

# Financial Algebra

## Unit 1 - Discretionary Expenses

Desired Results					
<p><b>ESTABLISHED GOALS</b></p> <p><b>Priority Standards</b></p> <p>F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* a. Graph linear and quadratic functions and show intercepts, maxima, and minima.</p> <p>S-ID.2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.</p> <p>N-Q.2. Define appropriate quantities for the purpose of descriptive modeling.</p> <p><b>Supporting Standards</b></p> <p>F-IF.1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If <math>f</math> is a function and <math>x</math> is an element of its domain, then <math>f(x)</math> denotes the output of <math>f</math> corresponding to the input <math>x</math>. The graph of <math>f</math> is the graph of the equation <math>y = f(x)</math>.</p> <p>F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of</p>	<b>Transfer</b>				
	<p><i>Students will be able to independently use their learning to ...</i></p> <p>Interpret and make sense of personal financial situations involving discretionary and essential expenses through algebraic, statistical and quantitative reasoning.</p>				
	<b>Meaning</b>				
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<p>the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. b. Use the properties of exponents to interpret expressions for exponential functions.</p> <p>S-ID.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).</p> <p>S-ID.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.</p> <p>S-ID.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. For example: Describe solutions to problems that require interpolation and extrapolation. c. Fit a linear function for a scatter plot that suggests a linear association.</p>	<p>→ Use quantitative reasoning to support personal financial decisions.</p>	<ul style="list-style-type: none"> <li>→ I can construct a scatter plot.</li> <li>→ I can fit a linear regression line to a scatterplot.</li> <li>→ I can find the equation of a linear regression line.</li> <li>→ I can compute and interpret the correlation coefficient.</li> <li>→ I can use extrapolation and interpolation to make predictions based on regression lines.</li> </ul> <p><b>Statistics &amp; Probability:</b></p> <ul style="list-style-type: none"> <li>→ I can determine the mean of a data set.</li> <li>→ I can determine the median of a data set.</li> <li>→ I can determine the mode of a data set.</li> <li>→ I can create and interpret a frequency distribution table.</li> <li>→ I can determine the mean, median, and mode of a data set presented as a frequency distribution table.</li> <li>→ I can determine and interpret cumulative frequency.</li> <li>→ I can determine and interpret relative frequency.</li> <li>→ I can determine and interpret relative cumulative frequency.</li> <li>→ I can model a distribution using a spreadsheet.</li> <li>→ I can state the difference between measures of central tendency and measures of dispersion.</li> <li>→ I can compute the range for a data set.</li> </ul>
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<p>S-ID.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.</p> <p>S-ID.8. Compute (using technology) and interpret the correlation coefficient of a linear fit.</p> <p>S-ID.9. Distinguish between correlation and causation.</p> <p>N-Q.1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.</p> <p>N-Q.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.</p>	<p>→ I can compute the mean deviation for a data set.</p> <p>→ I can compute the absolute mean deviation for a data set.</p> <p>→ I can compute the variance for a data set.</p> <p>→ I can compute the standard deviation for a data set.</p> <p>→ I can measure dispersion using the standard deviation as a unit.</p> <p>→ I can find percentages and percentiles using the normal distribution.</p> <p>→ I can compute and interpret z-scores.</p> <p>→ I can compute raw scores using z-scores.</p> <p>→ I can state the difference between univariate and bivariate data.</p> <p>→ I can interpret trends based in bivariate data.</p> <p><b>Number &amp; Quantity:</b></p> <p>→ I can determine and interpret percentiles.</p> <p>→ I can choose and interpret units consistently in formulas.</p> <p>→ I can choose and interpret the scale and the origin in graphs and data displays.</p> <p><b>Personal Finance:</b></p> <p>→ I can differentiate between essential and discretionary expenses.</p>
Evidence	
Evaluative Criteria	Assessment Evidence
Formative Assessments: <ul style="list-style-type: none"> <li>● Do Now and CCSS Warmups</li> </ul>	PERFORMANCE TASK(S): To be determined.

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- Homework Assignments
  - Check Your Understanding Problems
  - Extend Your Understanding Problems
- Ticket to Leave Activities (Exit Ticket)
- Direct and Indirect Teacher Questions
- Exploration of Essential Questions
- Written and Oral Responses
- Journals and Self-Reflection
- Performance Tasks
- Technology-based Assessments

### Summative Assessments:

- Lesson Opener Quizzes
- Unit Summative Exams
- Experiential Learning Activities

2019 Pilot

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## Unit 2 - Banking Services

Desired Results		
<p><b>ESTABLISHED GOALS</b></p> <p><b>Priority Standards</b></p> <p>F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i></p> <p>F-BF.1a. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.</p> <p>A-SSE.1a/b. Interpret expressions that represent a quantity in terms of its context.</p> <p><b>Supporting Standards</b></p> <p>A-CED.4. Rearrange formulas (literal equations) to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</p> <p>A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain</p>	<b>Transfer</b>	
	<p><i>Students will be able to independently use their learning to ...</i></p> <p>Interpret and make sense of personal financial situations involving banking services through algebraic and quantitative reasoning.</p>	
	<b>Meaning</b>	
	<p><b>UNDERSTANDINGS</b></p> <p><i>Students will understand that ...</i></p> <ol style="list-style-type: none"> <li>The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>Quantitative reasoning supports personal financial decisions.</li> </ol>	<p><b>ESSENTIAL QUESTIONS</b></p> <p><i>Students will keep considering ...</i></p> <ol style="list-style-type: none"> <li>How the Standards of Mathematical Practice support solving problems in a variety of contexts?</li> <li>How can I model financial situations using algebraic reasoning? What is the best way to model financial situations?</li> <li>How can I use quantitative reasoning to support my personal financial decisions?</li> </ol>
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	<p><i>Students will know how to ...</i></p> <ul style="list-style-type: none"> <li>→ Use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> <li>→ Use algebraic reasoning to model and efficiently solve financial situations.</li> <li>→ Use statistical reasoning to model, interpret and compare various financial situations.</li> <li>→ Use quantitative reasoning to support personal financial decisions.</li> </ul>	<p><i>Students will be skilled at ...</i></p> <p><b>Standards for Mathematical Practice:</b></p> <ul style="list-style-type: none"> <li>→ I can use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> </ul> <p><b>Algebraic Functions:</b></p> <ul style="list-style-type: none"> <li>→ I can model the reconciliation process using variables.</li> <li>→ I can reconcile a bank statement and check register using a spreadsheet.</li> </ul>

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<p>properties of the quantity represented by the expression.</p> <p>F-IF.8b. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as <math>y = (1.02)^t</math>, <math>y = (0.97)^t</math>, <math>y = (1.01)^{12t}</math>, <math>y = (1.2)^{t/10}</math>, and classify them as representing exponential growth or decay.</p> <p>F-BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.</p> <p>F-BF.5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.</p> <p>N-RN.1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3) \cdot 3}</math> to hold, so <math>(5^{1/3})^3</math> must</p>	<p>→ I can write the general form for an arithmetic sequence.</p> <p>→ I can find the common difference in an arithmetic sequence.</p> <p>→ I can use the simple interest formula to find the interest given the principal, rate, and time.</p> <p>→ I can use the simple interest formula to find the principal given the interest, rate, and time.</p> <p>→ I can use the simple interest formula to find the time given the principal, rate, and interest.</p> <p>→ I can use the simple interest formula to find the rate given the principal, interest, and time.</p> <p>→ I can apply the compound interest formula.</p> <p>→ I can explore annual, semiannual, quarterly, monthly, and daily iteration using the simple interest formula.</p> <p>→ I can use iteration to develop the formula for compound interest.</p> <p>→ I can use the compound interest formula to find the ending balance given the principal, rate and time.</p> <p>→ I can use the compound interest formula to find the rate given the principal, time and the balance.</p> <p>→ I can use the compound interest and simple interest formulas to determine the APY.</p>
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N-RN.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents. *For example: Write equivalent representations that utilize both positive and negative exponents.*

- I can determine  $f(x)$  as  $x$  approaches infinity given a polynomial function in terms of  $x$ .
- I can determine  $f(x)$  as  $x$  approaches infinity, given a rational function in terms of  $x$ .
- I can determine  $f(x)$  as  $x$  approaches infinity given an exponential function in terms of  $x$ .
- I can determine the limit as  $x$  approaches infinity of an exponential function  $f(x)$ .
- I can develop a working knowledge of  $e$ .
- I can determine the balance of an account using the compound interest formula.
- I can determine the balance in an account using the future value of a periodic deposit investment formula.
- I can determine the interest earned on an account using the future value of a periodic deposit investment formula.
- I can graph and interpret the graph of the future value of a periodic investment formula.
- I can derive the formula for the present value of a single deposit investment from the compound interest formula.
- I can use the present value of a single deposit investment formula to determine the principal that must be invested.
- I can derive the formula for the present value of a periodic deposit investment

