LSU Dual Enrollment Program for Math

COURSE PROFILE with LMS

Content Revised 7-12-2022

**COURSE NAME: Algebra I**

**HIGH SCHOOL COURSE CODE: 160321**

**PRIMARY ONLINE CONTENT SOURCE: *Algebra I in MyMathLab****,* **Elayn Martin-Gay, with**

**contributions from Robert Blitzer**

**COURSE/UNIT CREDIT: 1 Carnegie Unit for full year**

**GRADE(S): 7, 8, or 9**

**CHAPTERS**

**1 – Review of Real Numbers**

**2 – Solving Equations and Problem Solving**

**3 – Graphs and Functions**

**4 – Solving Inequalities and Absolute Value Equations and Inequalities**

**5 – Solving Systems of Linear Equations and Inequalities**

**6 – Exponents and Polynomials**

**7 – Factoring Polynomials**

**9 – Roots, Radicals, and Trigonometric Ratios**

**10 – Quadratic Equations**

| **SECTION NAMES (NUMBER OF EXERCISES) AND LEARNING OBJECTIVES** | **LMS #** | |
| --- | --- | --- |
| **CHAPTER 1: Review of Real Numbers** | **No data** | |
| **1.9 Properties of Real Numbers (45)**  Vocabulary and Readiness Check  Use the commutative and associative properties  Use the distributive property  Name the properties illustrated by the statements | A-SSE.A.2 | |
| **CHAPTER 2: Solving Equations and Problem Solving** | **No data** | |
| **2.1 Simplifying Algebraic Expressions (51)**  Combine like terms  Use the distributive property to remove parentheses  Write word phrases as algebraic expressions  Name the properties illustrated by the statements | A-APR.A.1  A-SSE.A.1a  6.EE.A.2  6.EE.A.3  7.EE.A.1 | |
| **2.2 and 2.3 Properties of Equality (35)**  Use the addition property of equality to solve linear equations  Simplify an equation and then use the addition property of equality  Use the multiplication property of equality to solve linear equations  Use addition and multiplication properties of equality to solve linear equations | A-REI.A.1  A-REI.B.3 | |
| **2.4 Solving Linear Equations (39)**  Apply a general strategy for solving a linear equation  Solve equations containing fractions | A.REI.A.1  A-REI.B.3  8.EE.C.7a | |
| **2.5 Introduction to Problem Solving (28)**  Solve problems involving direct translations  Solve problems involving relationships among unknown quantities  Solve problems involving consecutive integers | A-REI.B.3  A-CED.A.1 | |
| **2.6 Formulas and Problem Solving (35)**  Substitute values into a formula and solve for the unknown variable  Solve a formula for one of its variables  Use formulas to solve problems | N-Q.A.1  A-CED.A.1  A-CED.A.4  A-REI.B.3 | |
| **2.8 Mixture and Distance Problem Solving (17)**  Solve mixture problems  Solve uniform motion problems | N-Q.A.1  A-CED.A.1  A-CED.A.3  A-REI.B.3 | |
| **CHAPTER 3: Graphs and Functions** | **No data** | |
| **3.1 Reading Graphs and the Rectangular Coordinate System (34)**  Define the rectangular coordinate system and plot ordered pairs of numbers  Graph paired data to create a scatter diagram  Determine whether an ordered pair is a solution of an equation in two variables  Find missing coordinate of an ordered pair solution given one coordinate of the pair  Interpret information given in a scatter plot | S-ID.C.7  8.SP.A.1  6.EE.B.5  A-REI.D.10 | |
| **3.2 Graphing Linear Equations (32)**  Identify linear equations  Graph an equation by finding and plotting ordered pair solutions  Solve application problems | A-REI.D.10  F-IF.C.7a | |
| **3.3 Intercepts (28)**  Identify intercepts of a graph  Graph a linear equation by finding and plotting intercepts  Identify and graph vertical and horizontal lines | A-REI.D.10  F-IF.C.7a | |
| **3.4 Slope and Rate of Change (34)**  Find the slope of a line given points on the line  Find the slopes of horizontal and vertical lines  Find the slope of a line given its equation  Slope as a rate of change | F-IF.B.6 F-LE.B.5  S-ID.C.7  A-REI.D.10 | |
| **3.5 Equations of a Line (34)**  Use the slope-intercept form to write an equation of a line  Use the slope-intercept form to graph a linear equation  Use the point-slope form to find equation of line given slope and a point on the line  Use the point-slope form to find an equation of a line given two points on the line  Use the point-slope form to solve problems  Find equations of vertical and horizontal lines | A-CED.A.2  F-LE.A.1b  F-LE.A.2  F-LE.B.5 | |
| **3.6 Functions (31)**  Identify relations, domains, and ranges  Identify functions  Use the vertical line test  Use function notation | F-IF.A.1  F-IF.A.2  F-IF.B.5 | |
| **3.7 Graphing Linear Functions (18)**  Graph linear functions  Graph linear functions by finding intercepts  Graph vertical and horizontal lines  Decide whether a situation describes a linear function | F-IF.C.7a | |
| **3.8 Graphing Piecewise Defined Functions; Shifting/Reflecting Graphs (18)**  Graph piecewise-defined functions  Use vertical and horizontal shifts to graph a function  Use function notation  Graph nonlinear equations  Vertical and horizontal shifts | F-IF.A.2  F-IF.C.7ab  F-BF.A.1a  F-BF.B.3  A-REI.D.10 | |
