

Topics in Finite Mathematics

Mathematics Curriculum Framework

Revised 2004
Amended 2008

Course Title: Topics in Finite Mathematics
 Course/Unit Credit: 1
 Course Number:
 Teacher Licensure: Secondary Mathematics
 Grades: 9-12

Topics in Finite Mathematics

Topics in Finite Mathematics is designed for students who have successfully completed Geometry and Algebra II. This course will build upon concepts presented in Algebra II and Geometry to encourage higher order thinking. This course will include, but is not limited to, the following topics: linear systems and matrices, set theory, counting techniques, statistics, and finance. Arkansas teachers are responsible for integrating appropriate technology into the coursework for Topics in Finite Mathematics.

Strand	Content Standard
Linear Systems and Matrices	
	1. Students will examine linear systems and matrices and their applications.
Set Theory	
	2. Students will operate with sets and use set theory to solve problems.
Counting Techniques	
	3. Students will use combinatorial reasoning to find numbers of outcomes and related probabilities.
Statistics	
	4. Students will compute and analyze data using various statistical tools, with appropriate technology.
Finance	
	5. Students will solve real-world problems involving financial decision making.

Strand: Linear Systems and Matrices

Standard 1: Students will examine linear systems and matrices and their applications.

LSM.1.TFM.1	Use matrices (e.g., <i>row-echelon form</i> , <i>Gauss-Jordan method</i> , inverses) to solve systems of linear equations, with or without technology
LSM.1.TFM.2	Find and use the inverse of a matrix to solve real-world problems (e.g., cryptology)
LSM.1.TFM.3	Graph systems of linear inequalities with multiple <i>constraints</i> and identify vertices of the <i>feasible region</i>
LSM.1.TFM.4	Model and solve real-world problems using <i>linear programming</i> (e.g., maximum profit/minimal cost, investments, agriculture, manufacturing, banking)
LSM.1.TFM.5	Interpret the meaning of the minimum or maximum value in terms of the <i>objective function</i>

Strand: Set Theory

Standard 2: Students will operate with sets and use set theory to solve problems.

ST.2.TFM.1	Define sets using <i>set-builder notation</i>
ST.2.TFM.2	Use correct terminology to describe relationships between sets in various contexts
ST.2.TFM.3	Perform set operations such as <i>union</i> and <i>intersection</i> , <i>complement</i> , and <i>Cartesian product</i>
ST.2.TFM.4	Use Venn diagrams to explore relationships and patterns and to make arguments about relationships between sets, including real-world situations
ST.2.TFM.5	Use a <i>truth table</i> to draw conclusions about a statement
ST.2.TFM.6	Judge the <i>validity</i> of arguments and give counterexamples to disprove statements

Strand: Counting Techniques

Standard 3: Students will use combinatorial reasoning to find numbers of outcomes and related probabilities.

CT.3.TFM.1	Use fundamental counting principles of addition and multiplication to solve problems
CT.3.TFM.2	Evaluate expressions indicating <i>permutations</i> or <i>combinations</i> , with and without technology
CT.3.TFM.3	Evaluate expressions involving <i>distinguishable permutations</i>
CT.3.TFM.4	Distinguish between and use <i>permutations</i> and <i>combinations</i> to solve problems
CT.3.TFM.5	Calculate probabilities of <i>mutually exclusive events</i> , <i>independent events</i> , and <i>dependent events</i>
CT.3.TFM.6	Construct and examine <i>Pascal's triangle</i>
CT.3.TFM.7	Develop and use the <i>binomial theorem</i>
CT.3.TFM.8	Use <i>combinations</i> to find a specified term in a binomial expansion

Strand: Statistics

Standard 4. Students will compute and analyze data using various statistical tools, with appropriate technology.

S.4.TFM.1	Collect data using <i>random sampling</i>
S.4.TFM.2	Calculate and interpret statistical problems using <i>measures of central tendencies</i> and graphs <ul style="list-style-type: none">• histograms• normal curve
S.4.TFM.3	Analyze and compare data sets using <i>five-number summary</i> , graphically and numerically
S.4.TFM.4	Investigate and analyze the characteristics of <i>normal</i> and <i>skewed distributions</i>
S.4.TFM.5	Determine and interpret measures of variation of a data set, with or without technology <ul style="list-style-type: none">• <i>standard deviation</i>• <i>range</i>• <i>percentiles</i>• <i>variance</i>

Strand: Finance

Standard 5: Students will solve real-world problems involving financial decision making.