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		<p>from the future value of a periodic deposit investment formula.</p> <ul style="list-style-type: none"><li>→ I can use the present value of a periodic deposit investment formula to determine the amount to be deposited periodically.</li><li>→ I can graph and interpret the graph of the present value of a periodic deposit investment function.</li><li>→ I can determine the interest rate after inputting values for B, P, r, and n, in the compound interest formula.</li><li>→ I can develop both a conceptual and working understanding of a logarithm in the context of the term (maturity) of an account.</li><li>→ I can rewrite an exponential equation as an equivalent logarithmic equation.</li><li>→ I can rewrite a logarithmic equation as an equivalent exponential equation.</li><li>→ I can use the change-of-base formula where appropriate to make computations with logarithms easier to perform.</li><li>→ I can use logarithms to determine the term of a single deposit investment account when given the principal, monetary goal, rate, and compounding period.</li><li>→ I can recognize the relationship between logarithms, common logarithms and natural logarithms.</li></ul>
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		<ul style="list-style-type: none"> <li>→ I can express an exponential equation with base <math>e</math> in terms of an equivalent natural log equation.</li> <li>→ I can express a natural logarithm equation in terms of an exponential equation with base <math>e</math></li> <li>→ I can use of the change-of-base formula.</li> <li>→ I can explain and apply the One-to-One Property of logarithms.</li> <li>→ I can explain and apply the Power Property of logarithms.</li> <li>→ I can determine the term of systematic savings.</li> <li>→ I can determine the term of a systematic withdrawal..</li> </ul> <p><b>Number &amp; Quantity:</b></p> <ul style="list-style-type: none"> <li>→ I can order percentages.</li> <li>→ I can determine the balance in a check register.</li> </ul> <p><b>Personal Finance:</b></p> <ul style="list-style-type: none"> <li>→ I can make checking and savings account transactions.</li> <li>→ I can reconcile a bank statement and a check register.</li> </ul>
<b>Evidence</b>		
<b>Evaluative Criteria</b>	<b>Assessment Evidence</b>	
Formative Assessments: <ul style="list-style-type: none"> <li>● Do Now and CCSS Warmups</li> <li>● Homework Assignments               <ul style="list-style-type: none"> <li>○ Check Your Understanding Problems</li> <li>○ Extend Your Understanding Problems</li> </ul> </li> <li>● Ticket to Leave Activities (Exit Ticket)</li> </ul>	PERFORMANCE TASK(S): To be determined.	

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| <ul style="list-style-type: none"><li>● Direct and Indirect Teacher Questions</li><li>● Exploration of Essential Questions</li><li>● Written and Oral Responses</li><li>● Journals and Self-Reflection</li><li>● Performance Tasks</li><li>● Technology-based Assessments</li></ul> <p>Summative Assessments:</p> <ul style="list-style-type: none"><li>● Lesson Opener Quizzes</li><li>● Unit Summative Exams</li><li>● Experiential Learning Activities</li></ul> |  |
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## Unit 3 - Consumer Credit

Desired Results		
<p><b>ESTABLISHED GOALS</b></p> <p><b>Priority Standards</b></p> <p>F-BF.1. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context</p> <p>F-LE.5. Interpret the parameters in a linear or exponential function in terms of a context.</p> <p>S-ID.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. <i>Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.</i></p> <p><b>Supporting Standards</b></p> <p>N-Q.1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.</p> <p>N-Q.2. Define appropriate quantities for the purpose of descriptive modeling.</p>	<b>Transfer</b>	
	<p><i>Students will be able to independently use their learning to ...</i></p> <p>Make responsible decisions related to consumer credit based on algebraic, statistical and quantitative reasoning.</p>	
	<b>Meaning</b>	
	<p><b>UNDERSTANDINGS</b></p> <p><i>Students will understand that ...</i></p> <ol style="list-style-type: none"> <li>The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>Statistics are an essential tool when interpreting and comparing data sets and modeling financial situations.</li> <li>Quantitative reasoning supports personal financial decisions.</li> </ol>	<p><b>ESSENTIAL QUESTIONS</b></p> <p><i>Students will keep considering ...</i></p> <ol style="list-style-type: none"> <li>How the Standards of Mathematical Practice support solving problems in a variety of contexts?</li> <li>How can I model financial situations using algebraic reasoning? What is the best way to model financial situations?</li> <li>How can I use statistics to interpret and compare data sets and model financial situations?</li> <li>How can I use quantitative reasoning to support my personal financial decisions?</li> </ol>
<b>Acquisition</b>		
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A-CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing cost constraints in various situations.*

A-SSE.1. Interpret expressions that represent a quantity in terms of its context.

A-SSE.2. Use the structure of an expression to identify ways to rewrite it.

A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the properties of exponents to interpret expressions for exponential functions.

→ Use quantitative reasoning to support personal financial decisions.

→ I can model finance charges algebraically.

→ I can apply the simplified daily interest formula.

→ I can model loan payments.

→ I can understand how monthly payments are partially interest and partially payments towards principle.

→ I can use natural logarithms to compute loan lengths.

→ I can model average daily balances algebraically.

### **Statistics & Probability:**

→ I can use quadratic and cubic regression to fit scatterplots to curves.

### **Number & Quantity:**

→ I can compute how long it takes to save for items when credit is not used.

→ I can compute finance charges for installment purchases.

→ I can compute how credit scores can affect the cost of credit.

→ I can compute monthly payments using a monthly payment table.

→ I can compute finance charges on loans.

→ I can calculate interest on a student loan.

→ I can compute liabilities under the Truth in Lending Act.

→ I can compute monthly interest rates based on APR.

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		<ul style="list-style-type: none"><li>→ I can compute the average daily balance on a credit card.</li><li>→ I can understand how interest accumulates when only the minimum payment is paid monthly.</li><li>→ I can create an average daily balance calendar based on interpreting a credit card statement.</li><li>→ I can compute average daily balance.</li><li>→ I can find errors in credit card statements.</li><li>→ I can calculate and/or verify finance charges on a credit card statement.</li></ul> <p><b>Personal Finance:</b></p> <ul style="list-style-type: none"><li>→ I can understand the basic vocabulary necessary to use credit responsibly.</li><li>→ I can identify different types of lending institutions.</li><li>→ I can understand layaway plan fees.</li><li>→ I can understand deferred payment plans.</li><li>→ I can understand credit scores.</li><li>→ I explain options available for student loans.</li><li>→ I can understand the vocabulary of credit card usage.</li><li>→ I can understand credit legislation.</li><li>→ I can verify entries on a credit card statement.</li><li>→ I can understand the Schumer Box.</li><li>→ I can understand how purchases at different points in the billing cycle affect average daily balance.</li></ul>
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Evidence	
Evaluative Criteria	Assessment Evidence
<p>Formative Assessments:</p> <ul style="list-style-type: none"><li>● Do Now and CCSS Warmups</li><li>● Homework Assignments<ul style="list-style-type: none"><li>○ Check Your Understanding Problems</li><li>○ Extend Your Understanding Problems</li></ul></li><li>● Ticket to Leave Activities (Exit Ticket)</li><li>● Direct and Indirect Teacher Questions</li><li>● Exploration of Essential Questions</li><li>● Written and Oral Responses</li><li>● Journals and Self-Reflection</li><li>● Performance Tasks</li><li>● Technology-based Assessments</li></ul> <p>Summative Assessments:</p> <ul style="list-style-type: none"><li>● Lesson Opener Quizzes</li><li>● Unit Summative Exams</li><li>● Experiential Learning Activities</li></ul>	<p>PERFORMANCE TASK(S): To be determined.</p>

# Financial Algebra

## Unit 4 - Automobile Ownership

Desired Results		
<p><b>ESTABLISHED GOALS</b></p> <p><b>Priority Standards</b></p> <p>A-CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. <i>For example, represent inequalities describing cost constraints in various situations.</i></p> <p>A-REI.11. Explain why the x-coordinates of the points where the graphs of the equations <math>y = f(x)</math> and <math>y = g(x)</math> intersect are the solutions of the equation <math>f(x) = g(x)</math>; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where <math>f(x)</math> and/or <math>g(x)</math> are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.</p> <p>F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically, in tables, or by verbal descriptions). <i>For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</i></p>	<b>Transfer</b>	
	<p><i>Students will be able to independently use their learning to ...</i></p> <p>Make responsible decisions related to automobile ownership based on algebraic, statistical geometric and quantitative reasoning.</p>	
	<b>Meaning</b>	
	<p><b>UNDERSTANDINGS</b></p> <p><i>Students will understand that ...</i></p> <ol style="list-style-type: none"> <li>1. The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>2. Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>3. Statistics are an essential tool when interpreting and comparing data sets and modeling financial situations.</li> <li>4. Geometric reasoning is used to model and efficiently solve financial situations.</li> <li>5. Quantitative reasoning supports personal financial decisions.</li> </ol>	<p><b>ESSENTIAL QUESTIONS</b></p> <p><i>Students will keep considering ...</i></p> <ol style="list-style-type: none"> <li>1. How the Standards of Mathematical Practice support solving problems in a variety of contexts?</li> <li>2. How can I model financial situations using algebraic reasoning? What is the best way to model financial situations?</li> <li>3. How can I use statistics to interpret and compare data sets and model financial situations?</li> <li>4. How can I use geometric reasoning to model and efficiently solve financial situations?</li> <li>5. How can I use quantitative reasoning to support my personal financial decisions?</li> </ol>
<b>Acquisition</b>		
	<p><i>Students will know how to ...</i></p> <ul style="list-style-type: none"> <li>→ Use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> <li>→ Use algebraic reasoning to model and efficiently solve financial situations.</li> </ul>	<p><i>Students will be skilled at ...</i></p> <p><b>Standards for Mathematical Practice:</b></p> <ul style="list-style-type: none"> <li>→ I can use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> </ul>

