

**Course Information**

<b>Grade(s):</b>	<b>11 &amp; 12</b>
<b>Discipline/Course:</b>	<b>Mathematics</b>
<b>Course Title:</b>	<b>Advanced Mathematical Decision Making (AMDM)</b>
<b>Prerequisite(s):</b>	Advanced Geometric Reasoning, Polynomial and Exponential Functions, & Introduction to Quantitative Reasoning
<b>Course Description:</b> <i>Program of Studies</i>	<p>The Advanced Mathematical Decision Making (AMDM) course will give students further experiences with statistical information and summaries, methods of designing and conducting statistical studies, an opportunity to analyze various voting processes, modeling of data, basic financial decisions, and use network models for making informed decisions.</p> <p>Instruction and assessment will include the appropriate use of manipulatives and technology. Topics are represented in multiple ways, such as concrete/pictorial, verbal/written, numeric/data-based, graphical, and symbolic. Concepts are introduced and used, where appropriate, in the context of realistic phenomena.</p>
<b>Course Essential Questions:</b>	<b><i>How can mathematics be used to help make effective decisions and solve problems?</i></b>
<b>Course Enduring Understandings:</b>	<ul style="list-style-type: none"> <li>● A problem solver understands what has been done, knows why the process was appropriate, and can support it with reasons and evidence.</li> <li>● The context of a problem determines the reasonableness of a solution.</li> <li>● The ability to solve problems is the heart of mathematics.</li> </ul>
<b>Duration:</b>	One year
<b>Course</b>	Advanced Mathematical Decision Making (2017)

<b>Materials/Resources:</b>	
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**\*Note: Topics listed in the units may evolve over time based on adaptations to implementation. However, the overall content of the entire course will not change.**

### Academic Expectations

The Fairfield Public Schools describe a variety of cross curricular expectations that all students should exemplify during their time within the schooling experience. This page gives examples of what the practice standards look like at the specified grade level. Students are expected to:

Standards	Explanations	Example
1. Exploring and Understanding [MP1]	When students engage in problem solving situations, they should be able to understand the problem, determine relevant information, and ask relevant additional questions.	Students should be able to answer the following questions when approaching a problem: <ol style="list-style-type: none"> <li>1. Do you understand all the words used in stating the problem?</li> <li>2. What are you asked to find or show?</li> <li>3. Can you restate the problem in your own words?</li> <li>4. Can you think of a picture or diagram that might help you understand the problem?</li> </ol>
2. Synthesizing and Evaluating	Engaging in a problem solving situation, students should be able to analyze the most efficient approach, and reflect on the process used to solve the problem.	Students should be able to answer the following questions when analyzing how to approach a problem, and also reflect on the result: <ol style="list-style-type: none"> <li>1. Is there enough information to enable you to find a solution? If not, what additional information is needed?</li> <li>2. Are there multiple ways to complete the task? Which approach do you think is most efficient, and why?</li> <li>3. Do you know a related problem? Look at the unknown and try to think of a familiar problem having the same or similar unknown. Can you use it?</li> <li>4. Was your strategy effective? What worked? What didn't?</li> <li>5. Was there another approach that could have been more efficient?</li> <li>6. Is your answer reasonable? How do you know?</li> <li>7. Was your presentation approach effective? If not, what would you change?</li> <li>8. How did the communication tools allow you to get the message across to the intended audience?</li> </ol>

3. Creating and Constructing	Engaged in a problem solving situation, students should implement a plan.	Students should be able to answer the following question to implementing their plan to solve a problem: 1. What strategy will you use to complete the task?
4. Conveying Ideas	Students should be able to use correct mathematical language, logically display their work for the desired problem.	Students should be able to answer the following questions to convey their mathematical thinking to solve a problem: 1. How will you present your information to your intended audience? 2. Does your response illustrate the correct terms and work to the problem?
5. Using Communication Tools	Students should be able to choose the correct tools to illustrate their mathematical work to solve a specific problem.	Students should be able to answer the following question to use specific communication tools to solve a problem: 1. If applicable, what communication tools will you use to convey your ideas and solution?
6. Collaborating Strategically	Students should be able to work collaboratively to solve problems.	Students should be able to answer the following question to collaboratively solve problems: 1. In what ways did you work together to help solve the desired problem?

