Your name is: ______________________

Your student ID number is: ________________

Please circle your discussion:
   B01  B02  B03  B04  B05  B06  B07

Instructions:

1. After you print the final template, *clearly print* your name and student ID in the space above, and *circle* the discussion section you are in.

2. Before the exam, you are expected to carefully *read* the document “Information for the Final Examination” posted on the course web page, and get familiar with the Final Format and Procedure as well as Rules for the Final Exam written therein.

3. On the exam, show all your work clearly and in order on the template you have printed.
   You are expected to *justify* and *simplify* all answers unless the problem asks you not to.

4. If you use trig substitution, indicate the range of $\theta$. Also, you should not leave expressions like $\cos(\arcsin x)$ in your final answers.

5. For problems that ask you to set up integrals, you are expected to describe how you find the integrals, e.g., rewriting functions, finding radii.

6. There are 9 problems in total on pages 2–9. The last page (10) is intentionally left blank.
   You may use it if more space is needed for some of the problems. However, you *must* clearly indicate that you have done so under the original problem in order to get your solutions graded.

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1 (64 pts.) Evaluate the following integrals. Consider them as improper integrals where appropriate, and state clearly when and why you are doing so. State it if an improper integral diverges. Clearly indicate which $u$ you use when using substitution method.

(a) 

(b) 

(c)
2 (12 pts.)
3 (28 pts.)

(a) 

(b) 

1. 

2.
4 (12 pts.)

5 (12 pts.)
6 (24 pts.)

(a)

1.

2.

(b)
7 (24 pts.)

(a)

(b)

(c)
8 (12 pts.) Replace the polar equation

with equivalent Cartesian equation. Then describe the graph.

9 (12 pts.)