## Financial Algebra

<p>S-ID.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a) Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b) Informally assess the fit of a function by plotting and analyzing residuals. For example: Describe solutions to problems that require interpolation and extrapolation. c) Fit a linear function for a scatter plot that suggests a linear association.</p> <p>S-ID.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.</p> <p><b>Supporting Standards</b></p> <p>A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</p> <p>A-CED.4. Rearrange formulas (literal equations) to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i></p>	<ul style="list-style-type: none"> <li>→ Use statistical reasoning to model, interpret and compare various financial situations.</li> <li>→ Use quantitative reasoning to support personal financial decisions.</li> </ul>	<p><b>Algebraic Functions:</b></p> <ul style="list-style-type: none"> <li>→ I can model a classified ad pricing schedule using a piecewise function.</li> <li>→ I can find and interpret the cusp of a piecewise function.</li> <li>→ I can determine the intercepts of a depreciation equation.</li> <li>→ I can determine the slope of a depreciation equation.</li> <li>→ I can model an automobile depreciation situation using a linear equation.</li> <li>→ I can use a linear depreciation equation to determine the value of a car after a specified period of time.</li> <li>→ I can use a linear depreciation equation to determine depreciation time.</li> <li>→ I can write an automobile expense function.</li> <li>→ I can create and graph the system of equations composed of the linear automobile expense function and the linear depreciation function.</li> <li>→ I can interpret the domains and the intersection point for the expense/depreciation system of equations.</li> <li>→ I can model a time/value situation using an exponential depreciation function.</li> <li>→ I can determine the depreciation percentage.</li> <li>→ I can determine the depreciation rate.</li> <li>→ I can use a linear/exponential system to model automobile expense and depreciation.</li> </ul>
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## Financial Algebra

<p>A-REI.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.</p> <p>A-SSE.1. Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity.</p> <p>A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.</p> <p>F-IF.1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If <math>f</math> is a function and <math>x</math> is an element of its domain, then <math>f(x)</math> denotes the output of <math>f</math> corresponding to the input <math>x</math>. The graph of <math>f</math> is the graph of the equation <math>y = f(x)</math>.</p> <p>F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.</p> <p>F-IF.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined</p>		<ul style="list-style-type: none"><li>→ I can create and graph the system of equations composed of the linear automobile expense function and the exponential depreciation function.</li><li>→ I can interpret the domains and the intersection point for the expense/depreciation system of equations.</li><li>→ I can use logs to determine the age of a car given its value at that time.</li><li>→ I can use the accident reconstruction formulas and data taken from the scene of an accident to determine driving speed at the time of an accident.</li><li>→ I can use projectile motion equations to model an accident situation.</li></ul> <p><b>Statistics &amp; Probability:</b></p> <ul style="list-style-type: none"><li>→ I can determine the quartiles of a data set.</li><li>→ I can determine the interquartile range of a set of data.</li><li>→ I can identify any outliers in a set of data.</li><li>→ I can create a frequency distribution from a set of data.</li><li>→ I can use box-and-whisker plots and stem-and-leaf plots to display information.</li><li>→ I can determine the probability of an event.</li><li>→ I can interpret and explain two-way tables.</li></ul>
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## Financial Algebra

<p>recursively by <math>f(0) = f(1) = 1</math>, <math>f(n + 1) = f(n) + f(n - 1)</math> for <math>n \geq 1</math>.</p> <p>F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i></p> <p>F-IF.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.</p> <p>F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.</p> <p>F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.</p> <p>F-BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model</p>	<p>→ I can determine conditional probabilities.</p> <p>→ I can determine if two events are independent.</p> <p>→ I can model a situation using Venn Diagrams.</p> <p>→ I can use a Venn Diagram to solve a conditional probability problem.</p> <p>→ I can convert a raw score to a z-score.</p> <p><b>Number &amp; Quantity:</b></p> <p>→ I can determine the sales tax on an automobile purchase.</p> <p>→ I can determine the cost of a classified auto advertisement.</p> <p>→ I can calculate an insurance policy surcharge.</p> <p>→ I can determine insurance deductibles.</p> <p>→ I can determine an insurance payout from a claim.</p> <p>→ I can use geometric sequences to model car values over time.</p> <p>→ I can determine the common ratio in a geometric sequence.</p> <p>→ I can determine average speed.</p> <p>→ I can determine mpg and Kpg.</p> <p>→ I can use exchange rates to find the value of world currencies.</p> <p><b>Geometry:</b></p> <p>→ I can use the distance formula.</p> <p>→ I can determine reaction distance.</p> <p>→ I can determine braking distance.</p> <p>→ I can determine total stopping distance.</p>
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## Financial Algebra

<p>situations, and translate between the two forms.</p> <p>F-BF.5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.</p> <p>F-LE.1. Distinguish between situations that can be modeled with linear functions and with exponential functions.</p> <p>F-LE.2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or input-output table of values.</p> <p>F-LE.4. For exponential models, express the solution as a logarithm where the base <math>b</math> is 2, 10, or <math>e</math>; evaluate the logarithm using technology.</p> <p>F-LE.5. Interpret the parameters in a linear or exponential function in terms of a context.</p> <p>G-C.5. Use and apply the concepts of arc length and areas of sectors of circles. Determine or derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as</p>		<ul style="list-style-type: none"><li>→ I can use the stopping distance formula for metric measures.</li><li>→ I can use the skid speed square root formula to determine the minimum speed of a car when entering a skid.</li><li>→ I can use the square root skid speed formula for yaw marks.</li><li>→ I can determine the radius of a circle given the length of a chord and a middle ordinate drawn to that chord.</li></ul> <p><b>Personal Finance:</b></p> <ul style="list-style-type: none"><li>→ I can responsibly purchase and operate an automobile.</li></ul>
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## Financial Algebra

the constant of proportionality; derive the formula for the area of a sector.

S-ID.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).

S-ID.2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

S-ID.3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). For example: Justify why median price of homes or income is used instead of the mean.

S-ID.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

S-ID.5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

## Financial Algebra

S-CP.1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).

S-CP.2. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

S-CP.3. Understand the conditional probability of A given B as  $P(A \text{ and } B)/P(B)$ , and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

S-CP.4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the

## Financial Algebra

<p>student is in 10th grade. Do the same for other subjects and compare the results.</p> <p>S-MD.1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.</p> <p>S-MD.2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.</p> <p>S-MD.4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. <i>For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?</i></p>	
<b>Evidence</b>	
<b>Evaluative Criteria</b>	<b>Assessment Evidence</b>
<p>Formative Assessments:</p> <ul style="list-style-type: none"> <li>● Do Now and CCSS Warmups</li> <li>● Homework Assignments             <ul style="list-style-type: none"> <li>○ Check Your Understanding Problems</li> <li>○ Extend Your Understanding Problems</li> </ul> </li> <li>● Ticket to Leave Activities (Exit Ticket)</li> <li>● Direct and Indirect Teacher Questions</li> <li>● Exploration of Essential Questions</li> </ul>	<p>PERFORMANCE TASK(S): To be determined.</p>

## Financial Algebra

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| <ul style="list-style-type: none"><li>● Written and Oral Responses</li><li>● Journals and Self-Reflection</li><li>● Performance Tasks</li><li>● Technology-based Assessments</li></ul> Summative Assessments: <ul style="list-style-type: none"><li>● Lesson Opener Quizzes</li><li>● Unit Summative Exams</li><li>● Experiential Learning Activities</li></ul> |  |
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2019 Pilot

# Financial Algebra

## Unit 5 - Employment

Desired Results				
<p>ESTABLISHED GOALS</p> <p><b>Priority Standards</b></p> <p>F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.</p> <p>F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i></p> <p>F-BF.1. Write a function that describes a relationship between two quantities. a) Determine an explicit expression, a recursive process, or steps for calculation from a context. b) Combine standard function types using arithmetic operations. <i>For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and</i></p>	<b>Transfer</b>			
	<p><i>Students will be able to independently use their learning to ...</i></p> <p>Make responsible decisions related to employment based on algebraic and quantitative reasoning.</p>			
	<b>Meaning</b>			
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 5px;">UNDERSTANDINGS <i>Students will understand that ...</i></th> <th style="text-align: left; padding: 5px;">ESSENTIAL QUESTIONS <i>Students will keep considering ...</i></th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;"> <ol style="list-style-type: none"> <li>1. The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>2. Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>3. Quantitative reasoning supports personal financial decisions.</li> </ol> </td> <td style="padding: 5px;"> <ol style="list-style-type: none"> <li>1. How the Standards of Mathematical Practice support solving problems in a variety of contexts?</li> <li>2. How can I model financial situations using algebraic reasoning? What is the best way to model financial situations?</li> <li>3. How can I use quantitative reasoning to support my personal financial decisions?</li> </ol> </td> </tr> </tbody> </table>	UNDERSTANDINGS <i>Students will understand that ...</i>	ESSENTIAL QUESTIONS <i>Students will keep considering ...</i>	<ol style="list-style-type: none"> <li>1. The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>2. Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>3. Quantitative reasoning supports personal financial decisions.</li> </ol>
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<b>Acquisition</b>				
<p><i>Students will know how to ...</i></p> <ul style="list-style-type: none"> <li>→ Use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> <li>→ Use algebraic reasoning to model and efficiently solve financial situations.</li> <li>→ Use quantitative reasoning to support personal financial decisions.</li> </ul>	<p><i>Students will be skilled at ...</i></p> <p><b>Standards for Mathematical Practice:</b></p> <ul style="list-style-type: none"> <li>→ I can use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> </ul> <p><b>Algebraic Functions:</b></p> <ul style="list-style-type: none"> <li>→ I can express classified ad prices as piecewise functions.</li> <li>→ I can model payment procedures algebraically.</li> </ul>			



## Financial Algebra

relate these functions to the model. c) (+)  
Compose functions. For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height

### Supporting Standards

A-CED.1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A-CED.4. Rearrange formulas (literal equations) to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .*

A-REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

Graph square root, cube root, and piecewise-

- I can model payment procedures algebraically.
- I can model vacation time using linear functions.
- I can express Social Security payments as piecewise functions.
- I can graph Social Security deduction functions.
- I can find coordinates of cusps in Social Security graphs.

