MATH 2173 – Engineering Calculus B – Practice Midterm 2

Name:_____ March 29, 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. Unlike the recitation handouts and midterm 1 if you require additional pages to show your work for a given problem, include those pages in order immediately after the problem they pertain to. When you submit your exam to gradescope you are then required to mark the pages of your exam that correspond to the various problems on the exam. Video instructions for how to do this can be found here for the afternoon lecture and here for the morning lecture. 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.
Good luck!

Modified Problem 14.5.49 (8+15 points): Let S be the solid region in the first octant outside the cone $\varphi = \frac{\pi}{4}$ and inside the sphere $\rho = 4\cos(\varphi)$.

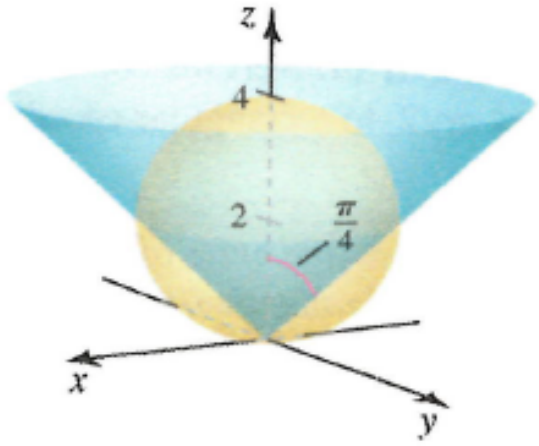


FIGURE 1. The unmodified picture of S from the textbook.

a. Set up but do not evaluate a triple integral in spherical coordinates to find volume of S.

b. Set up but do not evaluate a triple integral in cylindrical coordinates to find volume of S.

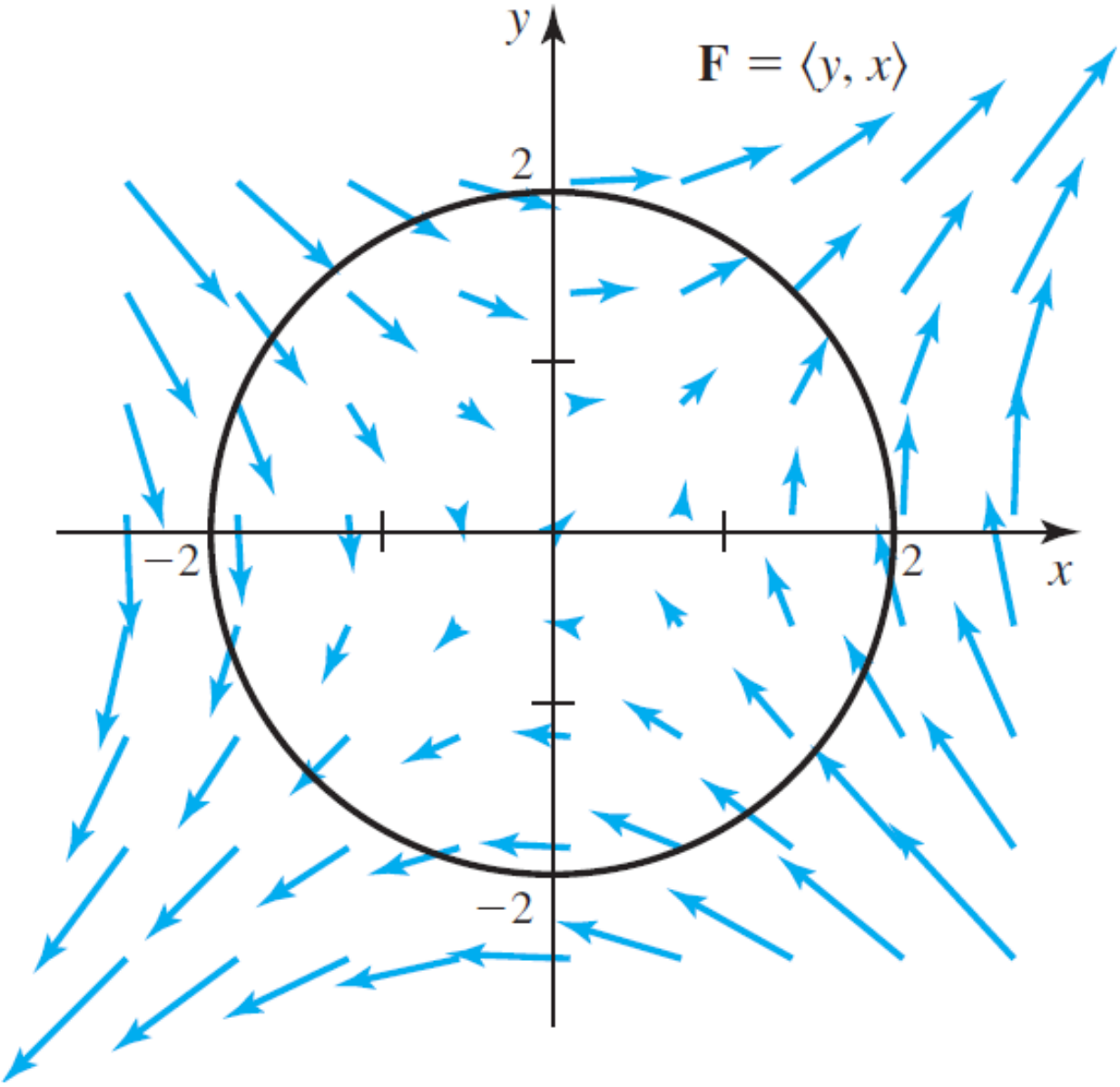
Modified Problem 14.R.77 (25 points): Let R be the region in the first quadrant bounded by the hyperbolas $xy = 1$ and $xy = 4$ and the lines $y = x$ and $y = 3x$. Evaluate

(1) $$\iint_R y^4 dA.$$

Problem 15.2.21 (18 points): Find the average value of the function $f(x, y) = x + 2y$ on the line segment from $(1, 1)$ to $(2, 5)$.

Problem 15.2.43 (14 points): Given the force field $\mathbf{F}(x, y, z) = \langle x, y, z \rangle$, find the work required to move an object around the tilted ellipse that is parameterized by $\mathbf{r}(t) = \langle 4\cos(t), 4\sin(t), 4\cos(t) \rangle$, $0 \leq t \leq 2\pi$.

Problem 15.2.66 (20 points): Consider the flow field $\mathbf{F} = \langle y, x \rangle$ shown in the figure below.



a. Compute the outward flux across the quarter circle C:$\mathbf{r}(t) = \langle 2\cos(t), 2\sin(t) \rangle$, $0 \leq t \leq \frac{\pi}{2}$.

b. Compute the outward flux across the quarter circle C:$\mathbf{r}(t) = \langle 2\cos(t), 2\sin(t) \rangle$, $\frac{\pi}{2} \leq t \leq \pi$.

c. Explain why the flux across the quarter circle in the third quadrant equals the flux computed in part **a**.

d. Explain why the flux across the quarter circle in the fourth quadrant equals the flux computed in part **b**.

e. What is the outward flux across the full circle?