Perris Union High School District
Course of Study

A. COURSE INFORMATION

Course Title:
Advanced Algebra with Financial Applications

x New
❑ Revised

Transcript Title/Abbreviation:
(To be assigned by Educational Services)

Transcript Course Code/Number:
(To be assigned by Educational Services)

Subject Area:
❑ Social Science
❑ English
x Mathematics
❑ Laboratory Science
❑ World Languages
❑ Visual or Performing Arts
❑ College Prep Elective
❑ Other

Is this classified as a Career Technical Education course?
❑ Yes
x No

Grade Level
❑ MS
❑ HS
❑ 5
❑ 6
❑ 7
❑ 8
❑ 9
❑ 10
x 11
x 12

Required for Graduation:
❑ Yes
x No

Meets UC/CSU Requirements?
x Yes
❑ No

Was this course *previously approved by UC* for PUHSD?
❑ Yes
x No
(Will be verified by Ed Services)

Meets "AP" Requirements?
❑ Yes
x No

Submitted by: Diana Fowles
Site: Heritage High School
Date: November 18, 2015

Credential Required to teach this course:
Mathematics

To be completed by Human Resources only.

Delisa Provost 3/9/16
Signature **Date**

Meets "Honors" Requirements?
❑ Yes
x No

Unit Value/Length of Course:
❑ 0.5 (half year or semester equivalent)
x 1.0 (one year equivalent)
❑ 2.0 (two year equivalent)
❑ Other:

Approvals	Name/Signature	Date
SAC		
EPC		4/7/2016
PUHSD Board		5-18-16

Prerequisite(s) (REQUIRED):
Algebra 1
Corequisite(s) (REQUIRED):
N/A
Brief Course Description (REQUIRED):
Advanced Algebra with Financial Applications is a mathematical modeling course that is algebra-based, applications-oriented, and technology-dependent. The course addresses college preparatory mathematics topic from Advanced Algebra, Statistics, Probability, Precalculus, and Calculus under seven financial umbrellas: Banking, Investing, Credit, Employment and Income Taxes, Automobile Ownership, Independent Living, and Retirement Planning and Household Budgeting. The course allows students to experience the interrelatedness of mathematical topics, find patterns, make conjectures, and extrapolate from known situations to unknown situations.

B. COURSE CONTENT
Course Purpose (REQUIRED): *What is the purpose of this course? Please provide a brief description of the goals and expected outcomes. Note: More specificity than a simple recitation of the State Standards is needed.*
The purpose of the course is for students to expand upon concepts learned in previous math courses through higher level applications of real world financial algebra, while earning mathematics A-G credit. This class is a project based learning class designed so that upon completion students are well prepared for financial decisions that they will face in their future.
Course Outline (REQUIRED): *Detailed description of topics covered. All historical knowledge is expected to be empirically based, give examples. Show examples of how the text is incorporated into the topics covered.*
Unit 1: Banking Services

CCSS Mathematical Practice standards: MP1, MP4, MP5, MP6, and MP8.

Students use exponential functions to compute compound interest and compare it to simple interest. They derive formulas and use iteration to compute compound interest. They apply their findings to short-term, long-term, single deposit and periodic deposit accounts. The problems, activities and projects inherent in studying banking are a natural forum for all eight Common Core State Standards for Mathematical Content that are addressed namely A-CED4, A-SSE1a, A-SSE1b, A-SSE3, F-IF4, F-IF8b, F-BF1a, N-RN1, N-RN2

Unit 1 Mathematics Learning Goals:

Students will:

- use the simple interest formula and use inverse operations to solve for missing variables in interest problems.
- use iteration to show how compounding pays "interest on your interest."
- derive the compound interest formula by using patterns and inductive reasoning.
- compute compound interest with and without the formula.
- apply and interpret limit notation.
- model an infinite series and finding a finite sum for an infinite series with common ratio ½.
- compute limits of polynomial functions.
- approximate the natural base *e* by examining the exponential sequence for increasing values of the exponent and denominator.
- inductively derive the natural base *e*.
- apply the natural base *e* in the formula for continuous compounding of interest.
- be able to identify exponential growth and decay formulas.
- model a geometric series
- graph exponential functions.
- analyze rational function behavior and limits.
- compute Annual Percentage Yield (APY), given the Annual Percentage Rate (APR).
- use the compound interest formula to derive the present value of a single deposit investment formula.
- use the compound interest formula to derive the rational function that models the present value of a periodic deposit investment.
- use the future value of a periodic deposit investment formula.
- adapt the algebra from banking formulas for input into a spreadsheet.

Key Assignment 1.1: How Interest Method Affects Monetary Growth

Mathematics: Simple interest, compound interest

Mathematics Learning Goals: Students will determine how increased compounding affects growth.

