be a gradient vector for $f(x, y)$.

Problem 2 (14 points): Consider the function $f(x, y) = x^2 + y^2$ and and the point $P = (2, 3)$.

(a) Find the unit vector that points in direction of maximum decrease of the function f at the point P.

(b) Calculate the directional derivative of f at the point P in the direction of the vector $\vec{u} = \langle 3, 2\rangle$.

Our work for the problem 2 is continued on page

Problem 3 (14 points): Determine all critical points of the function $f(x, y) = x^3 - y^3 + xy$, then classify each of the critical points as a local maximum, local minimum, or saddle point.

Our work for the problem 3 is continued on page

Problem 4 (22 points): Find the absolute minimum and absolute maximum values of the function $f(x, y) = xy$ over the region $R = \{(x, y) \mid (x-1)^2 + y^2 \leq 1\}$.

Our work for the problem 4 is continued on page

Problem 5 (22 points): Let R be the region that is bounded by both branches of $y = \frac{1}{x}$, the line $y = x + \frac{3}{2}$, and the line $y = x - \frac{3}{2}$. Sketch a picture of the region R, then write a sum of double integrals that would calculate the area of R. DO NOT EVALUATE THE INTEGRALS.

Our work for the problem 5 is continued on page

Problem 6 (22 points): Let R be the region in the xy-plane that is bounded by the spiral $r = \theta$ for $0 \leq \theta \leq \pi$ and the x-axis. Find the volume of the 3-dimensional solid S that lies above the region R and underneath the surface $z = x^2 + y^2$.

Our work for the problem 6 is continued on page

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