Calculus 2 — Outline for Final Exam

Main ideas

A. Techniques of integration: u-sub.; integration by parts; trig. integrals; trig. sub.; partial fractions

B. Applications: area between curves; volume of a solid of revolution using disks/washers; arc length

C. Improper integrals

D. Sequences, series, and tests for convergence

E. Power series, representing functions with power series, and Maclaurin/Taylor series

F. Parametric equations

Skills you should have

1. Be able to compute definite and indefinite integrals using u-substitution and/or integration by parts

- Be able to choose an appropriate substitution (and choose again if it doesn't work)
- Be able to apply the integration by parts formula
- Remember, you might need to use a substitution and integration by parts to solve a problem

2. Be able to compute definite and indefinite integrals using trigonometric identities, trigonometric substitution, and/or partial fractions

- Be able to apply various trig. identities to help solve an integral
- Be able to recognize when trig. substitution might help and know which substitution to choose
- Be able to substitute back after finding an antiderivative using trig. substitution
- Be able perform partial fraction decompositions by recognizing the correct form and solving for the unknown variables

3. Be able to compute the area enclosed by curves

- Be able to sketch the region enclosed by curves and find the points of intersection.
- You will be allowed to use a graphing calculator (or website like Desmos), but you still need to know how to put everything together to sketch/shade the region and label points of intersection

4. Be able to compute the volume of a solid of revolution using the disk/washer method

- Remember that when using the disk/washer method, you need to work in terms of x when revolving about the x-axis and in terms of y when revolving about the y-axis

5. Be able to compute improper integrals

- Be able to recognize when an integral is improper and be able to set up the corresponding limits
- Be able to compute the limits after integrating—this may require various techniques for evaluating limits such as L'Hôpital's Rule

6. Be able to set up and compute the length of a curve given by some function $f(x)$ from $x = a$ to $x = b$

7. Know and be able to work with the *definition* of a series as a limit of partial sums
    - Be able to analyze a series by looking the partial sums. This can be complicated—you would only be asked to do this if the partial sums have a nice form.
8. Be able to recognize a geometric series and find what it converges to or show it diverges
9. Know the meaning of absolute convergence, conditional convergence, and divergence for series
10. Be able to determine if a series converges absolutely, converges conditionally, or diverges
    - If you notice the terms don't go to zero, start with the divergence test.
    - We usually test for absolute convergence first—good tests to start with are the ratio test or the comparison tests
    - If a series does not converge absolutely and has an alternating sign, try the alternating series test.
11. Be able to able to find the interval and radius of convergence for a power series
    - Typically start with the ratio test; usually need to check the "endpoints" using other tests
12. Be able to find the Maclaurin/Taylor series for a given function using the definition (i.e. by computing derivatives, evaluating them at a, and plugging them into the formula)
13. Be able to find a power series representation for a function
    - We start from a series we know, like the series for $\frac{1}{1-x}$, $\ln(1+x)$, $\arctan x$, e^x, $\sin x$, etc.
    - Techniques: substituting, multiplying by a number or power of x, differentiating, integrating
    - Be able to power series to compute limits and find antiderivatives (e.g. $\int e^{x^2}\,dx$)
14. Be able to work with parametric equations
    - Be able to determine xy-coordinates given a t-value
    - Be able to find all t-values when the curve passes through a given point (x, y)
    - Be able to find $\frac{dy}{dx}$ from parametric equations and be able to find equations of tangent lines

How to study

I. Review core topics

II. Work/rework problems all of the way through—focus on WeBWorK problems and Discussion questions

III. Talk with me if you have any questions at all!