Calculus II

by

Neal Koblitz (Chapters 1 - 18) and J.H. Wells (Chapters 19 - 21)

A Text for Math 114

(1997–1998)

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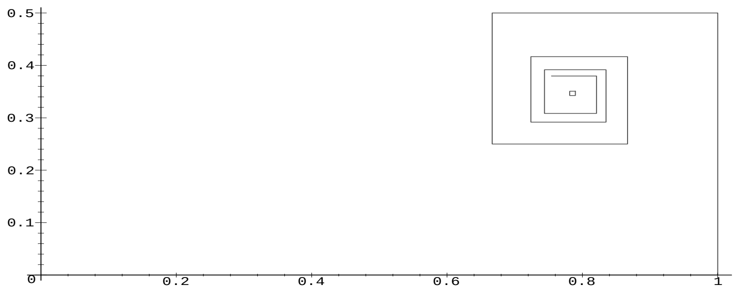

$$\left[\sum_{n=0}^{\infty} \frac{(-1)^n}{2\,n+1}, \sum_{n=0}^{\infty} \frac{(-1)^n}{2\,n+2}\right] = [1/4\,\pi, 1/2\,\ln(2)]$$

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Preface

Introduction to the Kentucky Text:

This text is a minor adaptation of Professor Neal Koblitz's notes from his University of Washington Math 125 course and material from two chapters of a book by Professor J. H. Wells. Professors Koblitz and Wells have generously permitted their use in this extension to Kentucky of Koblitz's idea of a complete calculus text for which students pay only the reproduction costs.

Errors which have been introduced into the text during the adaptation process are the responsibility of the Affordable Text Project of the University of Kentucky. This project has been supported by the National Science Foundation (NSF) **Calculus** and **Advanced Technical Education** (ATE) programs.

Advice for Students

The overwhelming emphasis in this course is on applications — story problems. To master story problems one needs a tremendous amount of practice — doing homework, worksheet, and practice exam problems. For this reason, this course will require much more of your time than would a high school or community college calculus course that does not have such a focus on word problems.

Here are some pointers for doing story problems:

1. Carefully read each problem twice before writing anything.
2. Assign letters to quantities that are described only in words; draw a diagram if appropriate.
3. Decide which letters are constants and which are variables. A letter stands for a constant if its value remains the same throughout the problem.
4. Using math notation, write down what you know and then write down what you want to find.
5. Decide what category of problem it is (this might be obvious if the problem comes at the end of a particular chapter, but will not necessarily be so obvious if it comes on an exam covering several chapters).
6. Double check each step as you go along; don't wait until the end to check your work.
7. Use common sense; if an answer is out of the range of practical possibilities, then check your work to see where you went wrong.

Suggestions for Using These Notes

1. Read the example problems carefully, filling in any steps that are left out (ask someone if you can't follow the solution to a worked example).
2. Later use the worked examples to study by covering the solutions, and seeing if you can solve the problems on your own.

3. Give yourself the practice midterms and finals in an exam situation (without access to material other than a single sheet of notes, and with the same time limit as on the exam).
4. The answers to homework and practice exam problems that are in the back of the notes should be used only as a final check on your work, not as a crutch. Keep in mind that sometimes an answer could be expressed in various ways that are algebraically equivalent, so don't assume that your answer is wrong just because it doesn't have exactly the same form as the answer in the back.

Formulas Used in This Course

Algebra

Completing the square: $X^2 + bX + c = (X + \frac{b}{2})^2 - \frac{b^2}{4} + c$.

Quadratic formula: roots of $aX^2 + bX + c$ are $\dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Exponents: $a^b \cdot a^c = a^{b+c}$; $\quad \dfrac{a^b}{a^c} = a^{b-c}$; $\quad (a^b)^c = a^{bc}$; $\quad a^{1/b} = \sqrt[b]{a}$.

Geometry

Circle: circumference $= 2\pi r$; area $= \pi r^2$.

Sphere: vol $= \frac{4}{3}\pi r^3$; surface area $= 4\pi r^2$.

Cylinder: vol $= \pi r^2 h$; lateral area $= 2\pi r h$; total surface area $= 2\pi r h + 2\pi r^2$.

Cone: vol $= \frac{1}{3}\pi r^2 h$; lateral area $= \pi r\sqrt{r^2 + h^2}$; total surface area $= \pi r\sqrt{r^2 + h^2} + \pi r^2$.

Analytic geometry

Point-slope formula for straight line: $y = y_0 + m(x - x_0)$.

Circle centered at (h, k): $(x - h)^2 + (y - k)^2 = r^2$.

Ellipse with semimajor axis along x-axis and semiminor axis along y-axis: $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$.

Trigonometry

$\sin = \dfrac{\text{opposite}}{\text{hypotenuse}}$; $\cos = \dfrac{\text{adjacent}}{\text{hypotenuse}}$; $\tan = \dfrac{\text{opposite}}{\text{adjacent}}$;

$\sec = \dfrac{1}{\cos}$; $\csc = \dfrac{1}{\sin}$; $\cot = \dfrac{1}{\tan}$; $\tan = \dfrac{\sin}{\cos}$; $\cot = \dfrac{\cos}{\sin}$;

$\sin x = \cos\left(\dfrac{\pi}{2} - x\right)$; $\cos x = \sin\left(\dfrac{\pi}{2} - x\right)$;

$\sin(x + \pi) = -\sin x$; $\cos(x + \pi) = -\cos x$.

Law of cosines: $a^2 = b^2 + c^2 - 2bc\cos A$.

Law of sines: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$.

Sine of sum of angles: $\sin(x + y) = \sin x \cos y + \cos x \sin y$.

$\sin^2$ and $\cos^2$ formulas: $\sin^2 + \cos^2 = 1$; $\sin^2 x = \dfrac{1 - \cos(2x)}{2}$; $\cos^2 x = \dfrac{1 + \cos(2x)}{2}$.

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