Syllabus — Math 121, Mathematics for Elementary Teachers I
Harold Washington College — One of the City Colleges of Chicago

Semester: Fall 2004
Instructor: Dr. A. N. DiVito, Professor of Mathematics
Office: 702C • Phone: 312-553-5931 • e-mail: adivito@ccc.edu

Grading:
• Final grades will be determined by averaging the scores of the four full period examinations
• Assignments will be collected at the end of each class. Attendance and homework are mandatory and will be used to decide final grades in borderline cases. Poor attendance may result in a lower grade, at the discretion of the instructor, without regard to other performance.
• The usual, but not guaranteed, conversions from percent score to letter grade are as follows: 86–100: A; 80–85: A/B; 70–79: B; 60–69: C; 50–59: D; 00–49: F.

Topics and Assignments:

Chapter 1 — The Study of How Many

1.1 Place Value: A Truly Brilliant Idea
    Roman numerals; converting between base 10 and other bases
    Assignment: sectional problems

1.2 Facts vs. Algorithms
    Modeling bundle lending and borrowing with Lego®-like bricks
    Assignment: sectional problems

1.3 Primes, and Composites, and 1
    Divisibility tests for 2, 3, 5, 7, 9, 10, 11; Fundamental Theorem of Arithmetic; GCFs and LCMs
    Assignment: sectional problems

Chapter 2 — The Study of How Much

2.1 Straightedge and Compass Constructions
    Copy line segments and angles; extend a line segment; perpendiculars and parallels through given point on or off line; line segment and angle bisectors; circumcenter, incenter, orthocenter, centroid; transferring n equal parts
    Assignment: sectional problems

2.2 Numbers as Lengths
    Ancient Greeks model; using prime factorization to obtain equal parts of a whole
    Assignment: sectional problems
2.3 *Equivalent Fractions and Mixed Numbers*
Changing form by multiplying by one; converting between improper fractions and mixed numbers
**Assignment:** sectional problems

2.4 *The Operation of Addition (for Numbers as Lengths)*
Geometric interpretation; methods: backwards Z, JuMBO, cross-multiplication, prime factorization method, formula method; adding mixed numbers
**Assignment:** sectional problems

2.5 *The Operation of Multiplication (for Numbers as Lengths)*
Geometric interpretation; stretching/shrinking with computer or elastic materials models; scalar multiplication for vectors; multiplying mixed numbers
**Assignment:** sectional problems

**Chapter 3 — The Modern Model: Numbers as Positions**

3.1 *Flaws in the Ancient Greeks Model*
Area for rectangles and right triangles; the Pythagorean Theorem; the irrationality of the square root of 2; constructing a length of $\sqrt{2}$
**Assignment:** sectional problems

3.2 *The Real Number Line*
Zero, one, two, and three dimensional spaces; position replaces length; negative numbers; absolute value (magnitude) and inequalities
**Assignment:** sectional problems

3.3 *Decimals*
Terminating vs. nonterminating (repeating vs. nonrepeating); geometric interpretation; comparing sizes in fractional vs. decimal notations; multiplying and dividing by powers of ten; scientific notation; percent notation; nonuniqueness of decimal notation
**Assignment:** sectional problems

3.4 *The Algorithms Pertaining to Decimals*
Arithmetic operations algorithms; converting fractions and decimals; estimation and rounding
**Assignment:** sectional problems

**Chapter 4 — Applications Rooted in Arithmetic**

4.1 *Linear and Angular Measurement*
**Assignment:** TBA

4.2 *The English System and the Metric System (SI)*
**Assignment:** TBA
4.3  *The Scale Model*
Similarity for two parameter models; scale factor vs. aspect ratio; rectilinear modeling; ratio and proportion; per unit analysis; percent analysis; direct proportionality; straight line models
**Assignment:** sectional problems

4.4  *Ratio and Proportion*
The vertical and horizontal consistency principle; false models
**Assignment:** sectional problems

4.5  *Percents*
The employee wage raise model; language and uses of percents; simple interest and advanced simple interest problems
**Assignment:** sectional problems

**Chapter 5 — The Basics of Algebra**

5.1  *Real Number Arithmetic (for Numbers as Positions)*
Addition as movement along the number line; the identity and inverses for addition; definition of subtraction; multiplication as stretching/shrinking/reversing; the identity and inverses for multiplication; definition of division; division by 0 is undefined; \(-1 \cdot u = -u\); three meanings of the symbol \(\sim\)
**Assignment:** sectional problems

5.2  *The Cornerstones of Algebra*
The Order of Operations; commutative, associative, and distributive laws; generalized commutative, associative and distributive laws; terminology: we add terms to obtain a sum, we multiply factors to obtain a products
**Assignment:** sectional problems

5.3  *A Primer on Sets*
Explicit vs. implicit set notations; terminologies and notations; interval notation; Venn diagrams
**Assignment:** sectional problems

5.4  *Linear Equations in One Variable*
Terminologies and techniques involving linear equations in one variable; strategies for approaching word problems; phenomenological experiments: model cars, mixing solutions, rates of fill
**Assignment:** sectional problems

5.5  *Elementary Proofs*
(e.g., to include divisibility tests, the Euclidean Algorithm, the infinity of primes)
**Assignment:** TBA