BUSINESS MATH with ALGEBRA

Course Description

The primary focus of this course is to provide students with further algebraic applications while reinforcing the algebraic concepts learned in earlier courses. Business Math with Algebra is a course that will enable students to make sound financial decisions dealing with personal or business financial management issues. Topics to be covered include compound interest of loans and investments, consumer credit issues, various payment methods, insurance, the stock market, figuring taxes, and other topics in economics and business. This course is designed to increase the high school level knowledge of algebraic concepts and, in part, prepare students for admission to a university.

Student Objectives
Apply algebraic and geometric concepts to solve problems.
Determine the amount withheld for federal income tax.
Compute state taxes on a straight percent basis.
Determine the state taxes on a graduated income tax basis.
Compute the amount withheld for Social Security and Medicare taxes.
Calculate the deduction for group insurance.
Calculate the net pay per pay period.
Compute the average monthly expenditures.
Use records of past expenditures to prepare a monthly budget sheet.
Compare the amount budgeted to actual expenditures.
Compute the maturity value and interest rate of a single-payment loan.
Calculate the down payment and the amount financed on an installment loan.
Calculate the monthly payment, total amount repaid, and finance charge on an installment loan.
Calculate the payment to interest, payment to principal, and the new balance.
Compute the final payment when paying off an installment loan.
Determine the annual percentage rate of a loan using a table and a formula.
Compute the sticker price of a new vehicle.
Calculate the dealer's cost of a new vehicle.
Figure out the average retail price or wholesale price of a used vehicle.
Use tables to compute the annual premium for vehicle insurance.
Compute the total cost per mile of operating and maintaining a vehicle.
Calculate the total cost of leasing a vehicle.
Calculate the cost to rent a vehicle and the cost per mile to drive a rented vehicle.
Compute the mortgage loan amount.
Determine the monthly payment using a table or formula, the total amount paid, and the total interest charged.

Calculate the total closing costs.

Compute the allocation of the monthly payment to principal and interest and the new principal.

Calculate the assessed value and real estate taxes for a home.

Determine the amount of coverage for homeowners insurance.

Calculate the annual homeowners insurance premium.

Compute the total housing cost and compare it with suggested guidelines.

Compare the total costs of renting with the costs of owning a home.

Compute health insurance premiums.

Calculate the amount the patient pays for health care.

Utilize tables to compute the annual premium for term life insurance.

Apply tables to data to compute the annual premiums for three types of life insurance.

Use tables or a formula to compute interest on certificates of deposit.

Determine the annual percentage of yield.

Calculate the total cost of a stock investment.

Calculate the profit or loss from a stock sale.

Compute the annual yield and annual dividend of a stock investment.

Compute the loading charge, number of shares purchased, and profit or loss when you sell a mutual fund.

Compute the annual interest and annual yield of a bond investment.

Compute the annual net income, the annual yield, and monthly rent to charge on an investment in real estate property.

Compute the required minimum distribution and the penalty for early withdrawal from an IRA.

Compute the markup in dollars.

Calculate the markup as a percent of the selling price.

Determine the net profit in dollars.

Find the net profit as a percent of the selling price.

Calculate the selling price of an item based on cost and markup rate based on selling price.

Calculate the markup rate based on cost.

Compute the selling price based on cost and markup rate.

Calculate the markdown in dollars and as a percent of the regular selling price.

KANSAS COLLEGE AND CAREER READY STANDARDS

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

KCCR Standards
The Real Number System
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 $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.
N-RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.
Quantities
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.
N-Q.2 Define appropriate quantities for the purpose of descriptive modeling.
Algebra-Seeing Structure in Expressions
A-SSE.1 Interpret expressions that represent a quantity in terms of its context.★
A-SSE.1a Interpret parts of an expression, such as terms, factors, and coefficients.
A.SSE.1b 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.
A.SSE.2 Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.
A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★
A-SSE.3a Factor a quadratic expression to reveal the zeros of the function it defines.
A-SSE.3b Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
A-SSE.3c Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.
A-SSE.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.★
Algebra-Creating Equations
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.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.
A-CED.4 Rearrange formulas 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.

Algebra-Reasoning with Equations and Inequalities
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.
A-REI.4 Solve quadratic equations in one variable.
A-REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
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).
Functions-Interpreting Functions
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.
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 in-creasing, 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 number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.★
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.★
F.IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima.
F.IF.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
F.IF.7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, mid-line, and amplitude.
F.IF.8b Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.
F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

Functions-Building Functions
F-BF.1 Write a function that describes a relationship between two quantities.★
F-BF.1a Determine an explicit expression, a recursive process, or steps for calculation from a context.
Functions-Linear, Quadratic, and Exponential Models
F-LQE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.
F-LQE.1b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
F-LQE.1c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
F-LQE.5 Interpret the parameters in a linear, quadratic, or exponential function in terms of a context.
Functions-Trigonometric Functions
F-TF.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
F-TF.3 (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to ex-press the values of sine, cosine, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x, where x is any real number.
Geometry-Congruence
G-CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, dis-tance along a line, and distance around a circular arc.
G-CO.9 Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's end-points.*
Geometry-Similarity, Right Triangles, and Trigonometry
G-SRT.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
G-SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
G-SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.★
Geometry-Expressing Geometric Properties with Equations
G-GPE.2 Derive the equation of a parabola given a focus and directrix.
Geometry-Geometric Measurement and Dimension
G-GMD.3   Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.★

Statistics and Probability-Interpreting Categorical and Quantitative Data
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).
S-ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
S-ID.6a 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.
S-ID.6c Fit a linear function for a scatter plot that suggests a linear association.
S-ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
S-ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.
Statistics and Probability-Making Inferences and Justifying Conclusions
S-IC.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
Statistics and Probability-Conditional Probability and the Rules of Probability
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.9 (+) Use permutations and combinations to compute probabilities of compound events and solve problems.

The high school standards specify the mathematics that all students should study in order to be college and career ready. Additional mathematics that students should learn in order to take advanced courses such as calculus, advanced statistics, or discrete mathematics is indicated by (+), as in this example:

> (+) Represent complex numbers on the complex plane in rectangular and polar form
> (including real and imaginary numbers).

Modeling is best interpreted not as a collection of isolated topics but in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (★). The star symbol sometimes appears on the heading for a group of standards; in that case, it should be understood to apply to all standards in that group.