### **Number & Quantity:**

- I can compute periodic salary based on annual contract salary.
- I can compute employment agency fees.
- I can compute weekly, semimonthly, and biweekly earnings given annual salary.
- I can compute hourly pay.
- I can compute overtime pay at different overtime rates.
- I can compute hourly rates from total paycheck that include overtime.
- I can compute pay based on percent commission.
- I can compute piecework pay.
- I can compute the costs of purchasing employee benefits.
- I can compute final average salaries for pensions.
- I can compute pensions.
- I can compute paycheck deductions for Social Security.

## Financial Algebra

<p>defined functions, including step functions and absolute value functions.</p> <p>F-LE.1. Distinguish between situations that can be modeled with linear functions and with exponential functions. a) Show that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b) Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c) Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.</p>		<ul style="list-style-type: none"> <li>→ I can compute paycheck deductions for Medicare.</li> <li>→ I can compute historical trends in Social Security deductions.</li> <li>→ I can compute excess Social Security taxes paid.</li> </ul> <p><b>Personal Finance:</b></p> <ul style="list-style-type: none"> <li>→ I can interpret abbreviations in classified ads.</li> <li>→ I can understand advantages and disadvantages of incentive-based pay.</li> <li>→ I can understand the value of pensions and health care insurance, stock ownership plans, paid vacations, and child care.</li> <li>→ I can understand unemployment insurance.</li> </ul>
<b>Evidence</b>		
<b>Evaluative Criteria</b>	<b>Assessment Evidence</b>	
<p>Formative Assessments:</p> <ul style="list-style-type: none"> <li>● Do Now and CCSS Warmups</li> <li>● Homework Assignments             <ul style="list-style-type: none"> <li>○ Check Your Understanding Problems</li> <li>○ Extend Your Understanding Problems</li> </ul> </li> <li>● Ticket to Leave Activities (Exit Ticket)</li> <li>● Direct and Indirect Teacher Questions</li> <li>● Exploration of Essential Questions</li> <li>● Written and Oral Responses</li> <li>● Journals and Self-Reflection</li> <li>● Performance Tasks</li> <li>● Technology-based Assessments</li> </ul> <p>Summative Assessments:</p> <ul style="list-style-type: none"> <li>● Lesson Opener Quizzes</li> </ul>	<p>PERFORMANCE TASK(S): To be determined.</p>	

# Financial Algebra

- Unit Summative Exams
- Experiential Learning Activities

## Unit 6 - Income Taxes

Desired Results		
<p><b>ESTABLISHED GOALS</b></p> <p><b>Priority Standards</b></p> <p>A-REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.</p> <p>F-BF.1. Write a function that describes a relationship between two quantities. a) Determine an explicit expression, a recursive process, or steps for calculation from a context. b) Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. c) (+) Compose functions. <i>For example, if <math>T(y)</math> is the temperature in the atmosphere as a function of height, and <math>h(t)</math> is the height of a weather balloon as a function of time, then <math>T(h(t))</math> is the temperature at the location of the weather balloon as a function of time.</i></p> <p>F-BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model</p>	<b>Transfer</b>	
	<p><i>Students will be able to independently use their learning to ...</i></p> <p>Interpret and make sense of personal financial situations involving income taxes based on algebraic and quantitative reasoning.</p>	
	<b>Meaning</b>	
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; vertical-align: top;"> <p><b>UNDERSTANDINGS</b></p> <p><i>Students will understand that ...</i></p> <ol style="list-style-type: none"> <li>1. The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>2. Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>3. Quantitative reasoning supports personal financial decisions.</li> </ol> </td> <td style="width: 50%; vertical-align: top;"> <p><b>ESSENTIAL QUESTIONS</b></p> <p><i>Students will keep considering ...</i></p> <ol style="list-style-type: none"> <li>1. How the Standards of Mathematical Practice support solving problems in a variety of contexts?</li> <li>2. How can I model financial situations using algebraic reasoning? What is the best way to model financial situations?</li> <li>3. How can I use quantitative reasoning to support my personal financial decisions?</li> </ol> </td> </tr> </table>	<p><b>UNDERSTANDINGS</b></p> <p><i>Students will understand that ...</i></p> <ol style="list-style-type: none"> <li>1. The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>2. Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>3. Quantitative reasoning supports personal financial decisions.</li> </ol>
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<b>Acquisition</b>		
<p><i>Students will know how to ...</i></p> <ul style="list-style-type: none"> <li>→ Use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> <li>→ Use algebraic reasoning to model and efficiently solve financial situations.</li> <li>→ Use quantitative reasoning to support personal financial decisions.</li> </ul>	<p><i>Students will be skilled at ...</i></p> <p><b>Standards for Mathematical Practice:</b></p> <ul style="list-style-type: none"> <li>→ I can use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> </ul> <p><b>Algebraic Functions:</b></p> <ul style="list-style-type: none"> <li>→ I can express taxable income ranges using compound inequality notation.</li> </ul>	

## Financial Algebra

situations, and translate between the two forms.

F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

### Supporting Standards

A-CED.1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

- I can express taxable income ranges using interval notation.
- I can determine the tax owed using a linear tax function.
- I can model a tax schedule taxable income amounts in both interval notation and compound inequality notation.
- I can model tax owed calculations on a given interval using a linear equation.
- I can model tax owed for different filing statuses using a piecewise function.
- I can evaluate a piecewise function for a given taxable amount.
- I can graph a tax owed piecewise function.
- I can identify the cusps of a tax owed piecewise function.

### Number & Quantity:

- I can determine net pay given gross pay.
- I can determine whether a taxpayer gets a refund or owes the IRS money.
- I can determine total income from a variety of sources.
- I can determine and apply adjustments to income.

### Personal Finance:

- I can use a tax schedule to determine the tax owed.
- I can use a tax worksheet to determine the tax owed.
- I can analyze an income statement.

## Financial Algebra

A-CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing cost constraints in various situations.

A-CED.4. Rearrange formulas (literal equations) to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .

A-SSE.1. Interpret expressions that represent a quantity in terms of its context. a) Interpret parts of an expression, such as terms, factors, and coefficients. b) Interpret complicated expressions by viewing one or more of their parts as a single entity.

F-IF.1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If  $f$  is a function and  $x$  is an element of its domain, then  $f(x)$  denotes the output of  $f$  corresponding to the input  $x$ . The graph of  $f$  is the graph of the equation  $y = f(x)$ .

F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

- I can identify data contained on a W-2 form.
- I can identify data contained on a 1099 form.
- I can determine a taxpayer's taxable income given information contained on W-2 and 1099 forms.
- I can complete a 1040EZ form.
- I can complete a 1040A form.
- I can apply standard deductions.
- I can complete Schedule B - Interest and Ordinary Dividends.
- I can complete Schedule A - Itemized Deductions.
- I can complete a 1040 tax form.

## Financial Algebra

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F-LE.1. Distinguish between situations that can be modeled with linear functions and with exponential functions. a) Show that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b) Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c) Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

### Evidence

#### Evaluative Criteria

Formative Assessments:

- Do Now and CCSS Warmups
- Homework Assignments
  - Check Your Understanding Problems
  - Extend Your Understanding Problems
- Ticket to Leave Activities (Exit Ticket)
- Direct and Indirect Teacher Questions
- Exploration of Essential Questions
- Written and Oral Responses
- Journals and Self-Reflection
- Performance Tasks

#### Assessment Evidence

PERFORMANCE TASK(S):  
To be determined.

