Final Review for Calculus II

Here is a list of what we've done this semester along with some exercises that you should be able to do. Of course, you are responsible for any homework problems we've done, so know how to do them, too.

(Exam 1 stuff)

Section 5.5 & 5.6: The Fundamental Theorem of Calculus

Duh. You'd better know this.

Problems: (Section 5.5) 2, 3, 7, 9, 10, 14, 18, 22, 25, 28, 29

Section 6.7: The Natural Logarithm as an Integral

Definition of the natural log as an integral, rules of logs (especially the "power rule" for logs), exponential form compared to log form, derivatives and integrals of exponential functions involving bases other than *e*, derivatives of logs involving bases other than *e*.

Problems: 1, 3, 7, 9, 12, 22, 27, 28

Section 8.1: Simple Equations and Models

Formulas for exponential growth and decay, how to solve for *t*.

Problems: #23, 33

Section 6.8: Inverse Trigonometric Functions

Definitions of the inverse trig functions (including the restricted domains necessary to define them), evaluate trig and inverse trig functions, differentiate and integrate functions involving inverse trig functions.

Problems: 1, 3, 11, 17, 25, 31-33, 41, 43, 49, 50

Section 6.9: Hyperbolic Functions

Definitions of $\cosh(x)$, $\sinh(x)$, and $\tanh(x)$, fundamental identity: $\cosh^2(x) - \sinh^2(x) = 1$, differentiate and integrate functions involving hyperbolic trig functions and inverse hyperbolic trig functions.

Problems: 1, 3, 7, 21, 43, 45

Section 7.2: Integral Tables and Simple Substitutions

Know ALL the simple integrals in Figure 7.2.1 (pg.492). Do simple substitutions to make integrals match formulas, some miscellaneous integration techniques.

Problems: Homework problems should suffice

Section 7.3: Integration by parts

Integration by parts, what to pick for *u* and *dv*, maybe know formula for the integral of $\sec(x)$, and how to do the integral for $\sec^3(x)$.

Problems: 3, 7, 10, 20, 21, 25, 31 (do more if you feel weak in this area)

Section 7.4: Trigonometric Integrals

Integration of functions involving trig functions. Know $\cos^2(x) + \sin^2(x) = 1$, the half-angle identities, the double-angle identities, (these come up in integration a lot) and at least sine, cosine, and tangent for the popular angles.

Problems: 9, 17, 19, 27, 30, 35

(Exam 2 Stuff)

Section 7.5: Rational Functions and Partial Fractions

Definition of a rational function & a proper rational function, how to divide polynomials with long division, how to write a rational function in its partial-fraction decomposition, how to find linear and

quadratic factors of the partial fraction decomposition (recalling definition of irreducible), including completing the square and the 2 important functions at the bottom of pg.514.
Problems: 1, 9, 11, 15, 19, 27, 29

Section 7.6: Trigonometric Substitution
See table at bottom of pg. 517, and know how to use "the triangle".
Problems: 1, 3, 5, 7, 25, 27, 31

Section 7.7: Integrals Involving Quadratic Polynomials
Completing the square (again), dealing with quadratic polynomials using previous techniques.
Problems: 1, 3, 5, 7, 18, 19, 29 (do partial fractions first)

Section 7.8: Improper Integrals
Convergence and divergence of the two types of improper integrals: infinite limits and infinite discontinuities on the interval of integration. L'Hospital's rule can be useful here.
Problems: 5, 7, 13, 19, 23, 25, 33

Section 9.2: Polar Coordinates
You should memorize the formulas for converting back and forth between polar and rectangular. Recognizing polar equations for circles, cardiods, lemiscons, and rose-type graphs would be very useful (there was a handout on this). Either way, you should be able to sketch graphs of polar equations and be able to find points of intersection of two different polar equations.
Problems: 1(a)(b), 2(a)(b), 3, 5, 7, 9, 13, 39, 41, 43, 45, 49, 53

Section 9.3: Area Computations in Polar Coordinates
Area of regions bounded by polar graphs. Memorize the appropriate formulas.
Problems: 7, 19, 25, 29