Students are first introduced to the meaning of compounding numerically via mathematical iteration. Before embarking on a rigorous study of limits and compound interest algebraic formulas, students are asked "How much would $1,000 grow to, in one year, at 100% interest compounded continuously?" The 100% interest and continuous compounding often leads them to guess much higher than the actual amount. Their guesses are recorded, and a statistical analysis of their guesses is made. Outliers are carefully noted. The findings of this activity are scrutinized after students complete Key Assignment 3.

Key Assignment 1.2: Deriving the Compound Interest Formula

Mathematics: Inductive reasoning, exponential functions, rational functions

Mathematics Learning Goals: Students will use patterns and induction to generate for selected forms of compounding and adapt them to monthly, weekly, daily, and hourly compounding.

Students will compute interest for each interest period over a semi-annual and quarterly compounded account for a given balance and interest rate. They will derive the general algebraic formulas for these two types of compounding. They will then look for patterns in the semi-annual and quarterly compound interest formulas to inductively conjecture about the general formula for compounding. They will then find formulas for monthly, weekly, daily and hourly compounding, and compute and compare the interest earned over one year for these accounts.

Key Assignment 1.3: Using Limits to Derive the Natural Base e

Mathematics: Rational functions, exponential functions

Mathematics Learning Goals: Students will use substitution and patterns to generate a series that approaches e

as x approaches infinity.

Students will be introduced to the notion of limits and limit notation and apply it to the compound interest formulas previously derived. They will increase the number of compoundings by first computing interest when the compounding period is every minute, and then every second, for a given balance and interest rate. They will then let the number of compoundings 'n' approach infinity to see what happens to the annual interest as the number of compoundings approaches infinity. They will analyze the compound interest formula without the balance, and explain the "battle" between the base and the exponent of the expression as n.

Key Assignment 1.4: Future Value and College Costs

Mathematics: Rational functions, regression

Mathematics Learning Goals: Students will estimate the cost of a college education in 18 years and determine how much needs to be saved each month to have the costs covered by the 18th year.

Students pick a college and find out the cost of tuition, room and board (if necessary) and fees over the past ten years. They set up a regression line or curve of best fit. They then predict the cost of a college education in 18 years (as if they just had a child and were trying to save for college). They then use the prevailing interest rate and the future value formula to determine the monthly periodic deposit that would be necessary to have the full college cost saved by the child's 18th birthday. They then do the problem with interest rates slightly higher than the prevailing rate.

Unit 2: Investing

Students are introduced to basic business organization terminology in order to read, interpret, chart and algebraically model stock ownership and transaction data. Statistical analysis plays a very important role in the modeling of a business. Using linear, quadratic, and regression equations in that process assists students in getting a complete picture of supply, demand, expense, revenue, and profit as they model the production of a new product. The problems, activities, and key assignments in this Investing Unit offer students opportunities to learn, explore, and use the CCSS Mathematical Practices MP1, MP2, MP3,MP4, MP5.

Common Core State Standards for Mathematical Content that are Addressed: A-CED1, A-CED2, A-CED3,

A-CED4,A-REI2, A-REI3, A-REI4b, A-REI6, A-REI7, A-REI10, A-REI11,A-REI12, A-SSE1, F-IE4, F-IF1, F-IF4, F-IF5, F-IF7a, F-IF8, S-ID6, N-Q1, N-Q2, N-Q3, S-ID8, S-ID9

Unit 2 Mathematical Learning Goals:

Students will:

- construct, use, and interpret algebraic ratios and proportions.
- determine, use, and interpret percent increase/decrease of monetary amounts.
- construct and interpret pictorial representations of data.
- Given a set of *n* data points, calculate and interpret *d*-day simple moving averages by applying the Arithmetic Average Formula and the Subtraction/Addition Method.
- calculate the post-split and pre-split price per share
- calculate the stock yield percentage.
- construct and interpret scatterplots.
- delineate causation vs. correlation for bivariate data.
- identify explanatory, response, and lurking variables.
- find, interpret, and graph linear regression equations and determine the correlation coefficient.
- translate verbal situations into algebraic linear functions.
- translate verbal situations into quadratic functions.
- translate verbal situations into linear and quadratic inequalities.
- solve linear systems of equations and inequalities and identify points of intersection and domains in the context of the problem situation.
- find the axis of symmetry, vertex, roots, and the concavity of parabolic curves.
- solve linear-quadratic systems of equations and inequalities, and interpret the roots, intersection points, relative extrema, absolute extrema, and domains in the context of the problem situation.
- use the transitive property of dependence.
- determine the zero net difference.
- write algebraic formulas for use in spreadsheets.

Key Assignment 2.1: Charting a Corporate Stock

Mathematics: Data Analysis, regression, prediction, modeling, graphical interpretation

Mathematics Learning Goals: Students will use mathematical modeling to chart and interpret stock market trends over a 15-day period. They will make trend predictions based on simple moving average crossover

analysis as well as regression models.

