Tennessee Mathematics Standards
Approved July 30, 2010

Discrete Mathematics
#3135

Standard 1 – Mathematical Processes

Course Level Expectations

CLE 3135.1.1 Use mathematical language, symbols, definitions, proofs and counterexamples correctly and precisely in mathematical reasoning.

CLE 3135.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including testing cases, estimation, and then checking induced errors and the reasonableness of the solution.

CLE 3135.1.3 Develop inductive and deductive reasoning to independently make and evaluate mathematical arguments and construct appropriate proofs; include various types of reasoning, logic, and intuition.

CLE 3135.1.4 Move flexibly between multiple representations (contextual, physical, written, verbal, iconic/pictorial, graphical, tabular, and symbolic), to solve problems, to model mathematical ideas, and to communicate solution strategies.

CLE 3135.1.5 Recognize and use mathematical ideas and processes that arise in different settings, with an emphasis on formulating a problem in mathematical terms, interpreting the solutions, mathematical ideas, and communication of solution strategies.

CLE 3135.1.6 Employ reading and writing to recognize the major themes of mathematical processes, the historical development of mathematics, and the connections between mathematics and the real world.

CLE 3135.1.7 Use technologies appropriately to develop understanding of abstract mathematical ideas, to facilitate problem solving, and to produce accurate and reliable models.

Check for Understanding (Formative/Summative Assessment)

- ✓ 3135.1.1 Use election theory techniques to analyze election data.
- ✓ 3135.1.2 Investigate and describe weighted voting and the results of various election methods. Both very standard and less-known techniques will be studied and compared; these may include approval and preference voting as well as plurality, majority, run-off, sequential run-off, Borda count, and Condorcet winners.
- ✓ 3135.1.3 Use fair division techniques to solve apportionment problems.
- ✓ 3135.1.4 Use inductive and deductive reasoning strategies to make predictions and valid conclusions based on contextual situations.
- ✓ 3135.1.5 Construct truth tables to determine the validity of an argument.

- ✓ 3135.1.6 Apply various problem-solving strategies to model and interpret physical, social, and mathematical phenomena.
- ✓ 3135.1.7 Use graphing calculators, computer spreadsheets, and multimedia presentations.
- ✓ 3135.1.8 Discuss the various examples and consequences of innumeracy; consider poor estimation, improper experimental design, inappropriate comparisons, and scientific notation comparisons.
- ✓ 3135.1.9 State a variety of map color programs. Develop solutions to examples of maps and discuss the final resolution of the four-color problem.
- ✓ 3135.1.10 Discuss the different interpretations of the four-color problem and the validity of a computer proof.

Standard 2 – Number & Operations

Course Level Expectations

CLE 3135.2.1 Understand the capabilities and the limitations of calculators and computers in solving problems.
CLE 3135.2.2 Apply appropriate counting techniques in discrete situations.
CLE 3135.2.3 Understand various bases as used in computer science and numerical data transmission, especially base 2, base 8 and base 12.
CLE 3135.2.4 Expand the understanding of place value to include numbers written in various numerical systems and in various bases.
CLE 3135.2.5 Appreciate the existence of a variety of error types and arithmetic abnormalities in computer arithmetic; include discussion of round-off error, over-flow error, and error arising from associating and adding in different orders.

Check for Understanding (Formative/Summative Assessment)

- ✓ 3135.2.1 Use calculators appropriately and make estimations without a calculator regularly to detect potential errors.
- ✓ 3135.2.2 Recognize the difference between continuous and discrete situations.
- ✓ 3135.2.3 Use base 2 arithmetic to understand check sums in data transmission.
- ✓ 3135.2.4 Convert numbers between bases, especially multi-digit numbers.
- ✓ 3135.2.5 Compare ancient numeral systems in various bases to base t and base 8 numerals.
- ✓ 3135.2.6 Perform familiar arithmetic processes in base 2, base 8 and base 12.
- ✓ 3135.2.7 Develop individual examples that demonstrate different types of numerical computer errors. Also, demonstrate how computers can take introductory minimal errors and magnify them to errors of much larger order of magnitude.

Standard 3 – Algebra

Course Level Expectations

CLE 3135.3.1 Represent and analyze functions by using iteration and recursion.
CLE 3135.3.2 Use iteration and recursion to model and solve problems.
CLE 3135.3.3 Use the Binomial Theorem to expand powers of binomials; interpret it to solve coloring problems and numerical problems.

CLE 3135.3.4 Develop the symbols and properties of Boolean Algebra; connect Boolean Algebra to standard logic.
CLE 3135.3.5 Derive basic combinatorics identities by counting the same sets two different ways to get a basic identity.

Check for Understanding (Formative/Summative Assessment)

- ✓ 3135.3.1 Use iterative and recursive thinking to solve a variety of contextual problems.
- ✓ 3135.3.2 Create and analyze iterative geometric patterns, including fractals.
- ✓ 3135.3.3 Describe, analyze, and create iterative procedures and recursive formulas by using technology such as computer software and graphing calculators.
- ✓ 3135.3.4 Build the Binomial Theorem using graphics/pyramid design; interpret it for both a multivariable binomial expansion and a variable and numeric binomial expansion.
- ✓ 3135.3.5 Prove the sum of first n integers adds up to n(n+1)/2 in three different manners.

Standard 4 – Geometry & Measurement

Course Level Expectations:

CLE 3135.4.1 Put numbers in perspective through estimation, comparisons, and scaling.
CLE 3135.4.2 Use graph theory to model and solve contextual problems.
CLE 3135.4.3 Analyze basic electrical networks; compare the networks to Boolean Algebra configurations.

Check for Understanding (Formative/Summative Assessment)

- ✓ 3135.4.1 Apply estimation techniques in solving Fermi-type problems.
- ✓ 3135.4.2 Apply estimation techniques to data given in a variety of ways.
- ✓ 3135.4.3 Use vertex-edge graphs to model and solve a variety of problems related to paths, circuits, networks, and relationships among a finite number of objects.
- ✓ 3135.4.4 The student will apply graphs to conflict-resolution problems, such as map coloring, scheduling, matching, and optimization.
- ✓ 3135.4.5 Develop electrical networks and translate them into Boolean algebra equations.

Standard 5 – Data Analysis, Statistics, & Probability

Course Level Expectations

CLE 3135.5.1 Represent, analyze, and apply permutations and combinations.
CLE 3135.5.2 Represent, apply, and describe relationships among the binomial theorem, Pascal’s Triangle, and combinations.
CLE 3135.5.3 Apply counting principals to probabilistic situations involving equally likely outcomes.
CLE 3135.5.4 Use combinatorial reasoning to construct proofs as well as solve a variety of problems.

Check for Understanding (Formative/Summative Assessment)

- ✓ 3135.5.1 Design and interpret simple experiments using tree-diagrams, permutations, and combinations.
- ✓ 3135.5.2 Use reasoning and formulas to solve counting problems in which repetition is not allowed and in which ordering does not matter.
- ✓ 3135.5.3 Construct and describe patterns in Pascal's Triangle.
- ✓ 3135.5.4 Connect Pascal's Triangle and probability to solve problems.
- ✓ 3135.5.5 Solve counting problems by using Venn diagrams and show relationships modeled by the Venn diagram.
- ✓ 3135.5.6 Apply the Law of Large Numbers to contextual situations.
- ✓ 3135.5.7 Informally prove the classical identity for $C(n,k) = C(n-1,k-1) + C(n-1,k)$ for integers n and k with $0<k<n$.