Section 9.4: Parametric Curves
Be able to eliminate parameter to convert to rectangular form, memorize formula for 1^{st} and 2^{nd} derivatives of smooth parametric curves (pg.648), and be able to evaluate these at a specific point.
Problems: 5, 7, 17, 19, 25, 27

Section 9.5: Integral computations with Parametric Curves
Know formulas on pg.655, which includes finding area under a (parametric) curve, volume of revolution, arc length, and area of a surface of revolution.
Problems: 1, 3, 7, 11, 19

(Exam 3 stuff, except for Section 9.6)
Section 9.6: Conic Sections and Applications
Know formulas (and how to find them) for the parabola, ellipse, and hyperbola, including their general forms and how to sketch them.
Problems: Homework problems should suffice.

Section 10.2: Infinite Sequences
In this section we defined a sequence, gave examples of sequences, including the Fibonacci sequence, gave the definition of the limit of a sequence, introduced limit laws for sequences, the substitution law for sequences, the squeeze law for sequences, L'Hopital's rule for sequences, bounded monotonic sequences, and the bounded monotonic sequence property.
Problems: 3, 9, 13, 15, 16, 23, 28, 29, 30, 33, 39, 59

Section 10.3: Infinite Series and Convergence
Definition of an infinite series, a term in a series, the sum of a series, the n^{th}-partial sum, the idea of convergence and divergence, telescoping sums, the geometric series (and its sum), properties of

convergent series, **nth-term test for divergence**, divergence of the harmonic series, series that are "eventually the same".
Problems: 1, 5, 9, 12, 18, 23, 24, 27, 39, 54

Section 10.4: Taylor Series and Taylor Polynomials
Polynomial approximations, definition of the Taylor polynomial of $f(x)$ at the point $x = a$, Taylor's formula (including the nth – degree remainder for $f(x)$ at $x = a$), Taylor series (including derivations of the Taylor series for e^x, $\cos(x)$, $\sin(x)$), the Maclaurin series, Euler's formula.
Problems: 1, 2, 3, 6, 11, 19, 22, 25, 27, 28, 29, 32, 33, 37, 38

Section 10.5: The Integral Test
Definition of a positive-term series, **the integral test**, definition of a *p*-series.
Problems: 1, 2, 5, 6, 7, 12, 15, 17, 22, 23, 24, 29, 30, 31, 32, 34, 36

Section 10.6: Comparison tests for positive-term series
Idea of comparing positive-term series to positive-term series which are known to converge/diverge (mostly the geometric series and p-series), **Comparison test**, **limit comparison test**, rearrangement and grouping.
Problems: 1, 3, 4, 5, 6, 8, 11, 12, 14, 15, 16, 19, 22, 24, 27, 33, 35

Section 10.7: Alternating series and absolute convergence
Definition of an alternating series, **Alternating Series Test**, Alternating series remainder estimate, definition of absolute convergence, **absolute convergence implies convergence**, difference between being absolutely convergent, conditionally convergent, or divergent, **Ratio test**, **Root test**.
Problems: 1, 4, 5, 7, 9, 10, 14, 15, 21, 22, 23, 24, 25, 26, 29, 31, 38, 41, 49

Section 10.8: Power Series
Definition of a power series, **convergence of a power series** (using ideas from Ratio test), definition of radius of convergence, definition of interval of convergence, how to find the interval of convergence of a power series, definition of and how to find the interval of convergence of a power series in powers of $x - c$.
Problems: 1, 2, 3, 5, 6, 7, 8, 11, 13, 15, 19, 21, 23

(New material since Exam 3: for review problems, just look over homework)
Section 10.9: Power Series Computations
Finding error, using alternating series remainder estimate for alternating series, adding & multiplying power series to get new power series (and their radii of convergence), power series & indeterminate forms.

Section 8.1: Simple Equations and Models
Using separation of variables on a differential equation with one variable missing.

Section 8.3: Separable Equations and Applications
Using separation of variables on differential equations in both variables, Newton's law of cooling.

Section 10.10: Series Solutions of Differential Equations
Power series method, shifting of indices of summation, identity principle for power series, recurrence relation, radius of convergence of power series solution, power series definitions of functions.

Section 6.5: Force and Work
Definition of work, work as an integral.