

# Math of Finance

*Course Description and Competencies for Math of Finance 4770*

## Course Description

Math of Finance is designed to increase students' readiness for careers and life. This course will strengthen students' problem-solving abilities through the use of projects and collaborative learning. Math of Finance utilizes a variety of mathematical concepts to engage in relevant, real-world applications, including, but not limited to:

- Banking and investing
- Creating and managing a business
- Economics
- Employment in an hourly or salaried position
- Exploring financial disparities within and beyond our communities
- Home ownership
- Short- and long-term Impacts of financial decisions
- Stock market analysis
- Planning for retirement

This course is *not* designed to meet the Personal Financial Literacy (PFL) graduation requirement, but when the Math of Finance competencies are applied to real world situations, opportunities to address several of the PFL standards and objectives become evident. Applicable PFL standards and objectives are identified below.

## Vision and Guiding Principles

The Math of Finance competencies are written with the same guiding principles as the *Oklahoma Academic Standards for Mathematics* (OAS-M) and support students in the development of the Mathematical Actions and Processes outlined in the standards. Researched best-practices, NCTM's *Principles to Actions*, NCTM's *Essential Standards for High School Mathematics*, and existing OAS-M were utilized in creating the competencies listed below.

Developing mathematical proficiency and literacy for Oklahoma students depends in large part on a clear, comprehensive, coherent, and developmentally appropriate set of competencies to guide curricular decisions. The understanding and implementation of these competencies and standards throughout PK-12 mathematics experience for students is based on the following guiding principles:

- *Guiding Principle 1:* Excellence in mathematics education requires equity—high expectations and strong support for all students.
- *Guiding Principle 2:* Mathematical ideas should be explored in ways that stimulate curiosity, create enjoyment of mathematics, and develop depth of understanding.
- *Guiding Principle 3:* An effective mathematics program focuses on problem solving.
- *Guiding Principle 4:* Technology is essential in teaching and learning mathematics.

The Math of Finance competencies envision all students in Oklahoma will become mathematically proficient and literate through a strong mathematics program that emphasizes and engages them in problem solving, communicating, reasoning and proof, making connections, and using representations. Mathematically proficient and literate students can confidently and effectively use mathematics concepts, computation skills, and numbers to problem-solve, reason, and analyze information.

## Math of Finance Competencies

### Oklahoma Mathematical Actions and Processes.

*The incorporation of the Oklahoma Mathematical Actions and Processes<sup>1</sup> were identified to be essential in the overall progression of PK-12 mathematics education. Throughout the implementation of the included competencies, it is essential to connect students to the holistic nature of mathematics that is represented within the Mathematical Actions and Processes. Throughout their PK-12 mathematical experience, students will:*

**Develop a Deep and Flexible Conceptual Understanding.** Demonstrate a deep and flexible conceptual understanding of mathematical concepts, operations, and relations while making mathematical and real-world connections.

**Develop Accurate and Appropriate Procedural Fluency.** Pursue efficient procedures for various computations and repeated processes based on a strong sense of numbers. They will develop a sophisticated understanding of the development and application of algorithms and procedures.

**Develop Strategies for Problem Solving.** Analyze the parts of complex mathematical tasks and identify entry points to begin the search for a solution. They will select from a variety of problem solving strategies and use corresponding multiple representations (verbal, physical, symbolic, pictorial, graphical, tabular) when appropriate. They will pursue solutions to various tasks from real-world situations and applications that are often interdisciplinary in nature. They will find methods to verify their answers in context and will always question the reasonableness of solutions.

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<sup>1</sup> The Mathematical Actions and Processes were included in the 2015 revisions of the Oklahoma Academic Standards for Mathematics. Each of the seven components is based on the Process Standards produced by the National Council of Teachers of Mathematics in 2000 and the interwoven strands of Mathematical Proficiency identified in the 2001 National Research Council report, Adding it Up.