Each student selects a corporation traded on the New York Stock Exchange. They produce a background paper PowerPoint presentation or poster board display on that corporation.

Students chart the open, close, high, low and volume data for 15 consecutive trading days. They graph the data using two different formats and then discuss trends that the data shows. They will also calculate three different cluster-lengths of moving averages and, using those clusters, they will create superimposed line graphs. Students discuss trading implications based upon stated domains of graph pairs before and after any intersection points. Finally, they determine the closing price curve of best fit using regression analysis. They must state the regression equation and support why their stated curve best fits the data of closing prices. Students will then use the curve of best fit to predict a closing price on the 16th trading day. They compare that predicted price with the actual closing price on the 16th day and find a percent error.

Key Assignment 2.2: Mathematically Modeling A Business

Mathematics: Linear and quadratic functions, linear/linear Systems, linear/quadratic systems, regression analysis

Mathematics Learning Goals: Students will create linear and quadratic models for a start-up business. They wi graph and interpret systems of these regression and modeling equations in order to explore the relationship between and among expense, demand, price, revenue and profit.

Students are given a market research scenario for a new product, obtained from a focus group questionnaire. The research contains a list of ordered pairs in the form (p,q) where p is a potential price and q is the quantity o the product that the focus group member would purchase if it was set at that price. Using these ordered pairs, students construct a scatterplot, determine the correlation coefficient, and identify a linear regression equation i which q is the independent variable and p is the dependent variable. Then, given information about expenses, they are to set up a linear expense function in terms of the quantity demanded. The quadratic revenue and profit equations are determined and graphed on the same axes with the expense function. Students identify an interpret the breakeven points, the coordinates of the maximum point on the revenue graph, the coordinates of the maximum point on the profit graph, and the price at which the product should be sold in order to maximize profit. Finally, students are told the initial price per share for the company's stock and asked to determine the

number of shares that must be sold in order to have enough money to start this business.

Unit 3 Employment and Income Taxes

Many Internal Revenue Service and Social Security Administration regulations can be modeled by using linear and polygonal functions that have different slopes over different domains. Line-by-line instructions for IRS forms can also be algebraically symbolized. The problems, activities and projects inherent in studying employment and income taxes are a natural forum for all eight CCSS Mathematical Practice standards, this unit highlights MP1, MP4, MP5, MP6, and MP7.

Common Core State Standards for Mathematical Content that are Addressed: A-CED1, A-CED2, A-CED3, A-CED4, A-REI3, A-SSE1, F-BF1, F-IF1, F-IF2, F-IF4, F-IF7b, F-IF8, F-LE1

Unit 3 Mathematics Learning Goals:

Students will:

- identify continuous and discontinuous functions by their graphs.
- interpret jump discontinuities.
- determine and interpret domains of piecewise functions
- graph exponential pay schedules
- graph piecewise functions with cusps
- compute measures of central tendency and rational functions
- use geometric sequences
- express percent increases and decreases as rational functions
- convert point-slope form to slope-intercept form
- graph continuous polygonal functions with multiple slopes and cusps
- translate verbal expressions into literal rational, exponential, and linear equations.
- model a tax bracket, given a compound inequality statement, and model a tax bracket to determine the tax using a linear equation
- model algebraically a tax schedule
- create and interpret piecewise functions
- adapt all algebraic formulas in the unit for use in spreadsheets

Key Assignment 3.1: Creating the Tax Worksheet

Mathematics: Domains, piecewise functions, linear functions and graphs, point-slope form, slope-intercept form graphs with cusps.

Mathematics Learning Goals: Students will derive the slope-intercept form used on the IRS tax worksheet by translating tax tables into piecewise functions.

The tax tables give taxpayers a function in which the independent variable is the taxable income and the dependent variable is the tax. It is convoluted and has confused taxpayers for years. Within the last decade, the IRS created a worksheet that uses the slope-intercept form of the equations of a line to simplify calculations for the taxpayer. In this Key Assignment, students interpret the IRS Schedule, express the domains using compound inequality notation, and create the piecewise function that models the IRS intentions. They then convert this function, which is a translated version of point-slope form, into the slope-intercept form to create the tax worksheet.

Key Assignment 3.2: Graphing the FICA Tax Function

Mathematics: Piecewise functions, slope, cusps, linear equations

Mathematics Learning Goals: Students will use graphs to compare the FICA tax longitudinally over a prescribed number of years.

Students look up the FICA tax percents, and maximum taxable incomes to create piecewise functions for each of the last six years. They compute the maximum FICA tax, and graph all six years on the same axes, and use the graph to write a paragraph on what has happened to FICA taxes over those years. They discuss the significance of the coordinates of the cusp. They do the same for the tax years 1981-86, and compare the last six years to the years 1981-1986. The assignment is replicated using the Medicare tax percent.