## Financial Algebra

- |   |  |
|---|--|
| <ul style="list-style-type: none"><li>● Technology-based Assessments</li></ul> Summative Assessments: <ul style="list-style-type: none"><li>● Lesson Opener Quizzes</li><li>● Unit Summative Exams</li><li>● Experiential Learning Activities</li></ul> |  |
|---|--|

2019 Pilot

# Financial Algebra

## Unit 7 - Independent Living

Desired Results		
<p><b>ESTABLISHED GOALS</b></p> <p><b>Priority Standards</b></p> <p>A-REI.6. Solve systems of linear equations exactly and approximately, e.g., with graphs or algebraically, focusing on pairs of linear equations in two variables.</p> <p>A-APR.6. Rewrite simple rational expressions in different forms; write <math>a(x)/b(x)</math> in the form <math>q(x) + r(x)/b(x)</math>, where <math>a(x)</math>, <math>b(x)</math>, <math>q(x)</math>, and <math>r(x)</math> are polynomials with the degree of <math>r(x)</math> less than the degree of <math>b(x)</math>, using inspection, long division, or, for the more complicated examples, a computer algebra system.</p> <p>F-TF.7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.</p> <p>G-SRT.5. Apply congruence and similarity properties and prove relationships involving triangles and other geometric figures.</p> <p>G-SRT.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.</p> <p>G-MG.3. Apply geometric methods to solve design problems (e.g., designing an object or</p>	<b>Transfer</b>	
	<p><i>Students will be able to independently use their learning to ...</i></p> <p>Make responsible decisions related to purchasing and maintaining a home or renting an apartment based on algebraic, statistical, geometric and quantitative reasoning.</p>	
	<b>Meaning</b>	
	<p><b>UNDERSTANDINGS</b></p> <p><i>Students will understand that ...</i></p> <ol style="list-style-type: none"> <li>The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>Statistics are an essential tool when interpreting and comparing data sets and modeling financial situations.</li> <li>Geometric reasoning is used to model and efficiently solve financial situations.</li> <li>Quantitative reasoning supports personal financial decisions.</li> </ol>	<p><b>ESSENTIAL QUESTIONS</b></p> <p><i>Students will keep considering ...</i></p> <ol style="list-style-type: none"> <li>How the Standards of Mathematical Practice support solving problems in a variety of contexts?</li> <li>How can I model financial situations using algebraic reasoning? What is the best way to model financial situations?</li> <li>How can I use statistics to interpret and compare data sets and model financial situations?</li> <li>How can I use geometric reasoning to model and efficiently solve financial situations?</li> <li>How can I use quantitative reasoning to support my personal financial decisions?</li> </ol>
<b>Acquisition</b>		
	<p><i>Students will know how to ...</i></p> <ul style="list-style-type: none"> <li>→ Use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> <li>→ Use algebraic reasoning to model and efficiently solve financial situations.</li> </ul>	<p><i>Students will be skilled at ...</i></p> <p><b>Standards for Mathematical Practice:</b></p> <ul style="list-style-type: none"> <li>→ I can use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> </ul>



## Financial Algebra

structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

G-GMD. Explain volume formulas and use them to solve problems.

### Supporting Standards

A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A-CED.4. Rearrange formulas (literal equations) to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .*

A-SSE.1. Interpret expressions that represent a quantity in terms of its context. a) Interpret parts of an expression, such as terms, factors, and coefficients. b) Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret  $P(1+r)^n$  as the product of  $P$  and a factor not depending on  $P$ .*

F-BF.1. Write a function that describes a relationship between two quantities. a) Determine an explicit expression, a recursive process, or steps for calculation from a context. b) Combine standard function types using arithmetic operations. For example,

- Use statistical reasoning to model, interpret and compare various financial situations.
- Use geometric reasoning to model and efficiently solve financial situations.
- Use quantitative reasoning to support personal financial decisions.

### **Algebraic Functions:**

- I can use simultaneous equations to model moving costs.
- I can find the slope of a line.
- I can determine the breakeven time for discount points.

### **Statistics & Probability:**

- I can use regression to determine the relationship between square footage and monthly rent.
- I can use probability and the Monte Carlo Method to compute the area of irregular regions.

### **Geometry:**

- I can compute the perimeter of a polygon.
- I can compute the area of a regular polygon using its apothem.
- I can convert scale drawing measurements to actual measurements.
- I can use subtraction of areas to find the areas of irregular regions.
- I can compute volumes of rectangular solids.
- I can use volume to compute BTU requirements for air-conditioning.
- I can find missing sides of right triangles using the Pythagorean Theorem.
- I can use the converse of the Pythagorean Theorem.
- I can describe proportions in similar triangles.

## Financial Algebra

build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. c) (+) Compose functions. *For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather balloon as a function of time.*

F-LE.1. Distinguish between situations that can be modeled with linear functions and with exponential functions. a) Show that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b) Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c) Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

G-C.5. Use and apply the concepts of arc length and areas of sectors of circles. Determine or derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

- I can find missing sides of right triangles using trigonometry.
- I can find missing angles in right triangles using inverse trigonometric functions.

### **Number & Quantity:**

- I can calculate the affordability of monthly rent.
- I can calculate and compare moving expenses.
- compute front-end ratios.
- I can compute back-end ratios.
- I can compute balloon payments.
- I can compute monthly payment using the monthly payment formula.
- I can compute the total interest on a home purchase.
- I can compute property taxes based on square footage and assessed value.
- I can estimate closing costs.
- I can calculate the discount points for a mortgage.
- I can calculate negative points.
- I can compute the costs of purchasing a cooperative or condominium.

### **Personal Finance:**

- I can determine lease signing costs.
- I can understand the vocabulary used in mortgages and promissory notes.
- I can understand the vocabulary of closing on a home.

## Financial Algebra

<p>S-ID.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a) Fit a function to the data; use functions fitted to data to solve problems in the context of the data. <i>Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.</i> c) Fit a linear function for a scatter plot that suggests a linear association.</p> <p>S-ID.8. Compute (using technology) and interpret the correlation coefficient of a linear fit.</p>		<p>→ I can create an amortization table for a fixed mortgage.</p> <p>→ I can investigate amortization tables for adjustable rate mortgages.</p> <p>→ I can understand the difference between cooperatives and condominiums.</p>
<b>Evidence</b>		
<b>Evaluative Criteria</b>	<b>Assessment Evidence</b>	
<p>Formative Assessments:</p> <ul style="list-style-type: none"> <li>● Do Now and CCSS Warmups</li> <li>● Homework Assignments             <ul style="list-style-type: none"> <li>○ Check Your Understanding Problems</li> <li>○ Extend Your Understanding Problems</li> </ul> </li> <li>● Ticket to Leave Activities (Exit Ticket)</li> <li>● Direct and Indirect Teacher Questions</li> <li>● Exploration of Essential Questions</li> <li>● Written and Oral Responses</li> <li>● Journals and Self-Reflection</li> <li>● Performance Tasks</li> <li>● Technology-based Assessments</li> </ul> <p>Summative Assessments:</p> <ul style="list-style-type: none"> <li>● Lesson Opener Quizzes</li> <li>● Unit Summative Exams</li> <li>● Experiential Learning Activities</li> </ul>	<p>PERFORMANCE TASK(S): To be determined.</p>	

### **Unit 8 - The Stock Market**

# Financial Algebra

Desired Results		
<p><b>ESTABLISHED GOALS</b></p> <p><b>Priority Standards</b></p> <p>N-Q.1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.</p> <p>N-Q.2. Define appropriate quantities for the purpose of descriptive modeling.</p> <p>N-Q.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.</p> <p><b>Supporting Standards</b></p> <p>A-CED.1. Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i></p> <p>A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</p> <p>A-CED.4. Rearrange formulas (literal equations) to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i></p>	<b>Transfer</b>	
	<p><i>Students will be able to independently use their learning to ...</i></p> <p>Interpret and make sense of the investment world and different types of business organizations based on algebraic and quantitative reasoning.</p>	
	<b>Meaning</b>	
	<p><b>UNDERSTANDINGS</b></p> <p><i>Students will understand that ...</i></p> <ol style="list-style-type: none"> <li>1. The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>2. Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>3.</li> <li>4. Quantitative reasoning supports personal financial decisions.</li> </ol>	<p><b>ESSENTIAL QUESTIONS</b></p> <p><i>Students will keep considering ...</i></p> <ol style="list-style-type: none"> <li>1. How the Standards of Mathematical Practice support solving problems in a variety of contexts?</li> <li>2. How can I model financial situations using algebraic reasoning? What is the best way to model financial situations?</li> <li>3. How can I use quantitative reasoning to support my personal financial decisions?</li> </ol>
	<b>Acquisition</b>	
	<p><i>Students will know how to ...</i></p> <ul style="list-style-type: none"> <li>→ Use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> <li>→ Use algebraic reasoning to model and efficiently solve financial situations.</li> <li>→ Use quantitative reasoning to support personal financial decisions.</li> </ul>	<p><i>Students will be skilled at ...</i></p> <p><b>Standards for Mathematical Practice:</b></p> <ul style="list-style-type: none"> <li>→ I can use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> </ul> <p><b>Algebraic Functions:</b></p> <ul style="list-style-type: none"> <li>→ I can create spreadsheet formulas to model stock share progress.</li> <li>→ I can graph simple moving averages using a spreadsheet.</li> <li>→ I can model yield computations algebraically.</li> </ul>

## Financial Algebra

A-REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

A-SSE.1. Interpret expressions that represent a quantity in terms of its context. a) Interpret parts of an expression, such as terms, factors, and coefficients. b) Interpret complicated expressions by viewing one or more of their parts as a single entity.

