Calculus & Analytic Geometry II

Review

1. antidifferentiation
2. integral
   (a) accumulation functions
   (b) definite integrals
   (c) Fundamental Theorem of Calculus parts 1 & 2
   (d) indefinite integrals
3. techniques of integration
   (a) substitution
   (b) by parts
   (c) trigonometric substitution
   (d) partial fractions
   (e) numerical approximations
4. applications of integrals
   (a) areas between curves
   (b) volumes of revolution (by slices, washers, shells)
   (c) work
   (d) average value of a function
   (e) arc length
   (f) surface area of revolution
   (g) center of mass
   (h) population models
5. differential equations
   (a) creating models based on rates of change
   (b) direction fields
   (c) equilibrium solutions
   (d) Euler's method
   (e) separable equations

Questions to Guide your Review

1. Can a function have more than one antiderivative? If so, how are the antiderivatives related?
2. What is the different between $\int f(t)dt$, $\int_a^x f(t)dt$, and $\int_a^b f(t)dt$?
3. What is an initial value problem? How do you solve one? Give and example.
4. What is a Riemann sum? Why might you want to consider such a sum?
5. How can you sometimes estimate quantities like distance traveled. area, and average value with finite sums? Why might you want to do so?
6. What is the relations between definite integral and area?
7. What is the average value of an integrable function over a closed interval? Must the function assume it average? Explain.
8. What is the Fundamental Theorem of Calculus? Why is it so important? Illustrate each part of the theorem with an example.
9. What does the Mean Value Theorem for Integrals say? How is it related to the Mean Value Theorem from last quarter?
10. How is integration by substitution related to the Chain Rule?
11. How do you define and calculate the area of a region between the graphs of two continuous functions?
12. How do you define and calculate the volumes of solids of revolution? How are the methods slicing by disk/washers and the method of cylindrical shells related? How are they different?
13. How do you calculate arc length? surface area?
14. When is a first order differential equation separable? How do you solve it?
15. How do you define and calculate the work done by a variable force along a portion of the x-axis? How do you calculate the work that it takes to pump a liquid from a tank?
16. What is a center of mass?
17. What is the formula for integration by parts? Where does it come from? Why might you want to use it?
18. What is the goal of the method of partial fractions?
19. How would you compare the relative merits of Simpson's Rule and the Trapezoid Rule?
20. What are improper integrals of Type I? Type II? How do you determine the convergence of such integrals?
21. What is the Comparison Theorem for improper integral?
22. When do you use trigonometric substitutions? Why are they sometimes called reverse substitutions?
23. What is a differential equation? What is the order of a differential equation? What is an initial condition?
24. What is a direction field for the differential equation $y' = F(x, y)$?
25. Explain how Euler's method works.
26. Write the logistic equation. Under what circumstances is this an appropriate model for population growth?