**Develop Mathematical Reasoning.** Explore and communicate a variety of reasoning strategies to think through problems. They will apply their logic to critique the thinking and strategies of others to develop and evaluate mathematical arguments, including making arguments and counterarguments and making connections to other contexts.

**Develop a Productive Mathematical Disposition.** Hold the belief that mathematics is sensible, useful and worthwhile. They will develop the habit of looking for and making use of patterns and mathematical structures. They will persevere and become resilient, effective problem solvers.

**Develop the Ability to Make Conjectures, Model, and Generalize.** Make predictions and conjectures and draw conclusions throughout the problem solving process based on patterns and the repeated structures in mathematics. They will create, identify, and extend patterns as a strategy for solving and making sense of problems.

**Develop the Ability to Communicate Mathematically.** Discuss, write, read, interpret and translate ideas and concepts mathematically. As they progress, students' ability to communicate mathematically will include their increased use of mathematical language and terms and analysis of mathematical definitions.

## Math of Finance Competencies (MF)

### Numbers and Operations (N)

*Reasoning with Numbers and Operations involves students developing number sense, understanding ways of representing numbers, analyzing relationships among numbers, and working with number systems. In Math of Finance, students organize numerical data and perform mathematical operations to make predictions about future trends, compare and contrast financial options, calculate estimated costs, and analyze additional financial applications.*

**MF.N.1 Students will extend the understanding of the real number system and how it relates to real-world applications such as earnings, taxes, financial management, and budgeting.**

**MF.N.1.1** Use the order of operations to solve real-world problems.

**MF.N.1.2** Apply the relationship between ratios, rates, equivalent fractions and percents to solve problems in various real-world contexts such as components of income.

**MF.N.2 Students will represent and solve mathematical and real-world problems using rational numbers, matrices, radical expressions, and expressions written with rational exponents.**

**MF.N.2.1** Determine the most appropriate numerical representations (percents, decimals, fractions) to use when solving real-world problems.

**MF.N.2.2** Use mathematical models to organize and represent data.

**MF.N.2.3** Use the properties of exponents and equivalent expressions to solve real-world problems such as repayment amounts paid on a loan.

**MF.N.2.4** Understand and apply the relationship of rational exponents to integer exponents and radicals to solve real-world problems.

## **Algebraic Reasoning & Algebra (A)**

*Students use algebraic reasoning to represent real-world or mathematical problems and solve these equations graphically and algebraically.*

*Students can utilize technology and their written process to justify their reasoning and solutions.*

### **MF.A.1. Students will represent and solve mathematical and real-world problems using equations and systems of equations.**

**MF.A.1.1** Represent real-world or mathematical problems using linear equations, and solve these equations graphically or algebraically.

**MF.A.1.1.1** Analyze mathematical change involving linear equations in real-world and mathematical problems.

**MF.A.1.1.2** Use arithmetic sequences to identify patterns in data and determine future trends.

**MF.A.1.1.3** Calculate and interpret slope and the x- and y-intercepts of a line using a graph, an equation, two points, or a set of data points to solve real-world problems.

**MF.A.1.1.4** Create graphing stories to represent financial situations such as comparison of earnings and compensation methods.

**MF.A.1.1.5** Use systems of linear equations to compare financial benefits of real-world situations such as opening different banking accounts and cost/benefit analysis.

**MF.A.1.2** Represent real-world or mathematical problems using exponential and logarithmic equations, such as compound interest, credit limit and interest charges, wage deductions, and geometric sequences determining future data trends, and solve these equations graphically or algebraically.

**MF.A.1.3** Compare and contrast real-world linear and exponential models, such as the different costs of operating a car.

**MF.A.1.4** Analyze and use formulas to calculate financial information including, but not limited to average daily balances, interest rates, estimated benefits, car price mark-up, profit-margins, and monthly payments.

### **MF.A.2 Students will represent, solve and interpret real-world problems using inequalities and systems of inequalities.**

**MF.A.2.1** Represent and solve real world situations with inequalities and interpret the solutions in their original context.