### **Number & Quantity:**

- I can express parts of a whole as ratios.
- I can compute financial responsibility of business ownership based on ratio and proportion.
- I can use net change to compute closing prices.
- I can use closing prices to compute net change.
- I can compute the volume of shares traded from a stock table.
- I can express net changes as percents of closing prices.
- I can understand how data is smoothed.
- I can calculate simple moving averages using the arithmetic average formula.
- I can calculate simple moving averages using the subtraction and addition method.
- I can compute gross capital gains and losses from stock trades.
- I can express capital gain as a percent of purchase price.
- I can compute the fees involved in buying and selling stocks.
- I can compare percent commissions to flat fees.
- I can calculate the post-split outstanding shares and share price for a traditional split.
- I can calculate the post-split outstanding shares and share price for a reverse split.

## Financial Algebra

		<ul style="list-style-type: none"><li>→ I can calculate the fractional value amount that a shareholder receives after a split.</li><li>→ I can compute dividend income.</li><li>→ I can compute the yield for a given stock.</li><li>→ I can compute yields after stock splits.</li><li>→ I can compute the interest earned on corporate bonds</li></ul> <p><b>Personal Finance:</b></p> <ul style="list-style-type: none"><li>→ I can understand the basic vocabulary of business organizations.</li><li>→ I can use stock data to follow the daily progress of a corporate stock.</li><li>→ I can interpret a stock bar chart.</li><li>→ I can create a stock bar chart.</li><li>→ I can interpret a stock candlestick chart.</li><li>→ I can create a stock candlestick chart.</li><li>→ I can compute net changes from bar charts and candlestick charts.</li><li>→ I can interpret stock market ticker displays.</li><li>→ I can determine the value of a trade form ticker output.</li><li>→ I can determine trade volumes from ticker displays.</li><li>→ I can understand the basic vocabulary of buying and selling shares of stock.</li><li>→ I can understand the basic vocabulary of stock trading.</li><li>→ I can understand the concept of shareowners splitting the profit of a corporation they own.</li></ul>
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## Financial Algebra

Evidence	
Evaluative Criteria	Assessment Evidence
<p>Formative Assessments:</p> <ul style="list-style-type: none"><li>● Do Now and CCSS Warmups</li><li>● Homework Assignments<ul style="list-style-type: none"><li>○ Check Your Understanding Problems</li><li>○ Extend Your Understanding Problems</li></ul></li><li>● Ticket to Leave Activities (Exit Ticket)</li><li>● Direct and Indirect Teacher Questions</li><li>● Exploration of Essential Questions</li><li>● Written and Oral Responses</li><li>● Journals and Self-Reflection</li><li>● Performance Tasks</li><li>● Technology-based Assessments</li></ul> <p>Summative Assessments:</p> <ul style="list-style-type: none"><li>● Lesson Opener Quizzes</li><li>● Unit Summative Exams</li><li>● Experiential Learning Activities</li></ul>	<p>PERFORMANCE TASK(S): To be determined.</p>

# Financial Algebra

## Unit 9 - Modeling a Business

Desired Results				
<p><b>ESTABLISHED GOALS</b>  <b>Priority Standards</b>                      A-REI.6. Solve systems of linear equations exactly and approximately, e.g., with graphs or algebraically, focusing on pairs of linear equations in two variables.</p> <p>A-REI.7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.</p> <p>A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).</p> <p>A-REI.11. Explain why the x-coordinates of the points where the graphs of the equations <math>y = f(x)</math> and <math>y = g(x)</math> intersect are the solutions of the equation <math>f(x) = g(x)</math>; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where <math>f(x)</math> and/or <math>g(x)</math> are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.</p>	<b>Transfer</b>			
	<p><i>Students will be able to independently use their learning to ...</i>                      Interpret and make sense of business organizations, including supply, demand, expense, revenue and profit, based on algebraic, statistical and quantitative reasoning.</p>			
	<b>Meaning</b>			
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: left;">UNDERSTANDINGS <i>Students will understand that ...</i></th> <th style="width: 50%; text-align: left;">ESSENTIAL QUESTIONS <i>Students will keep considering ...</i></th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top;"> <ol style="list-style-type: none"> <li>1. The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>2. Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>3. Statistics are an essential tool when interpreting and comparing data sets and modeling financial situations.</li> <li>4. Quantitative reasoning supports personal financial decisions.</li> </ol> </td> <td style="vertical-align: top;"> <ol style="list-style-type: none"> <li>1. How the Standards of Mathematical Practice support solving problems in a variety of contexts?</li> <li>2. How can I model financial situations using algebraic reasoning? What is the best way to model financial situations?</li> <li>3. How can I use statistics to interpret and compare data sets and model financial situations?</li> <li>4. How can I use quantitative reasoning to support my personal financial decisions?</li> </ol> </td> </tr> </tbody> </table>	UNDERSTANDINGS <i>Students will understand that ...</i>	ESSENTIAL QUESTIONS <i>Students will keep considering ...</i>	<ol style="list-style-type: none"> <li>1. The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>2. Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>3. Statistics are an essential tool when interpreting and comparing data sets and modeling financial situations.</li> <li>4. Quantitative reasoning supports personal financial decisions.</li> </ol>
UNDERSTANDINGS <i>Students will understand that ...</i>	ESSENTIAL QUESTIONS <i>Students will keep considering ...</i>			
<ol style="list-style-type: none"> <li>1. The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>2. Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>3. Statistics are an essential tool when interpreting and comparing data sets and modeling financial situations.</li> <li>4. Quantitative reasoning supports personal financial decisions.</li> </ol>	<ol style="list-style-type: none"> <li>1. How the Standards of Mathematical Practice support solving problems in a variety of contexts?</li> <li>2. How can I model financial situations using algebraic reasoning? What is the best way to model financial situations?</li> <li>3. How can I use statistics to interpret and compare data sets and model financial situations?</li> <li>4. How can I use quantitative reasoning to support my personal financial decisions?</li> </ol>			
<b>Acquisition</b>				
<p><i>Students will know how to ...</i></p> <ul style="list-style-type: none"> <li>→ Use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> <li>→ Use algebraic reasoning to model and efficiently solve financial situations.</li> <li>→ Use statistical reasoning to model, interpret and compare various financial situations.</li> </ul>	<p><i>Students will be skilled at ...</i></p> <p><b>Standards for Mathematical Practice:</b>                      → I can use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</p> <p><b>Algebraic Functions:</b>                      → I can interpret the graph of a supply and demand system of equations.</p>			



## Financial Algebra

<p>A-REI.12. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.</p> <p>S-ID.3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). For example: Justify why median price of homes or income is used instead of the mean.</p> <p>S-ID.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.</p> <p>S-ID.5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.</p>	<p>→ Use quantitative reasoning to support personal financial decisions.</p>	<ul style="list-style-type: none"> <li>→ Given bivariate data in the form of (price, demand), I can determine the linear regression demand function that models the data.</li> <li>→ I can represent expenses as a function of quantity produced.</li> <li>→ Given a demand function expressed in terms of price, <math>p</math>, and expense function expressed in terms of demand, I can write the expense function in terms of price.</li> <li>→ I can determine the breakeven point for a revenue and expense function both graphically and algebraically.</li> <li>→ I can create a linear expense function.</li> <li>→ I can graph a linear expense function.</li> <li>→ I can create a revenue function as the product of the price and quantity demanded.</li> <li>→ I can graph a revenue function.</li> <li>→ I can interpret the graph of a revenue function.</li> <li>→ I can interpret the zeros of a revenue function.</li> <li>→ I can interpret the breakeven points of a revenue function.</li> <li>→ I can use the method of completing the square to factor a quadratic.</li> <li>→ I can determine breakeven points using the quadratic formula.</li> <li>→ I can evaluate revenue and expense at breakeven points.</li> <li>→ I can set up and use a spreadsheet to determine breakeven points.</li> </ul>
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## Financial Algebra

<p>S-ID.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.</p> <p>S-ID.8. Compute (using technology) and interpret the correlation coefficient of a linear fit.</p> <p>S-ID.9. Distinguish between correlation and causation.</p> <p>S-IC.1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.</p> <p>S-IC.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.</p> <p>S-IC.4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.</p> <p>S-IC.5. Use data from a randomized experiment to compare two treatments; use</p>	<p>→ I can determine the quadratic profit equation given a linear expense equation and a quadratic revenue equation.</p> <p>→ I can determine the maximum point of a quadratic equation.</p> <p>→ I can use the axis of symmetry to determine the maximum point of a quadratic profit equation.</p> <p>→ I can interpret the maximum point of a quadratic profit equation.</p> <p>→ I can find the complex roots of a quadratic equation.</p> <p>→ I can determine the expense <math>E</math> for production of an item when the price <math>p</math>, expense equation, and demand equation are given.</p> <p>→ I can recognize when to use linear programming.</p> <p>→ I can set up inequality constraints.</p> <p>→ I can graph inequalities.</p> <p>→ I can construct a polygonal region.</p> <p>→ I can create and interpret a feasible region.</p> <p>→ I can determine the coordinates of the vertices of a feasible region.</p> <p>→ I can create and test an objective function.</p> <p>→ I can create and interpret a boundless feasible region.</p> <p><b>Statistics &amp; Probability:</b></p> <p>→ I can analyze survey questions looking for question-wording bias.</p>
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## Financial Algebra