Unit 4: Automobile Ownership

Various functions, their graphs, and data analysis can be instrumental in the responsible purchase and operatio of an automobile. In this unit, students will examine the mathematics of automobile advertising, sales and purchases, insurance, depreciation, safe driving, and accident reconstruction. The problems, activities, and key assignments in this Automobile Ownership Unit offer students opportunities to learn, explore, and use the CCSS

Mathematical Practices MP1, MP3,MP4, MP5, MP6.

Common Core State Standards for Mathematical Content that are Addressed: A-CED2, A-CED3, A-CED4,A-REI2, A-SSE1b, A-SSE3, F-IF1, F-IF2, F-IF4, F-IF6, F-IF7a, F-IF7b, F-IF7e, F-IF8b, F-IF9, F-LE1b, F-LE1c, F-LE5, G-C5, S-ID1, S-ID2, S-ID3, S-ID4, S-ID6, S-ID7

Unit 4 Mathematical Learning Goals:

Students will:

- model exponential depreciation
- transform raw data into a frequency distribution.
- create and interpret stem and leaf plots and side-by-side steam plots that display two distributions simultaneously.
- create and interpret side-by-side, modified box and whisker plots
- compute measures of dispersion
- compute Q_1, Q_2, Q_3 and Q_4 manually and with the graphing calculator
- compute boundaries for outliers
- compute measures of central tendency, median and mode
- determine the domains of a piecewise function from verbal situations
- graph piecewise functions using mutually exclusive domains
- determine the cusp of a piecewise function at a change in slope
- use multi-variable square root functions such as the skid length
- determine the reaction distance
- compute braking distance and stopping distance
- compute miles per gallon and distance
- use geometry theorems involving chords intersecting in a circle and radii perpendicular to chords to determine yaw mark arc length
- compute arc lengths
- use dilations to transform formulas between the English Standard and metric measurement system
- adapt all algebraic formulas from the chapter for use in spreadsheets

Key Assignment 4.1: Using Statistics to Negotiate Auto Transactions

Mathematics: Bivariate data, correlation, regression, mean, median, mode, quartiles, interquartile range, outliers, modified box-and-whisker plots, stem-and-leaf plots, frequency distributions, scatterplots.

Mathematics Learning Goals: Students will use measures of central tendency and measures of dispersion to mathematically negotiate the buying and/or selling of an automobile.

Students choose a make, model and year for an automobile. They use the Internet and newspaper classified ads to find 10-20 of those cars for sale. They get the price of the car and the mileage it has. They construct modified box-and-whisker plots and describe the frequency distribution. They pair each car's price with its mileage to create a scatterplot. They classify the association as positive or negative. They find the regression line and correlation coefficient and interpret the relationship as strong, moderate or weak, and discuss its linearity. Their results are presented to the class via PowerPoint presentation or poster presentation.

Key Assignment 4.2: Automobile Cost and Depreciation

Mathematics: Exponential regression, graphing linear and exponential functions, rational functions, linear/exponential systems, systems of linear equations, slope-intercept form.

Mathematics Learning Goals: Students use graphing techniques to compare the value of a car to the expense o purchasing it throughout its lifetime.

Using the monthly payment rational function, students graph the cost C of purchasing a new car, using the dowr payment as the y-intercept, and the monthly payment as the slope. They then investigate three types of depreciation: straight-line, exponential, and historical bathtub graphs. They graph the cost and depreciation functions on the same set of axes to find the month at which the total cost C of owning the car surpasses its value V as it depreciates. They identify and interpret the domains on which $C > V$ and $C < V$.

Key Assignment 4.3: The Physics of Driving

Mathematics: Quadratic equations, radical functions, arc length, geometry of the circle.

Mathematics Learning Goals: Students will use the mathematics listed to determine braking distances and to gather data from accidents scenes.

Students use formulas to determine reaction distance, braking distance, and figure out the speed a car was

going based on its skid marks. The braking-distance formula is a quadratic function, with speed as the independent variable. The skid speed formula is an irrational function that has three independent variables. Students also use the geometry of the circle to compute the radius of a given yaw mark, which is a curved skid mark, and use the radius and friction factor to find the speed the car was going when it began to skid. The students then prepare a PowerPoint or poster presentation for the driver's education class in their school.

Unit 5: Consumer Credit

Becoming familiar with credit terminology and regulations is critical in making wise credit decisions. Credit comes at a price and in this unit students learn how to use mathematics to make wise credit choices that fit their needs, current financial situation, and future goals. The problems, activities, and key assignments in this Consumer Credit Unit offer students opportunities to learn, explore, and use the CCSS Mathematical Practices MP1, MP2, MP4, MP5, MP6, MP7.

