

Advanced Mathematical Decision Making

Mathematical Practices

0 Display perseverance and patience in problem-solving. Demonstrate skills and strategies needed to succeed in mathematics, including critical thinking, reasoning, and effective collaboration and expression. Seek help and apply feedback. Set and monitor goals. [AMD.MP](#)

0.1 Make sense of problems and persevere in solving them. [AMD.MP.1](#)

0.2 Reason abstractly and quantitatively. [AMD.MP.2](#)

0.3 Construct viable arguments and critique the reasoning of others. [AMD.MP.3](#)

0.4 Model with mathematics. [AMD.MP.4](#)

0.5 Use appropriate tools strategically. [AMD.MP.5](#)

0.6 Attend to precision. [AMD.MP.6](#)

0.7 Look for and make use of structure. [AMD.MP.7](#)

0.8 Look for and express regularity in repeated reasoning. [AMD.MP.8](#)

Mathematical Modeling

1 Apply mathematics to real-life situations; model real-life phenomena using mathematics. [AMD.MM.1](#)

1.1 Explain contextual, mathematical problems using a mathematical model. [AMD.MM.1.1](#)

1.2 Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts. [AMD.MM.1.2](#)

1.3 Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation. [AMD.MM.1.3](#)

1.4 Use relevant information to create various mathematical representations and structures to solve real-life problems. [AMD.MM.1.4](#)

Quantitative & Proportional Reasoning

2 Make decisions and solve problems using ratios, rates, and percents in a variety of real-world applications. [AMD.QPR.2](#)

2.1 Apply proportions, ratios, rates, and percentages to various settings, including business, media, and consumerism. [AMD.QPR.2.1](#)

2.2 Solve problems involving ratios in mechanical and agricultural contexts. [AMD.QPR.2.2](#)

- 2.3 Use proportions to solve problems involving large quantities that are not easily measured. [AMDM.QPR.2.3](#)

3 Make predictions by analyzing averages and indices of large data sets through investigations of real-world contexts. [AMDM.QPR.3](#)

- 3.1 Use averages and weighted averages to make decisions. [AMDM.QPR.3.1](#)
- 3.2 Calculate and interpret indices. [AMDM.QPR.3.2](#)

Patterning & Algebraic Reasoning

4 Develop methods or algorithms to analyze discrete situations. [AMDM.PAR.4](#)

- 4.1 Create and verify identification numbers. [AMDM.PAR.4.1](#)
- 4.2 Analyze and evaluate the mathematics behind various methods of voting and selection. [AMDM.PAR.4.2](#)
- 4.3 Evaluate various voting and selection processes to determine an appropriate method for a given situation. [AMDM.PAR.4.3](#)
- 4.4 Apply various ranking algorithms to determine an appropriate method for a given situation. [AMDM.PAR.4.4](#)

5 Analyze the chances for success or failure in order to make decisions. [AMDM.PR.5](#)

- 5.1 Determine conditional probabilities and probabilities of compound events to make decisions in problem situations. [AMDM.PR.5.1](#)
- 5.2 Use probabilities to make and justify decisions about risks in everyday life. [AMDM.PR.5.2](#)

8 Create and analyze mathematical models to make decisions related to earning, investing, spending, and borrowing money. [AMDM.PAR.8](#)

- 8.1 Use exponential functions to model change in a variety of financial situations. [AMDM.PAR.8.1](#)
- 8.2 Determine, represent, and analyze mathematical models for income, expenditures, and various types of loans and investments. [AMDM.PAR.8.2](#)

11 Use functions to model problem situations in both discrete and continuous relationships. [AMDM.PAR.11](#)

- 11.1 Represent situations and solve problems using vectors, in areas such as transportation, computer graphics, and the physics of force and motion. [AMDM.PAR.11.1](#)
- 11.2 Represent geometric transformations and solve problems using matrices. [AMDM.PAR.11.2](#)

12 Make informed decisions and solve problems with a variety of network models in quantitative situations. [AMDM.PAR.12](#)

- 12.1 Solve problems represented by a vertex-edge graphs. [AMDM.PAR.12.1](#)
- 12.2 Construct, analyze, and interpret flow charts to develop an algorithm to describe processes such as quality control procedures. [AMDM.PAR.12.2](#)

12.3 Investigate the scheduling of projects using Program Evaluation Review Technique (PERT). [AMDM.PAR.12.3](#)

12.4 Consider problems that can be resolved by coloring graphs. [AMDM.PAR.12.4](#)

Probabilistic Reasoning

6 Model strategic interaction among rational decision-makers. [AMDM.PR.6](#)

6.1 Calculate expected value to analyze mathematical fairness, payoff, and risk. [AMDM.PR.6.1](#)

6.2 Analyze real-life situations involving strategic interactions using the mathematics of zero-sum games. [AMDM.PR.6.2](#)

6.3 Construct a mathematical model of probabilistic situations to make mathematical assumptions. [AMDM.PR.6.3](#)

Data & Statistical Reasoning

7 Conduct investigative research to solve real-life problems and answer statistical investigative questions involved in business and financial decision-making. [AMDM.DSR.7](#)

7.1 Apply statistical methods to design, conduct, and analyze statistical studies. Identify a contextual, real-life problem that can be answered using investigative research. [AMDM.DSR.7.1](#)

7.2 Build the skills and vocabulary necessary to analyze and critique reported statistical information, summaries, and graphical displays. Develop statistical investigative questions that can help solve a real-life problem involved in business and financial decision-making. [AMDM.DSR.7.2](#)

7.3 Create a statistical study using sound methodology to answer statistical investigative questions and to solve the real-life problem. [AMDM.DSR.7.3](#)

7.4 Explain how the sample size impacts the precision with which estimates of the population parameters can be made (i.e., the larger the sample size the more precision). [AMDM.DSR.7.4](#)

7.5 Recognize that random selection from a population plays a different role than random assignment in an experiment. [AMDM.DSR.7.5](#)

7.6 Incorporate random designs in data collection. [AMDM.DSR.7.6](#)

7.7 Describe ways in which big data can be used to make decisions in various business enterprises and in the context of business and financial decision-making. [AMDM.DSR.7.7](#)

7.8 Use distributions to identify the key features of the data collected. [AMDM.DSR.7.8](#)

7.9 Interpret results and make connections to the original research question. [AMDM.DSR.7.9](#)

Functional & Graphical Reasoning

9 Use functions to model problem situations in both discrete and continuous relationships. [AMDM.FGR.9](#)

9.1 Determine whether a problem situation involving two quantities is best modeled by a discrete or continuous relationship. [AMDM.FGR.9.1](#)

9.2 Use linear, exponential, logistic, and piecewise functions to construct a model. [AMDM.FGR.9.2](#)

Geometric & Spatial Reasoning

10 Use functions to model problem situations in both discrete and continuous relationships. [AMDM.GSR.10](#)

- 10.1** Create and use two-dimensional and three-dimensional representations to model authentic situations. [AMDM.GSR.10.1](#)
- 10.2** Solve problems involving inaccessible distances using basic trigonometric principles including extensions of right triangle trigonometry. [AMDM.GSR.10.2](#)