**MF.A.2.2** Use algebraic, interval, and set notations to specify the solution sets of one and two variable inequalities.

**MF.A.2.3** Recognize and apply the idea that inequalities can be connected with linear, quadratic, and exponential contexts.

## Functions (F)

*Reasoning with functions provides students with opportunities to investigate multiple representations using the same data. Students will deepen their understanding of functions through real-world applications involving finance.*

### **MF.F.1 Students will analyze properties of functions through the use of data.**

- MF.F.1.1** Identify the dependent and independent variables as well as the domain and range; identify the restrictions on the domain and range in real-world contexts.
- MF.F.1.2** Identify the type of function used within a real-world situation while representing the function using tables, graphs or equations.
- MF.F.1.3** Describe the contextual meaning of the coordinate point or interval within a function.
- MF.F.1.4** Identify and graph vertex-form quadratic functions to help solve real-world problems.

### **MF.F.2 Students will understand functions as descriptions of covariation (how related quantities vary together) in real-world and mathematical problems.**

- MF.F.2.1** Represent functions in multiple ways and use the representation to interpret real-world and mathematical problems.
- MF.F.2.2** Given a graph or real-world situation (i.e. Federal Withholding Tax), read, interpret, and model using piecewise-functions.

## Geometry (G)

*Geometry enables students to use proofs, mathematical modeling, and properties of polygons to solve mathematical and real-world problems.*

### **MF.G.1 Students will use geometric concepts to determine financial benefits and outcomes.**

- MF.G.1.1** Use appropriate tools and logic to evaluate mathematical arguments.
- MF.G.1.2** Apply properties of polygons and determine scale factors to solve real-world problems such as cost of living, home value, and property lines.

## Data and Probability (D)

*Data and Probability involves extending students' observational skills and ability to differentiate between types of data. Students will become fluent with data interpretation and choosing the best data display for any occasion.*

### **MF.D.1 Students will have opportunities to create, describe, and analyze multiple representations of data.**

- MF.D.1.1** Recognize and interpret the different representations of data including, but not limited to scatterplots, box-and-whisker plots, histograms, circle graphs, and data tables.
- MF.D.1.2** Use real-world scenarios to recognize patterns in problems.

- MF.D.1.3** Use graphing technology to determine regression lines and correlation coefficients; use regression lines to make predictions and correlation coefficients to assess the reliability of those predictions. Identify the difference between correlation vs. causation of data.
- MF.D.1.4** Describe a data set using data displays, describe and compare data sets using summary statistics, including measures of central tendency, location, and spread. Know how to use calculators, spreadsheets, or other appropriate technology to display data and calculate summary statistics.
- MF.D.1.5** Evaluate reports based on data published in the media by identifying the source of the data, the design of the study, and the way the data are analyzed and displayed. Given spreadsheets, tables, or graphs, recognize and analyze distortions in data displays.
- MF.D.1.6** Identify and explain misleading uses of data, and show how graphs and data can be distorted to support different points of view.

**MF.D.2 Students will make predictions based on probability and data.**

- MF.D.2.1** Calculate experimental probabilities by performing simulations or experiments involving a probability model and using relative frequencies of outcomes.
- MF.D.2.2** Apply probability concepts to real-world situations to make informed decisions.
- MF.D.2.3** Use organized data to develop conditional probabilities and analyze how conditions or assumptions affect the computation of a probability.

## **Personal Financial Literacy (PFL) Standards and Objectives**

*By applying the Math of Finance competencies, teachers will have the opportunities to also address the following Personal Financial Literacy standards and objectives. Note, this course does not address all of the [Oklahoma Personal Financial Literacy Standards](#).*

**PFL.1\* The student will describe the importance of earning an income and explain how to manage personal income through the use of a budget.**

- PFL.1.1** Using decision-making models, evaluate how career choices, educational/vocational preparation, skills, and entrepreneurship affect income and standard of living (e.g., postsecondary degree/ certification, needs versus wants, and the ability to live on less than you earn).