Common Core State Standards for Mathematical Content that are Addressed: A-CED3, A-SSE1, A-SSE2, A-SSE3, F-IF8b, F-BF1a, F-LE5, N-Q1, N-Q2, S-ID6a

Unit 5 Mathematics Learning Goals:

Students will:

- create, evaluate, interpret and solve algebraic proportions.
- model situations using linear, quadratic, cubic, and exponential equations.
- determine the curve of best fit using linear, quadratic, or cubic regression equations.
- create, use, and interpret exponential growth and decay equations that model given situations.
- use the slope-intercept form y=Mx+b where M is the exponential monthly payment equation.
- use the finance formula
- use inverse functions to create the natural logarithm function.
- solve for the exponent *t* in the monthly payment formula
- interpret and use summation notation to model the average daily balance.
- create and use algebraic formulas and apply them for use in spreadsheets.

Key Assignment 5.1: Can I Afford This Loan?

Mathematics: Exponential functions, logarithmic functions, system of exponential and linear functions,

modeling, graphical interpretation

Mathematics Learning Goals: Students will use three modalities to determine the affordability of a loan: exponential formula evaluation, logarithmic formula evaluation, and interpreting an exponential/linear system. T use technology (graphing utility and/or spreadsheet) to make the determinations required and justify their responses.

Students are given a scenario in which a family must make a decision about the affordability of a loan based on the principal, the loan-length, the APR and the maximum affordable monthly payment the family is able to make towards loan debt reduction. Students determine the affordability of the loan in three different ways: using the monthly payment function, interpreting the graphs of the system of equations defined by the exponential monthl payment function and the linear maximum affordable monthly payment, and using the logarithmic loan length function. They are then asked to construct two spreadsheets: a monthly payment spreadsheet that charts the monthly payment as loan length time varies from 1 to 20 years, and a loan length spreadsheet that charts time as monthly payments vary from $100 to $1000. Finally, students must write up a summary analysis for this situation explaining how the algebraic modeling by the spreadsheet formulas supports their prior work.

Key Assignment 5.2: Mathematically Modeling a Credit Card Statement

Mathematics: Algebraic modeling and spreadsheet formula creation

Mathematics Learning Goals: Students will algebraically model a month of activity on a person's credit card.

Students create a 21-day credit calendar that depicts algebraic representations of daily balances based upon a opening balance of Y dollars, an X-dollar purchased on the 8th day, a Z dollar payment on the 13th day, and a W-dollar purchased on the 20th day. Using these representations from the calendar, they write algebraic expressions for the sum of the daily balances, the average daily balance, and the finance charge for this 21-day period given that the APR on this credit card is P%. Students then create a spreadsheet that models the situation described above and test their spreadsheet for a given data set.

Unit 6: Independent Living

In this unit, students work their way through the mathematics that models moving, renting, and purchasing a

place to live. They also explore the geometric demands of floor plans and design. and cover the relationship between area and probability.

Common Core State Standards for Mathematical Content that are addressed: A-APR6, A-CED2, A-CED3, A-REI6, A-SSE, F-BF1, G-C5, G-MG3, S-ID6a, S-ID6c, S-ID68

Unit 6 Mathematics Learning Goals:

Students will:

- use rational functions to compute back-end and front-end ratios for mortgage applications
- make computations based on the monthly payment formula
- compute mortgage interest
- use the apothem to derive the formula for the area of a regular polygon
- use probability to find the area of irregular plane region (The Monte Carlo Method)
- use factors of dilations to draw to scale
- compute areas of irregular and shaded regions
- use rational functions to compute BTUs
- solve scale problems using proportions
- use literal equations to create multi-variable tax assessment equations
- use exponential equations to model rent increases
- read and interpret data
- use the future value of a periodic deposit formula to make comparisons to mortgage payments and increasing resale value of a home
- adapt all algebraic formulas for use in spreadsheets
- translate verbal expressions into literal equations

Key Assignment 6.1: Areas of Irregular Plane Figures

Mathematics: Probability, ratios, random integers, graphing, random number table

Mathematics Learning Goals: Students will use the Monte Carlo method to find the area of any regular or irregular plane figure.

Students superimpose a grid on an irregular plane figure that is part of a landscape design. They outline the irregular figure with a rectangle and use a random number generator from a calculator, or a random number

table, to generate 500 points, which they plot on their rectangular grid. As they plot each point, they note if it is inside or outside of the irregular region. They find the percent of random points that landed in the irregular regio and take that percent of the area of the enclosing rectangle to approximate the area of the irregular region.

Key Assignment 6.2: Areas of Shaded Regions

Mathematics: Area formulas

Mathematics Learning Goals: Students will determine areas of plane figures that have sections removed from them.

As part of a unit on floor plans and interior design, students compute areas of floors to find the cost of new flooring. They also compute the cost of paint by taking the areas of the walls and subtracting window and door areas. They employ the area of a circle, square, triangle, rectangle, trapezoid, and parallelogram, and create a poster display on what a specific room cost to redo.

