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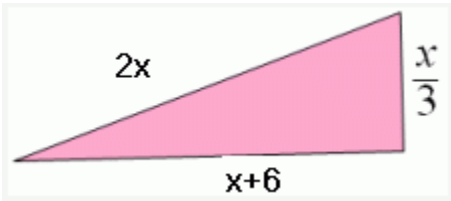
Algebra Examples

Utah Algebra Core	Examples
Standard I: Students will expand number sense to understand, perform operations, and solve problems with real numbers. **Objective 1: Represent real numbers as points on the number line and distinguish rational numbers from irrational numbers.** a. Define a rational number as a point on the number line that can be expressed as the ratio of two integers, and points that cannot be so expressed as irrational. b. Classify numbers as rational or irrational, knowing that rational numbers can be expressed as terminating or repeating decimals and irrational numbers can be expressed as non-terminating, non-repeating decimals. c. Classify *pi* and square roots of non-perfect square numbers as irrational. d. Place rational and irrational numbers on a number line between two integers.	• Classify each of the following numbers as rational or irrational and place them on a number line. o 4/5 o .333… o $\sqrt{2}$ o $\sqrt{5}$ o .252525… o $3\sqrt{2}$
Objective 2: Compute fluently and make reasonable estimates with rational and irrational numbers. a. Simplify, add, subtract, multiply, and divide expressions with square roots. b. Evaluate and simplify numerical expressions containing rational numbers and square roots using the order of operations. c. Compute solutions to problems, represent answers in exact form, and determine the reasonableness of answers. d. Calculate the measures of the sides of a right triangle using the Pythagorean Theorem.	• Simplify $2\sqrt{6} - 4\sqrt{6} + \sqrt{24}$ • What is the perimeter of this triangle if x = 12.6 cm?  • Simplify $(1+\sqrt{2})(4+3\sqrt{2})$
Standard II: Students will extend concepts of proportion to represent and analyze linear relations. **Objective 1: Represent and analyze the slope of a line.** a. Identify the slope of a line when given points, a graph, or an equation. b. Identify horizontal and vertical lines given the equations or slopes.	• What is the slope of the graph of the equation $2x-3y=7$? • Which graph is steeper? $y=\frac{1}{3}x-5$ or $y=\frac{2}{5}x-2$

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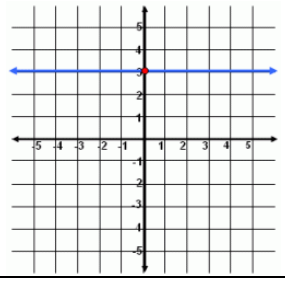
c. Determine the effect of changes in slope or *y*-intercept in $y = mx + b$. d. Determine and explain the meaning of slopes and intercepts using real-world examples.	• Describe the relationship between the graphs of y = 3x + 6 and y = 3x - 10 • What is the slope of this line? 
Objective 2: Model and interpret problems having a constant rate of change using linear functions. a. Write algebraic expressions or equations to generalize visual patterns, numerical patterns, relations, data sets, or scatter plots. b. Represent linear equations in slope-intercept form, $y = mx + b$, and standard form, $Ax + By = C$. c. Distinguish between linear and non-linear functions by examining a table, equation, or graph. d. Interpret the slope of a linear function as a rate of change in real-world situations.	• Rewrite 2x + 3y = 12 in slope-intercept form. • The bill (parts and labor) for the repair of an automobile was $350. The cost for parts was $285. The cost of labor was $35 per hour. Let x represent the number of hours of labor. Write an equation that expresses the total bill for the repair of the automobile.
Objective 3: Represent and analyze linear relationships using algebraic equations, expressions, and graphs. a. Write the equation of a line when given two points or the slope and a point on the line. b. Approximate the equation of a line given the graph of a line. c. Identify the *x*- and *y*-intercepts from an equation or graph of a line or a table of values. d. Graph linear relations and inequalities by plotting points, by finding *x*- and *y*-intercepts, or by using the slope and any point on the line.	• Write the equation of the line that passes through (1, 2) and has a slope of -5. • Determine whether or not the number of college and community orchestras in the U.S. from 1980 to 1988 has a linear relationship. If it does, write the equation of the line that describes this relationship. Orchestra's, x: 1311, 1311, 1304, 1306, 1317, 1317, 1298, 1301, 1253 Year, y: 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988
Standard III: Students will develop fluency with the language and operations of algebra to analyze and represent relationships.	• Which of the following is the simplest form of this