<b>Unit Number and Title:</b>	<b>Unit 1: Analyzing Numerical Data</b>
<b>Resource(s):</b>	AMDM - Chapter 1
<b>Learning Goals</b>	
<b>Standard(s):</b>	N/A
<b>Essential Question(s):</b>	In what ways can we organize information to help make decisions?
<b>Enduring Understanding(s):</b>	Proportional relationships express how quantities change in relationship to each other. The way that data is collected, organized and displayed influences interpretation.
<b>Learning Goal(s):</b> <i>Students will be able to use their learning to:</i>	<ul style="list-style-type: none"> <li>● Use precision and accuracy in real-life situations related to measurement</li> <li>● Apply and analyze published ratings, weighted averages, and indices to make informed decisions</li> <li>● Solve problems involving quantities that are not easily measured using proportionality</li> <li>● Solve geometric problems involving indirect measurement, including similar triangles, the Pythagorean Theorem</li> <li>● Solve problems involving large quantities using combinatorics</li> <li>● Use arrays to efficiently manage large collections of data</li> <li>● Select and apply an algorithm of interest to solve real-life problems such as the validity in recorded and transmitted data using checksums and hashing; sports rankings, weighted class rankings, and search engine rankings; and communicate to peers the application of the algorithm in precise mathematical and nontechnical language.</li> </ul>

<b>Unit Number and Title:</b>	<b>Unit 2: Probability</b>
<b>Resource(s):</b>	AMDM - Chapter 2
<b>Learning Goals</b>	
<b>Standard(s):</b>	N/A
<b>Essential Question(s):</b>	How can we use concepts of probability to justify decisions?
<b>Enduring Understanding(s):</b>	The probability of an event's occurrence can be predicted with varying degrees of confidence.
<b>Learning Goal(s):</b> <i>Students will be able to use their learning to:</i>	<ul style="list-style-type: none"> <li>● Use a two-way frequency table as a sample space to identify whether two events are independent and to interpret the results;</li> <li>● Use the Addition Rule, <math>P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)</math>, in mathematical and real-world problems</li> <li>● Calculate conditional probabilities and probabilities of compound events using tree diagrams, Venn diagrams, area models, and formulas</li> <li>● Interpret conditional probabilities and probabilities of compound events by analyzing representations to make decisions in problem situations</li> <li>● Use probabilities to make and justify decisions about risks in everyday life</li> <li>● Calculate expected value to analyze mathematical fairness, payoff, and risk.</li> </ul>

<b>Unit Number and Title:</b>	<b>Unit 3: Statistical Studies</b>
<b>Resource(s):</b>	AMDM - Chapter 3
<b>Learning Goals</b>	
<b>Standard(s):</b>	N/A
<b>Essential Question(s):</b>	In what ways can we analyze statistical studies to better inform our judgement?
<b>Enduring Understanding(s):</b>	The way that data is collected, organized and displayed influences interpretation Making predictions, inferences, and decisions depends on analyzing and interpreting numerical data.
<b>Learning Goal(s):</b> <i>Students will be able to use their learning to:</i>	<ul style="list-style-type: none"> <li>● Identify limitations and lack of relevant information in studies reporting statistical information, especially when studies are reported in condensed form;</li> <li>● Interpret and compare statistical results using appropriate technology given a margin of error;</li> <li>● Identify potential misuses of statistics to justify particular conclusions, including assertions of a cause-and-effect relationship rather than an association, and missteps or fallacies in logical reasoning;</li> <li>● Describe strengths and weaknesses of sampling techniques, data and graphical displays, and interpretations of summary statistics and other results appearing in a study, including reports published in the media;</li> <li>● Determine the need for and purpose of a statistical investigation and what type of statistical analysis can be used to answer a specific question or set of questions;</li> <li>● Identify the population of interest for a statistical investigation, select an appropriate sampling technique, and collect data</li> <li>● Identify the variables to be used in a study</li> </ul>

- Determine possible sources of statistical bias in a study and how bias may affect the validity of the results
- Create data displays for given data sets to investigate, compare, and estimate center, shape, spread, and unusual features of the data
- Analyze possible sources of data variability, including those that can be controlled and those that cannot be controlled
- Report results of statistical studies to a particular audience, including selecting an appropriate presentation format, creating graphical data displays, and interpreting results in terms of the question studied
- Justify the design and the conclusion(s) of statistical studies, including the methods used
- Communicate statistical results in oral and written formats using appropriate statistical and nontechnical language

<b>Unit Number and Title:</b>	<b>Unit 4: Using Recursion in Models and Decision Making</b>
<b>Resource(s):</b>	AMDM - Chapter 4
<b>Learning Goals</b>	
<b>Standard(s):</b>	N/A
<b>Essential Question(s):</b>	How can data be used to help model situations to help make effective decisions?
<b>Enduring Understanding(s):</b>	Making predictions, inferences, and decisions depends on analyzing and interpreting numerical data.
<b>Learning Goal(s):</b> <i>Students will be able to use their learning to:</i>	<ul style="list-style-type: none"> <li>● Select and apply an algorithm of interest to solve real-life problems such as problems using recursion or iteration involving population and communicate to peers the application of the algorithm in precise mathematical and nontechnical language</li> <li>● Collect numerical bivariate data to create a scatter plot, select a function to model the data, justify the model selection, and use the model to interpret results and make predictions;</li> <li>● Describe the degree to which uncorrelated variables may or may not be related and analyze situations where correlated variables do or do not indicate a cause-and-effect relationship</li> <li>● Determine or analyze an appropriate growth or decay model for problem situations, including linear and exponential functions</li> <li>● Determine or analyze an appropriate cyclical model for problem situations that can be modeled with periodic functions</li> <li>● Identify potential misuses of statistics to justify particular conclusions, including assertions of a cause-and-effect relationship rather than an association, and missteps or fallacies in logical reasoning;</li> </ul>