<p>simulations to decide if differences between parameters are significant.</p> <p>S-CP.1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).</p> <p>S-CP.3. Understand the conditional probability of A given B as <math>P(A \text{ and } B)/P(B)</math>, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.</p> <p>N-CN.1. Know there is a complex number <math>i</math> such that <math>i^2 = -1</math>, and every complex number has the form <math>a + bi</math> with <math>a</math> and <math>b</math> real.</p> <p>N-CN.7. Solve quadratic equations with real coefficients that have complex solutions.</p> <p><b>Supporting Standards</b></p> <p>A-CED.1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</p>	<p>→ I can determine how to select a sample in order to maximize the chance that it is a representative sample of the population.</p> <p>→ I can use a random number table.</p> <p>→ I can use a random number table to avoid bias in sampling.</p> <p>→ I can determine whether or not a test is fair.</p> <p>→ I can create and use a completely randomized design.</p> <p>→ I can create and use a matched pairs design.</p> <p>→ I can create and use an observational study.</p> <p>→ I can create and use a hypothesis test.</p> <p>→ I can determine, interpret and use z-scores.</p> <p>→ I can calculate sample sizes.</p> <p>→ I can take a simple random sample.</p> <p>→ I can take a stratified random sample.</p> <p>→ I can compare and contrast methods of sampling.</p> <p>→ I can calculate and interpret an unbiased estimator.</p> <p>→ I can determine whether the sample range is an unbiased estimator of the population range.</p> <p><b>Number &amp; Quantity:</b></p> <p>→ I can calculate a retail price after a markup.</p> <p>→ I can determine average cost.</p>
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## Financial Algebra

A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A-CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing cost constraints in various situations.

A-CED.4. Rearrange formulas (literal equations) to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .*

A-REI.1. Apply properties of mathematics to justify steps in solving equations in one variable.

A-REI.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

A-REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

### **Personal Finance:**

→ I can create a summary analysis of a business model.

## Financial Algebra

A-REI.4. Solve quadratic equations in one variable. b) Solve quadratic equations by inspection (e.g., for  $x^2 = 49$ , taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as  $a \pm bi$  for real numbers  $a$  and  $b$ .

F-IF.1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If  $f$  is a function and  $x$  is an element of its domain, then  $f(x)$  denotes the output of  $f$  corresponding to the input  $x$ . The graph of  $f$  is the graph of the equation  $y = f(x)$ .

F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*

F-IF.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function  $h(n)$  gives the

## Financial Algebra

number of person-hours it takes to assemble  $n$  engines in a factory, then negative numbers would be an inappropriate domain for the function.

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a) Graph linear and quadratic functions and show intercepts, maxima, and minima.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a) Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. b) Use the properties of exponents to interpret expressions for exponential functions.

S-ID.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a) Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. *Emphasize linear, quadratic, and exponential models.* b) Informally assess the fit of a function by plotting and analyzing residuals. *For example: Describe solutions to problems that*

## Financial Algebra

<p><i>require interpolation and extrapolation.</i> c) Fit a linear function for a scatter plot that suggests a linear association.</p> <p>N-Q.1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.</p> <p>N-Q.2. Define appropriate quantities for the purpose of descriptive modeling.</p> <p>N-Q.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.</p>		
<b>Evidence</b>		
<b>Evaluative Criteria</b>	<b>Assessment Evidence</b>	
<p>Formative Assessments:</p> <ul style="list-style-type: none"> <li>● Do Now and CCSS Warmups</li> <li>● Homework Assignments             <ul style="list-style-type: none"> <li>○ Check Your Understanding Problems</li> <li>○ Extend Your Understanding Problems</li> </ul> </li> <li>● Ticket to Leave Activities (Exit Ticket)</li> <li>● Direct and Indirect Teacher Questions</li> <li>● Exploration of Essential Questions</li> <li>● Written and Oral Responses</li> <li>● Journals and Self-Reflection</li> <li>● Performance Tasks</li> <li>● Technology-based Assessments</li> </ul> <p>Summative Assessments:</p> <ul style="list-style-type: none"> <li>● Lesson Opener Quizzes</li> <li>● Unit Summative Exams</li> </ul>	<p>PERFORMANCE TASK(S): To be determined.</p>	

# Financial Algebra

- Experiential Learning Activities

## Unit 10 - Retirement

Desired Results		
<p>ESTABLISHED GOALS</p> <p><b>Priority Standards</b></p> <p>A-SSE.1. Interpret expressions that represent a quantity in terms of its context. a) Interpret parts of an expression, such as terms, factors, and coefficients. b) Interpret complicated expressions by viewing one or more of their parts as a single entity.</p> <p>F-BF.1. Write a function that describes a relationship between two quantities. a) Determine an explicit expression, a recursive process, or steps for calculation from a context. b) Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. c) (+) Compose functions. <i>For example, if <math>T(y)</math> is the temperature in the atmosphere as a function of height, and <math>h(t)</math> is the height of a weather balloon as a function of time, then <math>T(h(t))</math> is the temperature at the location of the weather balloon as a function of time.</i></p>	<b>Transfer</b>	
	<p><i>Students will be able to independently use their learning to ...</i></p> <p>Make responsible personal financial decisions years ahead of their retirement date based on algebraic, statistical and quantitative reasoning.</p>	
	<b>Meaning</b>	
	<p><b>UNDERSTANDINGS</b></p> <p><i>Students will understand that ...</i></p> <ol style="list-style-type: none"> <li>1. The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>2. Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>3. Statistics are an essential tool when interpreting and comparing data sets and modeling financial situations.</li> <li>4. Quantitative reasoning supports personal financial decisions.</li> </ol>	<p><b>ESSENTIAL QUESTIONS</b></p> <p><i>Students will keep considering ...</i></p> <ol style="list-style-type: none"> <li>1. How the Standards of Mathematical Practice support solving problems in a variety of contexts?</li> <li>2. How can I model financial situations using algebraic reasoning? What is the best way to model financial situations?</li> <li>3. How can I use statistics to interpret and compare data sets and model financial situations?</li> <li>4. How can I use quantitative reasoning to support my personal financial decisions?</li> </ol>
	<b>Acquisition</b>	
	<p><i>Students will know how to ...</i></p> <ul style="list-style-type: none"> <li>→ Use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> <li>→ Use algebraic reasoning to model and efficiently solve financial situations.</li> </ul>	<p><i>Students will be skilled at ...</i></p> <p><b>Standards for Mathematical Practice:</b></p> <ul style="list-style-type: none"> <li>→ I can use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> </ul>



## Financial Algebra

<p>F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. d) (+) Graph rational functions, identifying zeros and discontinuities (asymptotes/holes) using technology, and algebraic methods when suitable factorizations are available, and showing end behavior.</p> <p>S-MD.1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions</p> <p>S-MD.2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.</p> <p>S-MD.4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. <i>For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household.</i></p>	<ul style="list-style-type: none"> <li>→ Use statistical reasoning to model, interpret and compare various financial situations.</li> <li>→ Use quantitative reasoning to support personal financial decisions.</li> </ul>	<p><b>Algebraic Functions:</b></p> <ul style="list-style-type: none"> <li>→ I can compare investment returns using linear and exponential functions.</li> </ul> <p><b>Statistics &amp; Probability:</b></p> <ul style="list-style-type: none"> <li>→ I can chart investment plans.</li> </ul> <p><b>Number &amp; Quantity:</b></p> <ul style="list-style-type: none"> <li>→ I can determine the balance of a retirement savings account into which monthly deposits are made.</li> <li>→ I can determine the tax benefit of using a pre-tax retirement savings account.</li> <li>→ I can determine the principal in a periodic deposit retirement. account in order to meet a specified monetary goal at the end of a given number of years.</li> <li>→ I can determine the penalty and extra taxes incurred by making an early withdrawal from an IRA.</li> <li>→ I can calculate the monetary benefits of an employer matching pension plan.</li> <li>→ I can determine Social Security tax overpayment from working two jobs in a given year.</li> <li>→ I can calculate Social Security credits.</li> <li>→ I can calculate Social Security benefits.</li> <li>→ I can calculate income taxes on Social Security benefits.</li> <li>→ I can calculate Medicare premium cost.</li> <li>→ I can determine the monthly pension benefits under a variety of pension benefit plans.</li> </ul>
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## Financial Algebra

*How many TV sets would you expect to find in 100 randomly selected households?*

S-MD.5. (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. a) Find the expected payoff for a game of chance.

*For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant. b) Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.*

### Supporting Standards

A-CED.1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

A-CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing cost constraints in various situations.*

- I can use a spreadsheet to calculate pension benefits.
- I can calculate insurance premium costs.
- I can express percent increase as a literal expression.
- I can determine an insurance company's profit on a given plan using expected value.

### **Personal Finance:**

- I can report Social Security benefits on form 1040.
- I can read and interpret a mortality table.