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Objective 1: Simplify polynomials and the quotient of monomials. a. Simplify and evaluate monomial expressions and formulas. b. Add and subtract polynomials. c. Multiply monomials by a polynomial. d. Multiply binomials. e. Simplify the quotient of monomials using positive exponents.	expression? $(-4)^0(x^3)^4$ • Multiply (x+5)(x-5) • Multiply $3x^2y^3(4x^3-3x^2+2y)$ • Simplify $\frac{7x^3y^6}{14x^5y^7}$
Objective 2: Solve and interpret linear equations and inequalities in various situations including real-world problems. a. Solve single-variable linear equations and inequalities algebraically and graphically. b. Solve real-world problems involving constant rates of change. c. Solve equations for a specified variable. d. Solve proportions that include algebraic first-degree expressions.	• Solve for x: $3(x-5)+7x=-4x-4(2x-5)$ • Solve for x: xy + 3z = -4 • Solve $\frac{x+1}{8}=\frac{1}{2}$ • Solve: -4x + 4 > 16
Objective 3: Solve and interpret pairs of linear equations and inequalities. a. Solve systems of two linear equations graphically and algebraically with and without technology. b. Determine the number of possible solutions for a system of two linear equations. c. Graph a system of linear inequalities and identify the solution.	• Determine the number of possible solutions for this system of equations. If there is only one solution, find it. $\begin{Bmatrix} 2x+y=3 \\ 4x+2y=8 \end{Bmatrix}$ • Graph the solution area for $y > x-1$ $x > y-2$
Objective 4: Factor polynomials with common monomial factors and factor simple quadratic expressions. a. Find the greatest common monomial factor of a polynomial. b. Factor trinomials with integer coefficients of the form x^2+bx+c. c. Factor the difference of two squares and perfect square trinomials.	• Factor the polynomial $x^2 + 5x + 6$ • Factor $15x^2-20xy$
Objective 5: Solve quadratic equations using factoring or by taking square roots. a. Solve quadratic equations that can be simplified to the form $x^2=a$ where $a \geq 0$ by taking square roots. b. Solve quadratic equations using factoring. c. Write a quadratic equation when given the solutions.	• Solve for x: $4x^2=16$ • Solve $x^2+7x+12=0$ • If the solutions of a quadratic equation are 4 and -3, what is the equation in standard form?

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Standard IV: Students will understand concepts from statistics and apply statistical methods to solve problems.

Objective 1: Summarize, display, and analyze bivariate data.

a. Collect, record, organize, and display a set of data with at least two variables.
b. Determine whether the relationship between two variables is approximately linear or non-linear by examination of a scatter plot.
c. Characterize the relationship between two linear related variables as having positive, negative, or approximately zero correlation.

- The data in this table shows the number of people y (in millions) in the United States that were employed from 1983 to 1993. x represents the year and x = 3 corresponds to 1983. (Source: U.S. Bureau of Labor Statistics.) Plot the data to determine if it appears to be linear. Would you characterize the relationship as positive negative or approximately zero correlation?

x	3	5	8	10	13
y	113	117	123	126	130

Objective 2: Estimate, interpret, and use lines fit to bivariate data.

a. Estimate the equation of a line of best fit to make and test conjectures.
b. Interpret the slope and *y*-intercept of a line through data.
c. Predict *y*-values for given *x*-values when appropriate using a line fitted to bivariate numerical data.

- Fifteen students were asked on Wednesday to keep track of the number of hours they spent studying for a test on Monday. The data is graphed here. Estimate a line of best fit and describe the meaning of the slope and y-intercept.