Calculus 2 Final Exam Study Guide

For the final exam, you should be able to:

1. Apply prerequisite skills such as graphing polynomial, exponential, natural log, sine, cosine and tangent functions, finding where functions intersect, etc.
2. Find the area between 2 curves. You may be asked to set up but not evaluate the integral(s).
3. Find volumes using cylindrical shells, washers, disks, or slicing. You may be asked to set up but not evaluate.
4. Find the average value of a function. You may be asked to set up but not evaluate the integral.
5. Integrate using integration by parts, trigonometric substitution, and partial fractions. Evaluate trigonometric integrals and improper integrals. Estimate integrals using the midpoint, trapezoidal and Simpson’s rule.
6. Determine whether a sequence converges or diverges.
7. Determine whether a series converges or diverges using the test for divergence (zero test), p series test, the geometric series, the comparison test, the limit comparison test, the integral test, the alternating series test, and the ratio or root test.
8. Find the sum of a telescoping series.
9. Estimate the sum of an alternating series and/or estimate the error when approximating an alternating series with a partial sum.
10. Find a power series representation for a function using
   a. The formula for series such as geometric series and binomial series. For more examples see Table 1 on page 762 of Section 11.10.
   b. Differentiation or integration
   c. The formula \( f(x) = \sum_{n=0}^{\infty} \frac{f^{(n)}(a)}{n!} (x-a)^n \).

   If asked to simplify the power series, this means that there should be no factors in front of the summation sign and there should only be one factor involving \( x \) or \( (x-a) \) raised to a power. For example, the power series
   \[
   \frac{x^2}{5} \sum_{n=0}^{\infty} \left(-\frac{x^7}{5}\right)^n
   \]
   should be simplified as
   \[
   \sum_{n=0}^{\infty} \left(-\frac{1}{5}\right)^n \cdot \frac{1}{5^{n+1}} = \sum_{n=0}^{\infty} \frac{(-1)^n \cdot x^{7n+2}}{5^{n+1}}.
   \]
11. Find the radius and/or interval of convergence of a power series.
12. Find arc length of a curve using Cartesian equations \( y = f(x) \) or \( x = g(y) \), parametric equations, or polar equations. You may be asked to set up but not evaluate the integral.
13. Find surface area (generated by rotating a curve) using Cartesian equations or parametric equations. You may be asked to set up but not evaluate the integral.
14. Find the area of a region bounded by polar curve(s). You may be asked to set up but not evaluate the integral.
15. Find a moment or center of mass.
16. Eliminate the parameter to find a Cartesian equation for a parametric curve.
17. Sketch a parametric equation and indicate the direction with an arrow. Find the first and second derivatives of a parametric curve. Find the equation of the tangent to a parametric curve.
18. Convert polar coordinates to Cartesian coordinates and vice-versa. Find a Cartesian equation for a curve represented by a polar equation and vice-versa.
19. Sketch a polar graph, find the slopes of tangent lines of a given a polar curve, and find the point(s) of intersection of given polar curves.
Here are some problems that you could use for practice:

1. Section 6.1: 21, 23, 25
2. Section 6.2: 11, 23, 59
3. Section 6.3: 15, 37, 39
4. Section 6.5: 9
5. Section 7.1: 37, 39, 41, 45
6. Section 7.2: 7, 19, 29, 35
7. Section 7.3: 5, 9, 11, 13, 37
8. Section 7.4: 15, 19, 21, 23, 25
9. Section 7.5: 15, 21, 39, 45
10. Section 7.7: 11
11. Section 7.8: 17, 29, 31, 35
12. Section 11.1: 41, 49, 77
13. Section 11.2: 1, 35, 43, 47
14. Section 11.3: 21, 23
15. Section 11.4: 13, 17, 23
16. Section 11.5: 7, 11, 17, 23
17. Section 11.6: 6, 11, 12, 15, 16
18. Section 11.7: 15, 17, 21
19. Section 11.8: 7, 13, 25, 27
20. Section 11.9: 5, 7, 25
21. Section 11.10: 7, 19, 29, 33, 47
22. Section 8.1: 7, 9, 13
23. Section 8.2: 1a, 5, 7, 13
24. Section 8.3: 23, 27, 35
25. Section 10.1: 7, 15, 19, 21, 27
26. Section 10.2: 9, 13, 17, 33, 37(set up only), 39(set up only), 41, 61
27. Section 10.3: 9, 17, 23, 35, 39
28. Section 10.4: 7, 11, 17, 23, 29