F.5.TFM.1	Read and interpret graphs related to finance
F.5.TFM.2	Apply properties of logarithms to convert and solve logarithmic (common and natural) and exponential equations
F.5.TFM.3	Solve real-world problems involving <ul style="list-style-type: none">• compound interest• amortization• annuities• appreciation• depreciation• investments

Glossary for Topics in Finite Mathematics

Binomial theorem	<p>A method for distributing powers of binomials as shown below:</p> $(a + b)^n = \binom{n}{0}a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \dots + \binom{n}{n-1}ab^{n-1} + \binom{n}{n}b^n$ $= \sum_{k=0}^n \binom{n}{k} a^{n-k} b^k$ <p style="text-align: right;">Example: $(a + b)^4 = a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$</p>
Cartesian product	The <i>Cartesian product</i> of two sets A and B (also called the product set, set direct product, or cross product) is defined to be the set of all points (a, b) where $a \in A$ and $b \in B$.
Combination	Collection of objects from a set in which order is not important
Complement	The set of all elements in the universal set that are not in set A ; $B \setminus A = \{x \in B \mid x \notin A\}$.
Constraint	A statement or inequality that defines the <i>feasibility region</i>
Dependent events	Two events in which the outcome of the second is influenced by the outcome of the first
Distinguishable permutation	The number of different arrangements of a set of objects that includes repeated elements (If there are n objects with n_1 duplicates of one kind, n_2 duplicates of a second kind, ..., n_k duplicates of a k th kind, then the number of <i>distinguishable permutations</i> of these n objects is $n!/(n_1!n_2!\dots n_k!)$)
Feasible region	A set of points which satisfies every <i>constraint</i>
Five-number summary	A data set that consists of (1) the minimum (smallest observation), (2) the lower quartile or first quartile (which cuts off the lowest 25% of the data), (3) the median (middle value), (4) the upper quartile or third quartile (which cuts off the highest 25% of the data), and (5) the maximum (largest observation)
Gauss-Jordan method	Method of using elementary row operations to produce an equivalent matrix in reduced <i>row-echelon form</i>
Independent events	Events in which the occurrence of either of them has no effect on the probability of the other
Intersection	Set of elements common to both set A and set B $A \cap B = \{x \mid x \in A \text{ and } x \in B\}$
Linear programming	A method for finding the maximum or minimum value of a function in two variables subject to given <i>constraints</i> on the variables
Measures of central tendencies	Mean, median, and mode
Mutually exclusive events	Two events in a sample space that do not have outcomes in common
Normal distribution	A pattern for the distribution of a set of data which follows a bell shaped curve; sometimes called the Gaussian distribution
Objective function (or objective quantity)	An algebraic expression in two or more variables describing a quantity that must be maximized or minimized

Pascal's triangle	<p>The figure below, extended infinitely; A particular entry is found by adding the two numbers that are above and on either side of the element. Note: The numbers which make up Pascal's triangle are called binomial coefficients.</p> <p style="text-align: center;">Pascal's triangle</p> <p>Note that the sum of any two adjacent elements in a row can be found between them on the next row. Each row begins and ends with 1.</p> <div style="text-align: center;"> <pre> 1 1 1 1 2 1 1 3 3 1 1 4 6 4 1 1 5 10 10 5 1 </pre> <p>etc.</p> </div>
Percentile	A value on a scale of one hundred that indicates the percent of a distribution that is equal to or below it
Permutation	Collection of objects from a set in which order is important
Random sampling	A sample of n measurements from a population where a subset of the population is selected in a manner such that (a) every sample of size n from the population has an equal chance of being selected and (b) every member of the population has an equal chance of being included in the sample
Range	The difference between the maximum and minimum in a set of data
Row-echelon form	In mathematics, a matrix is in <i>row-echelon form</i> if it satisfies the following requirements: All nonzero rows are above any rows of all zeroes. <ul style="list-style-type: none"> The leading coefficient of a row is always strictly to the right of the leading coefficient of the row above it. The leading coefficient of each nonzero row is one.
Set-builder notation	A mathematical notation for describing a set by stating the properties that its members must satisfy
Skewed distribution	A non-symmetric distribution that may be skewed right or skewed left
Standard deviation	Measures how widely spread the values in a data set are (If many data points are close to the mean, then the <i>standard deviation</i> is small; If many data points are far from the mean, then the <i>standard deviation</i> is large.)
Truth table	A mathematical table used in logic to compute the functional values of logical expressions and each of their functional arguments
Union	Set of elements that are members of set A or of set B or of both sets $A \cup B = \{x \mid x \in A \text{ or } x \in B\}$
Validity	The degree to which an observed result can be relied upon and not attributed to random error in sampling
Variance	The square of the <i>standard deviation</i>