Key Assignment 6.3: The Apothem and the Area of a Regular Polygon

Mathematics: Inscribed circles, area of a triangle, perimeter, congruence.

Mathematics Learning Goals: Students will derive a formula for the area of any regular polygon.

Students use the area of a triangle to find the area of a regular polygon. They divide a regular polygon into triangles, by connecting the center to each vertex. They draw in the altitude, which is renamed the apothem, an find the area of the triangle. They discuss the congruence of the n triangles formed in the regular n-gon, and multiply to find the area of the polygon. They then model this algebraically, and use the commutative property of multiplication to derive the formula that the area is half the product of the apothem and the perimeter of the regular polygon.

Key Assignment 6.4: How Increased Payments Affect Mortgages

Mathematics: Rational functions

Mathematics Learning Goals: Students will determine the reduction in interest that extra mortgage payments

result in.

Students use the monthly payment formula to compute the monthly payment for a hypothetical mortgage amount over 15 and 30 years. They compute the total payments, based on 12 monthly payments each year, an the total interest for the entire loan. They then use a mortgage calculator to assume an extra, 13th payment is made each year, so payments are made once every 4 weeks instead of once each month. They compute the interest and new total repayment period and compare the total interest to the original conventional mortgage to see the savings in total years and interest.

Unit 7: Retirement Planning and Budgeting

The focus of this unit is on the mathematics of fiscal plans that workers can make years ahead of their retirement date. This involves a detailed study of retirement savings plans, both personal and federal, employe pension programs, and life insurance. Additionally, students are asked to call upon the knowledge acquired in al of the preceding units in order to create and chart a responsible personal budget plan, to mathematically analyz cash flow, and to determine net worth. The problems, activities and projects inherent in studying budgeting and retirement planning are a natural forum for all eight CCSS Mathematical Practice standards, this unit highlights MP1, MP2, MP4, MP5, MP6, and MP8.

Common Core State Standards for Mathematical Content that are Addressed: A-CED3, A-REI10, A-SSE1, F-BF1, F-IF4, F-IF5, F-IF7a, F-IF7b, F-IF8b, N-Q1, N-Q2, N-VM6, S-MD1, S-MD2, S-MD4, S-MD5

Unit 7 Mathematics Learning Goals:

Students will:

- use the exponential future value of a periodic investment formula to predict balances after t years when given a periodic deposit amount, an investment return rate, and compounding information. *Financial Algebra* section 3-7 teaches students how to compute the future value of an account in which the same periodic investment is made over a long period of time.
- use the exponential present value of a periodic investment formula of the form to determine the principa when given a future value, a time in years, an investment return rate, and compounding information. *Financial Algebra* section 3-8 shows students how much they have to contribute over a certain length of time to reach a future financial goal. This is part of Key Assignment 7.2, in which students act as financial planners.
- use rational functions to plan retirement funding. *Financial Algebra* section 9-1 uses multi-variable

rational functions to compute requirements to meet specific financial goals. This is also a component of Key Assignment 7.2.Students will create and analyze discrete probability distributions. *Financial Algebra* section 9-4 requires students to set up a table representing a discrete probability distribution by filling in the values of a random variable and the associated probabilities. Key Assignment 7.1 uses the mortality tables to compute life insurance benefits at different periods in the policy of a term insurance policy.use inequalities to define domains when creating algebraic expressions.*Financial Algebra* section 9-1 expresses income brackets as compound inequalities which serve as the domain for tax functions.

- write rational expressions to represent increase over time. *Financial Algebra* section 9-4 requires students to express percent increases in life insurance premiums as rational functions.
- use and interpret the greatest integer function. *Financial Algebra* section 10-2 introduces the greatest integer function to algebraically model cell phone charges.
- determine and interpret the expected value of a probability distribution. *Financial Algebra* section 9-4 develops the concept of expected value, in the context of life insurance. The random variable is the life insurance benefit. Mortality tables supply the probabilities associated with each value of the random variable.
- create interpret, and graph greatest integer functions. *Financial Algebra* section 10-2 incorporates the greatest integer function to model billing that is dependent on entries being integers.
- incorporate the greatest integer function into a piecewise function. *Financial Algebra* section 10-2 combines piecewise functions with the greatest integer function when the criteria involved in the splitting of the function depends on whether the input variable is an integer or not.
- create, interpret, and graph a system of a linear and a piecewise function and determine the point of intersection.*Financial Algebra* section 10-2 compares two optional billing plans offered by a utility to determine at what usage the costs are equivalent. This would be one facet of the many variable inheren in the completion of Key Assignment 7.4.
- use sectors and central angles of a circle to depict proportional categories on a pie chart when given categorical information. *Financial Algebra* section 10-3 requires the students to proportionally divide a circle into sectors that represent given percentages, to display budget allocation.
- create and interpret linear budget line equations and inequalities to optimize purchases within a given monetary constraint. *Financial Algebra* section 10-3 features these graphs. Key Assignment 7.4 investigates the combinations of possible purchases within a constrained budget.
- use multiple representations to chart data relating to retirement and budgeting. *Financial Algebra* sections 10-3 and 10-4 uses a matrix to chart budgeting for a household over a year. Key Assignment 7.3 uses spreadsheets to calculate cash flow, net worth, and debt reduction.

