Math 226 Final Exam
Fa25
Wed Dec 10

Firstname Lastname: _____

USC Email: _____ UscID: _____

Instructions.

- This examination consists of 19 pages not including this cover page.
- Write your initials in the designated spot at the top–right of each page that contains work which you would like to have graded.
- This examination consists of 9 questions for a total of 100 points. You have 120 minutes to complete this examination.
- Do not use books, calculators, computers, tablets, or phones.
- You may use a single 8.5 in by 11 in page of notes, handwritten on both sides.
- Write legibly in the boxed area only. Cross out any work that you do not wish to have scored.
- Show all of your work and cite theorems you use. Unsupported answers may not earn credit.
- If you run out of space: there is an extra page after each problem, and one extra page at the end. Please indicate on the page containing the original question when you are continuing your work on another page.
- All work you submit should represent your own thoughts and ideas. If the graders suspect otherwise: you can expect your instructor to file a report with USCs Office of Academic Integrity (OAI).

Circle your instructor: Prof Geske Prof Haine Prof Reyes Souto Prof Ziane

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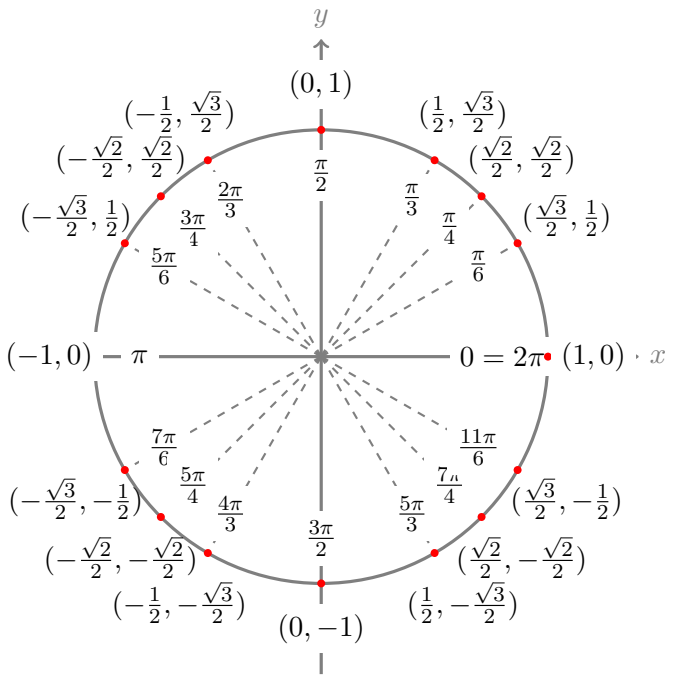
Question:	1	2	3	4	5	6	7	8	9	Total
Points:	10	12	10	10	10	10	12	12	14	100



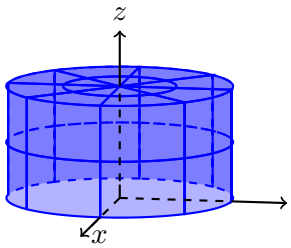
$$\cos^2\theta = \tfrac{1}{2}(1+\cos 2\theta)$$

$$\sin^2\theta = \tfrac{1}{2}(1-\cos 2\theta)$$

$$\sin 2\theta = 2\sin\theta\cos\theta$$

3. (10 points) Use Lagrange multipliers to find the maximum and minimum values of $f(x, y) = x^2y + 1$ subject to $2x^2 + 4y^2 = 3$.

9. (14 points) Let $\mathcal{S}$ consist of the cylinder defined by $x^2 + y^2 = 1$ with $0 \leq z \leq 1$ along with its **top** $x^2 + y^2 \leq 1$ with $z = 1$. Orient $\mathcal{S}$ with outward normals.



$\mathcal{S}$ (top included, bottom not included)

(a) The surface $\mathcal{S}$ is not closed. Describe the simplest surface $\mathcal{B}$ that you would have to join to $\mathcal{S}$ to obtain a closed surface. To be compatible with outward normals for the closed surface: should the normals to $\mathcal{B}$ point up or down?

(b) Find $\iint_{\mathcal{B}} \mathbf{F} \cdot d\mathbf{S}$ where $\mathcal{B}$ is from part (a) and:

$$\mathbf{F} = \left(x + ye^{z^3}\right)\mathbf{i} + \left(z^2\cos(x^2) - y\right)\mathbf{j} + \left(1 + z\right)\mathbf{k}$$

(c) Using a combination of the divergence theorem and your earlier work, find:

$$\iint_{\mathcal{S}} \mathbf{F} \cdot d\mathbf{S}$$

where $\mathbf{F}$ is from part (b) and $\mathcal{S}$ is from the top of the page.