## Financial Algebra

<p>F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. b) Use the properties of exponents to interpret expressions for exponential functions.</p> <p>F-LE.2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or input-output table of values.</p>		
<b>Evidence</b>		
<b>Evaluative Criteria</b>	<b>Assessment Evidence</b>	
<p>Formative Assessments:</p> <ul style="list-style-type: none"> <li>● Do Now and CCSS Warmups</li> <li>● Homework Assignments             <ul style="list-style-type: none"> <li>○ Check Your Understanding Problems</li> <li>○ Extend Your Understanding Problems</li> </ul> </li> <li>● Ticket to Leave Activities (Exit Ticket)</li> <li>● Direct and Indirect Teacher Questions</li> <li>● Exploration of Essential Questions</li> <li>● Written and Oral Responses</li> <li>● Journals and Self-Reflection</li> <li>● Performance Tasks</li> <li>● Technology-based Assessments</li> </ul> <p>Summative Assessments:</p> <ul style="list-style-type: none"> <li>● Lesson Opener Quizzes</li> <li>● Unit Summative Exams</li> <li>● Experiential Learning Activities</li> </ul>	<p>PERFORMANCE TASK(S): To be determined.</p>	

# Financial Algebra

## Unit 11 - Prepare a Budget

Desired Results				
<p><b>ESTABLISHED GOALS</b>  <b>Priority Standards</b>            A-APR.1. Add, subtract, and multiply polynomials. Understand that polynomials form a system similar to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication.</p> <p>A-APR.7. (+) Add, subtract, multiply, and divide rational expressions. Understand that rational expressions form a system similar to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression.</p> <p>F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a) Graph linear and quadratic functions and show intercepts, maxima, and minima. b) Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. d) (+) Graph rational functions, identifying zeros and discontinuities (asymptotes/holes) using technology, and algebraic methods when</p>	<b>Transfer</b>			
	<p><i>Students will be able to independently use their learning to ...</i>            Create and chart a responsible personal budget plan based on algebraic, statistical and quantitative reasoning.</p>			
	<b>Meaning</b>			
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 5px;">UNDERSTANDINGS <i>Students will understand that ...</i></th> <th style="text-align: left; padding: 5px;">ESSENTIAL QUESTIONS <i>Students will keep considering ...</i></th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;"> <ol style="list-style-type: none"> <li>1. The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>2. Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>3. Statistics are an essential tool when interpreting and comparing data sets and modeling financial situations.</li> <li>4. Quantitative reasoning supports personal financial decisions.</li> </ol> </td> <td style="padding: 5px;"> <ol style="list-style-type: none"> <li>1. How the Standards of Mathematical Practice support solving problems in a variety of contexts?</li> <li>2. How can I model financial situations using algebraic reasoning? What is the best way to model financial situations?</li> <li>3. How can I use statistics to interpret and compare data sets and model financial situations?</li> <li>4. How can I use quantitative reasoning to support my personal financial decisions?</li> </ol> </td> </tr> </tbody> </table>	UNDERSTANDINGS <i>Students will understand that ...</i>	ESSENTIAL QUESTIONS <i>Students will keep considering ...</i>	<ol style="list-style-type: none"> <li>1. The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>2. Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>3. Statistics are an essential tool when interpreting and comparing data sets and modeling financial situations.</li> <li>4. Quantitative reasoning supports personal financial decisions.</li> </ol>
UNDERSTANDINGS <i>Students will understand that ...</i>	ESSENTIAL QUESTIONS <i>Students will keep considering ...</i>			
<ol style="list-style-type: none"> <li>1. The eight Standards of Mathematical Practice support solving problems in a variety of contexts.</li> <li>2. Algebraic reasoning is used to model and efficiently solve financial situations.</li> <li>3. Statistics are an essential tool when interpreting and comparing data sets and modeling financial situations.</li> <li>4. Quantitative reasoning supports personal financial decisions.</li> </ol>	<ol style="list-style-type: none"> <li>1. How the Standards of Mathematical Practice support solving problems in a variety of contexts?</li> <li>2. How can I model financial situations using algebraic reasoning? What is the best way to model financial situations?</li> <li>3. How can I use statistics to interpret and compare data sets and model financial situations?</li> <li>4. How can I use quantitative reasoning to support my personal financial decisions?</li> </ol>			
<b>Acquisition</b>				
<p><i>Students will know how to ...</i></p> <ul style="list-style-type: none"> <li>→ Use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</li> <li>→ Use algebraic reasoning to model and efficiently solve financial situations.</li> <li>→ Use statistical reasoning to model, interpret and compare various financial situations.</li> </ul>	<p><i>Students will be skilled at ...</i></p> <p><b>Standards for Mathematical Practice:</b>            → I can use the eight Standards of Mathematical Practice to solve problems in a variety of contexts.</p> <p><b>Algebraic Functions:</b></p>			

## Financial Algebra

<p>suitable factorizations are available, and showing end behavior.</p> <p>N-VM.6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.</p> <p>N-VM.7. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.</p> <p>N-VM.8. (+) Add, subtract, and multiply matrices of appropriate dimensions.</p> <p>N-VM.9. (+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.</p> <p>N-VM.10. (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.</p> <p><b>Supporting Standards</b></p> <p>A-CED.1. Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i></p>	<p>→ Use quantitative reasoning to support personal financial decisions.</p>	<p>→ I can recognize the general form of a rational function and the limitations on its domain.</p> <p>→ I can set up and interpret an average utility cost function.</p> <p>→ I can use the greatest integer and piecewise functions to represent a phone cost.</p> <p>→ I can use the greatest integer and piecewise functions to represent data usage costs on a cell phone plan.</p> <p>→ I can compare average monthly costs of two different cell phone plans using an average cost rational function.</p> <p>→ I can graph and interpret a system of two average cost rational functions.</p> <p>→ I can set up and interpret a budget line equation.</p> <p>→ I can define a matrix.</p> <p>→ I can define the dimension of a matrix. I can identify the dimensions of a given matrix.</p> <p><b>Statistics &amp; Probability:</b></p> <p>→ I can set up an interpret a budget pie chart.</p> <p>→ I can set up and interpret a budget bar graph.</p> <p>→ I can set up and interpret a budget line graph.</p> <p>→ I can use budget constraints to analyze a budget situation.</p> <p><b>Number &amp; Quantity:</b></p>
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## Financial Algebra

<p>A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</p> <p>A-CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. <i>For example, represent inequalities describing cost constraints in various situations.</i></p> <p>A-CED.4. Rearrange formulas (literal equations) to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i></p> <p>A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).</p> <p>A-SSE.1. Interpret expressions that represent a quantity in terms of its context. a) Interpret parts of an expression, such as terms, factors, and coefficients. b) Interpret complicated expressions by viewing one or more of their parts as a single entity.</p> <p>F-IF.4. For a function that models a relationship between two quantities,</p>		<ul style="list-style-type: none"><li>→ I can determine electric of an appliance cost based on wattage requirements, time used, and the kilowatt-hour charge.</li><li>→ I can determine the monthly utility amount in a balanced billing account.</li><li>→ I can calculate energy savings.</li><li>→ I can determine the cost of a pay phone call.</li><li>→ I can make cell phone data usage approximations.</li><li>→ I can calculate text message charges.</li><li>→ I can calculate monthly cable costs.</li><li>→ I can create a cash flow analysis spreadsheet.</li><li>→ I can use cash flow information to verify if spending is within stated guidelines.</li><li>→ I can create and interpret a frequency budget plan.</li><li>→ I can create and interpret a frequency budget spreadsheet.</li><li>→ I can calculate and interpret net worth.</li><li>→ I can create a debt reduction plan.</li><li>→ I can calculate the debt-to-income ratio.</li><li>→ I can define a budget matrix.</li><li>→ I can use a matrix to model a budget situation.</li><li>→ I can determine if two matrices can be added or subtracted.</li><li>→ I can add and subtract matrices.</li><li>→ I can use addition and subtraction of budget matrices to model a budget situation.</li><li>→ I can define a scalar.</li></ul>
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## Financial Algebra

<p>interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i></p> <p>F-IF.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble <math>n</math> engines in a factory, then negative numbers would be an inappropriate domain for the function.</i></p> <p>N-Q.1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.</p> <p>N-Q.2. Define appropriate quantities for the purpose of descriptive modeling.</p>	<p>→ I can perform scalar multiplication.</p> <p>→ I can use scalar multiplication to model a budget situation.</p> <p>→ I can determine of two matrices can be multiplied together.</p> <p>→ I can multiply matrices.</p> <p>→ I can use multiplication of budget matrices to model a budget situation.</p> <p><b>Personal Finance:</b></p> <p>→ I can read and interpret a water meter.</p> <p>→ I can read and interpret an electric meter.</p> <p>→ I can read and interpret a cell phone plan bill.</p> <p>→ I can set up and interpret a budget matrix.</p>
<b>Evidence</b>	
<b>Evaluative Criteria</b>	<b>Assessment Evidence</b>
Formative Assessments: <ul style="list-style-type: none"> <li>● Do Now and CCSS Warmups</li> <li>● Homework Assignments               <ul style="list-style-type: none"> <li>○ Check Your Understanding Problems</li> </ul> </li> </ul>	PERFORMANCE TASK(S): To be determined.

## Financial Algebra

○ Extend Your Understanding Problems

- Ticket to Leave Activities (Exit Ticket)
- Direct and Indirect Teacher Questions
- Exploration of Essential Questions
- Written and Oral Responses
- Journals and Self-Reflection
- Performance Tasks
- Technology-based Assessments

Summative Assessments:

- Lesson Opener Quizzes
- Unit Summative Exams
- Experiential Learning Activities

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