

The following is checklist of skills you will likely need to be successful on midterm exam 1. If you don't feel solid on any of these topics, you should look in the book for example problems to work on, or inquire with Will or Adam for more detail.

1. Be able to express regions in 2D as type 1 and type 2 areas and set up iterated integrals for each.
2. Given an iterated integral, be able to infer what set D is being integrated over.
3. Probability: Given a probability density in two variables $p(x, y)$, be able to compute the probability of an event via integration, by determining what set D the event corresponds to and be able to compute the integral: $P(event) = \iint_D p dA$.
4. Be able to compute 2D integrals in polar coordinates when necessary.
5. Be able to set up 3D volume integrals in cartesian and spherical coordinates.
6. Be able to choose a change of variables to transform an integration over a complicated domain D by finding a function $\vec{r}(u, v) = (x(u, v), y(u, v))$ from a simple domain in the u - v plane into the x - y set D and find the area distortion factor.
7. Be able to compute the area of a surface S in 3D by finding a mapping $\vec{r}(u, v) = (x(u, v), y(u, v), z(u, v))$ and performing the required methods.
8. Know the definition of a gradient field and a potential function and how the fundamental theorem of line integrals applies to them.
9. Know the definition of independence of path, and conservative. What object do these words apply to? What kinds of things can you accomplish by knowing if they apply?
10. Be able to compute a straightforward work integral along a specified path C by finding an appropriate parameterization $\vec{r}(t)$ and setting up the integral.
11. Be able to determine if a given vector field $\vec{F}$, in either 2- or 3D, is conservative. In 2D, what is the test? In 3D, what is the test? (Answer: 2D: $Q_x - P_y = 0$ and smoothness of partials, no holes. In 3D: $Curl(\vec{F}) = \vec{0}$ and smoothness, no holes).
12. If a given 2D vector field $\vec{F} = (P, Q)$ is conservative, know the method to find the potential function f .
13. If you have the potential function f for $\vec{F}$, know how to compute the work moving from one point p_1 to another p_2 . Also, know the value of the work integral on a closed path C (i.e., a loop).
14. Suppose along and within a closed path C in 2D that the vector field $\vec{F} = (P, Q)$ exists and is smooth there. Know how to use Green's theorem to compute the work on that path C .
15. Know the definition and meaning of the Curl and Divergence operators on vector fields in 2- and 3D.
16. Know the essential identities $Curl(\nabla f) = ?$ and $Div(Curl(\vec{F})) = ?$.