<b>Unit Number and Title:</b>	<b>Unit 5: Using Functions in Models and Decision Making</b>
<b>Resource(s):</b>	AMDM - Chapter 5
<b>Learning Goals</b>	
<b>Standard(s):</b>	N/A
<b>Essential Question(s):</b>	How can data be used to help model situations to help make effective decisions?
<b>Enduring Understanding(s):</b>	Data collection and its organization helps formulate relevant questions that can be answered using mathematical tools. Making predictions, inferences, and decisions depends on analyzing and interpreting numerical data.
<b>Learning Goal(s):</b> <i>Students will be able to use their learning to:</i>	<ul style="list-style-type: none"> <li>● Collect numerical bivariate data to create a scatter plot, select a function to model the data, justify the model selection, and use the model to interpret results and make predictions</li> <li>● Describe the degree to which uncorrelated variables may or may not be related and analyze situations where correlated variables do or do not indicate a cause-and-effect relationship</li> <li>● Determine or analyze an appropriate growth or decay model for problem situations, including linear, exponential, and logistic functions</li> <li>● Determine or analyze an appropriate cyclical model for problem situations that can be modeled with periodic functions</li> <li>● Determine or analyze an appropriate piecewise model for problem situations</li> <li>● Identify potential misuses of statistics to justify particular conclusions, including assertions of a cause-and-effect relationship rather than an association, and missteps or fallacies in logical reasoning</li> </ul>

<b>Unit Number and Title:</b>	<b>Unit 6: Decision Making in Finance</b>
<b>Resource(s):</b>	AMDM - Chapter 6
<b>Learning Goals</b>	
<b>Standard(s):</b>	N/A
<b>Essential Question(s):</b>	In what ways can we use mathematics to make effective decisions within finance and business?
<b>Enduring Understanding(s):</b>	Mathematical models can be used to represent and understand quantitative relationships.
<b>Learning Goal(s):</b> <i>Students will be able to use their learning to:</i>	<ul style="list-style-type: none"> <li>● Create, represent, and analyze mathematical models for various types of income calculations to determine the best option for a given situation</li> <li>● Create, represent, and analyze mathematical models for expenditures, including those involving credit, to determine the best option for a given situation</li> <li>● Create, represent, and analyze mathematical models and appropriate representations, including formulas and amortization tables, for various types of loans and investments to determine the best option for a given situation.</li> </ul>

<b>Unit Number and Title:</b>	<b>Unit 7: Networks and Graphs</b>
<b>Resource(s):</b>	AMDM - Chapter 7
<b>Learning Goals</b>	
<b>Standard(s):</b>	N/A
<b>Essential Question(s):</b>	How can we use networks and graphs to make effective decisions?
<b>Enduring Understanding(s):</b>	Mathematical models can be used to represent and understand quantitative relationships.
<b>Learning Goal(s):</b> <i>Students will be able to use their learning to:</i>	<ul style="list-style-type: none"> <li>Select and apply an algorithm of interest to solve real-life problems such as problems involving scheduling or routing situations using vertex-edge graphs, critical paths, Euler paths, and minimal spanning trees and communicate to peers the application of the algorithm in precise mathematical and nontechnical language.</li> </ul>

<b>Unit Number and Title:</b>	<b>Unit 8: Geometric and Logical Reasoning</b>
<b>Resource(s):</b>	AMDM - Chapter 8
<b>Learning Goals</b>	
<b>Standard(s):</b>	N/A
<b>Essential Question(s):</b>	How can the rules of logic help us solve problems and make effective decisions?
<b>Enduring Understanding(s):</b>	Analyzing geometric relationships develops reasoning and justification skills.
<b>Learning Goal(s):</b> <i>Students will be able to use their learning to:</i>	<ul style="list-style-type: none"> <li>● Use precision and accuracy in real-life situations related to measurement and significant figures</li> <li>● Solve geometric problems involving indirect measurement Law of Sines, Law of Cosines, and the use of dynamic geometry software;</li> <li>● Add, subtract, and multiply matrices to solve applied problems, including geometric transformations</li> <li>● Determine the validity of logical arguments that include compound conditional statements by constructing truth tables</li> </ul>