**PFL.2 The student will identify and describe the impact of local, state, and federal taxes on income and standard of living.**

- PFL.2.1** Identify and explain types of taxes (e.g., personal income, sales, and property taxes) and explain the reasons for taxation at the local, state, and federal levels (e.g., roads, water and sanitation services, social services, schools, and law enforcement).
- PFL.2.2** Explain how taxes, employee benefits, and payroll deductions affect income.
- PFL.2.3** Explain the individual importance of meeting tax obligations and describe possible consequences of failing to meet those obligations (e.g., fees, penalties, interest, garnishment of wages, and imprisonment).

**PFL.2.4** Explain the societal importance for meeting tax obligations (e.g., market economy and capitalism: poverty, pollution, medical research, government assistance programs, education, and government funded services and projects).

**PFL.3\*** The student will describe the functions and uses of banks and other financial service providers.

**PFL.3.2** Describe and compare the most common financial products and services (e.g., checking, contactless payments systems, credit cards, Automated Teller Machines, savings, loans, investments, and insurance)

**PFL.5** The student will analyze the costs and benefits of saving and investing.

**PFL.5.1** Explain reasons for saving and investing to meet goals and build wealth (e.g., opportunity cost, return on investment, emergencies, major purchases, down payments, and education).

**PFL.5.2** Identify and compare the costs and benefits of various investment strategies (e.g., compound interest, interest rates, tax implications, account liquidity, and investment diversification) and how inflation affects investment growth.

**PFL.6** The student will explain and evaluate the importance of planning for retirement.

**PFL.6.1** Describe the necessity of accumulating financial resources needed for specific retirement goals, activities and lifestyles, based on life expectancy.

**PFL.6.2** Explain the roles of Social Security, employer retirement plans (401k or 403b) and personal investments (e.g., annuities, IRAs, real estate, stocks, and bonds) as sources of retirement income, and how to acquire these plans (e.g., banks, insurance companies).

**PFL.7\*** The student will identify the procedures and analyze the responsibilities of borrowing money.

**PFL.7.4** Explain how the terms of a loan (e.g., interest rates, fees, and repayment schedules) affect the cost of credit.

**PFL.7.5** Explain the impact of non-repayment on individuals, families, business, and the broader economic system as a whole.

**PFL.8** The student will describe and explain interest, credit cards, and online commerce.

**PFL.8.1** Compare costs and benefits of using credit cards and making online purchases (e.g., interest rates, fees, repayment schedules, and personal information protection).

**PFL.8.2** Evaluate options for payments on credit cards (e.g., minimum payment, delayed payments, or payment in full).

**PFL.10** The student will explain and compare the responsibilities of renting versus buying a home.

**PFL.10.1** Compare the costs and benefits of renting versus buying a home.

**PFL.10.2** Explain the elements of a standard lease agreement (e.g., deposit, due date, grace period, late fees, and utilities).

**PFL.10.3** Explain the elements of a mortgage (e.g., down payment, escrow account, due date, late fees, property taxes, potential early payment penalties, and amortization tables); types of lenders; and fixed or adjustable rate mortgage loans.

**PFL.11\* The student will describe and explain how various types of insurance can be used to manage risk.**

**PFL.11.3** Examine appropriate amounts of insurance and how insurance deductibles work.

**PFL.12 The student will explain and evaluate the financial impact and consequences of gambling.**

**PFL.12.1** Analyze the probabilities involved in winning at games of chance (e.g., sports betting, online betting, and fantasy sports).

**PFL.12.2** Evaluate costs and benefits of gambling to individuals and society (e.g., family budget, addictive behaviors, and the local and state economy).

**PFL.13\* The student will evaluate the consequences of bankruptcy.**

**PFL.13.1** Assess the costs and benefits of bankruptcy to individuals, families, and society.

*\*indicates partial coverage of a PFL standard*

## Questions about this document?

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## Submit your feedback:

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