Key Assignment 7.1: How Do Life Insurance Companies Earn a Profit?

Mathematics: Expected value, random variables, probability distributions

Mathematics Learning Goals: Students will use probability distributions and mortality tables to compute the profi earned on a five-year term life insurance policy.

Students use the probability inherent in mortality tables and life insurance annual premiums to compute the expected profit for a life insurance company's term policy. They create probability distributions for the random variable profit and compute expected profit by summing the products of the individual profits and probabilities fo each year of the policy. They compute the minimum annual premium the company must charge to earn a profit.

Key Assignment 7.2: Planning For Retirement

Mathematics: Exponential equations, expected value, data analysis, modeling and predicting

Mathematics Learning Goals: Students will apply prior knowledge from the banking unit to make decisions about the feasibility of a retirement plan.

Students are given financial information about a prospective retiree and asked to act as a financial retirement planner. The prospective retiree has also supplied the planner with desired monetary goals in retirement. Base upon information about savings plans, social security benefits, pensions, and life insurance policies, and using formulas learned in this unit, the planner is to write up a financial plan for the prospective retiree that includes at least two ways of meeting the goals and has mathematical justification for the recommendations made.

Key Assignment 7.3: Cash Flow, Net Worth and Debt Reduction

Mathematics: Algebraic ratios, modeling, linear equations

Mathematics Learning Goals: Students will create a spreadsheet that calculates cash flow, net worth, and debt to income ratio.

Students are given a budget spreadsheet that contains the headings of income, fixed expenses, variable expenses, and non-monthly expenses. There are sub-headings under each of these listing specific categories

relating to the heading. Students are given a full accounting of a person's financial status and asked to build a spreadsheet that calculates that person's cash flow. In addition, the students are given information about the person's assets and liabilities and are asked to add it to the spreadsheet and determine the net worth. Finally, based upon the calculation of the debt-to-income ratio, students are asked to develop a debt reduction plan for the individual if necessary.

Key Assignment 7.4: Budget Line Equations

Mathematics: Linear equations, domain, range, constraints, modeling,

Mathematics Learning Goals: Students will construct and interpret a graphical representation of a particular aspect of a budget.

A budget line graph allows the user to interpret many combinations of product usage based upon given constraints. The interpretation of the combinations allows the user to make decisions about affordability. Students are given information about a particular aspect of a personal budget. This data contains prices and budgeting constraints. Students are asked to construct a budget line equation of the form where and are costs related to two budgeted items, x and y, and B is the budgeted amount. They then examine the regions above, on, and below the budget line to identify points representing affordability data. Students make recommendation for this budget item based upon the interpretation of the budget line graph.

Internet Resources for Supporting Learning in the Budgeting/Retirement Planning Unit

Mapping Your Future www.mappingyourfuture.org. Students can get budget tips and then plan a budget by entering their expenses into a software template.

Practical Money Skills www.practicalmoneyskills.com. This site gives students access to a budget worksheet and budget calculators.

Writing Assignments (REQUIRED):
Give examples of the writing assignments and the use of critical analysis within the writing assignments.

Writing assignments for the class will include but are not limited to summaries and/or essay writing on the following key assignments: 1.1: How Interest Method Affects Monetary Growth, 1.4: Future Value and College Costs, 2.2: Mathematically Modeling A Business, 5.1: Can I Afford This Loan?, 7.1: How Do Life Insurance Companies Earn a Profit? and 7.2: Planning For Retirement

INSTRUCTIONAL MATERIALS (REQUIRED)	
Textbook #1	
Financial Algebra: Advanced Algebra with Financial Applications	Edition: 1st
Author: Robert Gerver and Richard Sgroi	ISBN: ISBN13: 978-1-285-44485-7
Publisher: South-Western CENGAGE Learning	Publication Date: 2014
Usage: ❑ Primary Text ❑ Read in entirety or near	
Textbook #2	
Title:	Edition:
Author:	ISBN:
Publisher:	Publication Date:
Usage: ❑ Primary Text ❑ Read in entirety or near	
Supplemental Instructional Materials *Please include online, and open source resources if any.*	
N/A	
Estimated costs for classroom materials and supplies (REQUIRED). *Please describe in detail.* If more space is needed than what is provided, please attach backup as applicable.	
Cost for class set of textbooks: 2,977.92	Description of Additional Costs: A Student Edition for PUHSD $82.75 (Regularly $111.95) and for every 20 student editions we get a free teacher's edition. ($82.75 x 36 = $2,977.92)
Additional costs:	
Total cost per class set of instructional materials:	$2,977.92

Key Assignments (REQUIRED):
Please provide a detailed description of the Key Assignments including tests, and quizzes, which should incorporate not only short answers but essay questions also. How do assignments incorporate topics? Include all major

assessments that students will be required to complete

Key assignments and projects:

- 1.1: How Interest Method Affects Monetary Growth
- 1.2: Deriving the Compound Interest Formula
- 1.3: Using Limits to Derive the Natural Base e
- 1.4: Future Value and College Costs
- 2.1: Charting a Corporate Stock
- 2.2: Mathematically Modeling A Business
- 3.1: Creating the Tax Worksheet
- 3.2: Graphing the FICA Tax Function
- 4.1: Using Statistics to Negotiate Auto Transactions
- 4.2: Automobile Cost and Depreciation
- 4.3: The Physics of Driving
- 5.1: Can I Afford This Loan?
- 5.2: Mathematically Modeling a Credit Card Statement
- 6.1: Areas of Irregular Plane Figures
- 6.2: Areas of Shaded Regions
- 6.3: The Apothem and the Area of a Regular Polygon
- 6.4: How Increased Payments Affect Mortgages
- 7.1: How Do Life Insurance Companies Earn a Profit?
- 7.2: Planning For Retirement
- 7.3: Cash Flow, Net Worth and Debt Reduction
- 7.4: Budget Line Equations

Instructional Methods and/or Strategies (REQUIRED):

Please list specific instructional methods that will be use.

This class will entail some direct instruction and a significant amount of project based learning and student directed research.

Assessment Methods and/or Tools (REQUIRED):

Please list different methods of assessments that will be used.

Students will be assessed through quizzes and chapter tests, as well as, based on the quality and depth of their key assignments.

COURSE PACING GUIDE AND OBJECTIVES (REQUIRED)				
Day(s)	**Objective**	**Standard(s)**	**Chapter(s)**	**Reference**
	Unit 1:Banking Services	MP1, MP4, MP5, MP6, and MP8 A-CED4, A-SSE1a, A-SSE1b, A-SSE3, F-IF4, F-IF8b, F-BF1a, N-RN1, N-RN2	Ch 3	
	Unit 2: Investing	MP1, MP2, MP3, MP4, MP5 A-CED1, A-CED2, A-CED3, A-CED4,A-REI2, A-REI3, A-REI4b, A-REI6, A-REI7, A-REI10, A-REI11,A-REI12, A-SSE1, F-IE4, F-IF1, F-IF4, F-IF5, F-IF7a, F-IF8, S-ID6, N-Q1, N-Q2, N-Q3, S-ID8, S-ID9	Ch 1 and 2	
	Unit 3: Employment and Income Taxes	MP1, MP4, MP5, MP6, and MP7 A-CED1, A-CED2, A-CED3, A-CED4, A-REI3, A-SSE1, F-BF1, F-IF1, F-IF2, F-IF4, F-IF7b, F-IF8, F-LE1	Ch 6 and 7	
	Unit 4: Automobile Ownership	MP1, MP3,MP4, MP5, MP6 A-CED2, A-CED3, A-CED4,A-REI2, A-SSE1b, A-SSE3, F-IF1, F-IF2, F-IF4, F-IF6, F-IF7a, F-IF7b, F-IF7e, F-IF8b, F-IF9, F-LE1b, F-LE1c, F-LE5, G-C5, S-ID1, S-ID2, S-ID3, S-ID4, S-ID6, S-ID7	Ch 5	
	Unit 5: Consumer Credit	MP1, MP2, MP4, MP5, MP6, MP7 A-CED3, A-SSE1, A-SSE2, A-SSE3, F-IF8b, F-BF1a, F-LE5, N-Q1, N-Q2, S-ID6a	Ch 4	
	Unit 6: Independent Living	A-APR6, A-CED2, A-CED3, A-REI6, A-SSE, F-BF1, G-C5, G-MG3, S-ID6a, S-ID6c, S-ID68	Ch 8	
	Unit 7: Retirement Planning and Budgeting	MP1, MP2, MP4, MP5, MP6, and MP8 A-CED3, A-REI10, A-SSE1, F-BF1,	Ch 9, and 10	

		F-IF4, F-IF5, F-IF7a, F-IF7b, F-IF8b, N-Q1, N-Q2, N-VM6, S-MD1, S-MD2, S-MD4, S-MD5		

C. HONORS COURSES ONLY
Indicate how much this honors course is different from the standard course.

D. BACKGROUND INFORMATION
Context for course (optional)
History of Course Development (optional)