| **CHAPTER 4: Solving Inequalities and Absolute Value Equations and Inequalities** | | **nil** |
| **4.1 Linear Inequalities and Problem Solving (33)**  Graph inequalities on number lines  Solve inequalities  Solve inequality applications | A-CED.A.1  A-REI.B.3 | |
| **4.2 Compound Inequalities (33)**  Solve compound inequalities involving or  Solve compound inequalities involving and | A-REI.B.3 | |
| **4.3 Absolute Value Equations (27)**  Solve absolute value equations | A-REI.B.3 | |
| **4.4 Absolute Value Inequalities (26)**  Solve absolute value inequalities of the form  Solve absolute value inequalities of the form | A-REI.B.3 | |
| **4.5 Graphing Linear Inequalities in Two Variables (30)**  Determine ordered pairs that are solutions to linear inequalities in two variables  Graph linear inequalities in two variables | A-REI.D.12 | |
| **CHAPTER 5: Solving Systems of Linear Equations and Inequalities** | **No data** | |
| **5.1 Solving Systems of Linear Equations by Graphing (23)**  Determine if an ordered pair is a solution of a system of equations in two variables  Solve a system of linear equations by graphing | A-REI.C.6 | |
| **5.2 Solving Systems of Linear Equations by Substitution (20)**  Use the substitution method to solve a system of linear equations | A-REI.C.6 | |
| **5.3 Solving Systems of Linear Equations by Elimination (23)**  Use the addition method to solve a system of linear equations | A-REI.C.6 | |
| **5.4 Systems of Linear Equations and Problem Solving (22)**  Choose a solution that satisfies the given conditions  Write a system of equations to describe a situation  Use a system of equations to solve problems | A-REI.C.6  A-CED.A.2  A-CED.A.3 | |
| **5.5 Systems of Linear Inequalities (16)**  Solve systems of linear inequalities  Use mathematical models involving linear inequalities | A-REI.C.6  A-CED.A.3 | |
| **5.7 Mean, Median, and Mode (17)**  Calculate mean, median, and mode  Determine effects of linear transformations of data  Work with box plots  Use box plots to discuss and compare data sets  Determine the median, first and third quartiles, and interquartile range of a data set  Work with measures of central tendency | S-ID.A.1  S-ID.A.2  S-ID.A.3 | |
| **CHAPTER 6: Exponents and Polynomials** | **No data** | |
| **6.1 Exponents (39)**  Evaluate exponential expressions  Use the product rule for exponents  Use the power rules for products and quotients  Use the quotient rule for exponents, and define a number raised to the 0 power  Decide which rule(s) to use to simplify an expression | 8.EE.A.1 | |
| **6.2 Adding and Subtracting Polynomials (45)**  Vocabulary and Readiness Check  Define polynomial, monomial, binomial, trinomial, and degree  Find the value of a polynomial given replacement values for the variables  Simplify a polynomial by combining like terms  Add and subtract polynomials | A-SSE.A.1a  A-APR.A.1 | |
| **6.3 Multiplying Polynomials (41)**  Use the distributive property to multiply polynomials | A-APR.A.1 | |
| **6.4 Special Products (28)**  Square a binomial  Multiply the sum and difference of two terms | A-APR.A.1  A-SSE.A.2 | |
| **6.5 Negative Exponents (32)**  Simplify expressions containing negative exponents  Use all the rules and definitions for exponents to simplify exponential expressions | 8.EE.A.1  8.EE.A.4 | |
| **6.6 Graphing Exponential Functions and Using the Compound Interest Formula (30)**  Graph exponential functions  Graph transformations of exponential functions  Use the compound interest formula | F-BF.B.3  F-LE.A.2  F-IF-C.7e  A-SSE.B.3c | |
| **6.7 Exponential Growth and Decay Functions (10)**  Model exponential growth  Model exponential decay  Model exponential decay with half-life | F-LE.A.1c  A-SSE.A.1b | |
| **A.F Arithmetic and Geometric Sequences (27)**  Identify arithmetic sequences and their common differences  Identify geometric sequences and their common ratios  Determine if a sequence is arithmetic or geometric | F-IF.A.3  F-LE.A.2 | |
| **CHAPTER 7: Factoring Polynomials** | **No data** | |
| **7.1 Greatest Common Factor and Factoring by Grouping (29)**  Find the greatest common factor of a list of integers  Factor out the greatest common factor from a polynomial  Factor a polynomial by grouping | A-SSE.A.1  A-SSE.A.2 | |
| **7.2 Factoring Trinomials of the Form**  **(40)**  Factor trinomials of the form  Factor out greatest common factor and factor a trinomial of the form | A-SSE.A.1a  A-SSE.A.2 | |
| **7.3 Factoring Trinomials of the Form** **and Perfect Square Trinomials (47)**  Factor trinomials of the form , where *a* is not equal to 1  Factor out a GCF before factoring a trinomial of the form  Use the grouping method to factor trinomials of the form  Factor perfect square trinomials | A-SSE.A.1a  A-SSE.A.2 | |
| **7.5 Factoring Binomials (24)**  Factor the difference of two squares  Factor other binomials | A-SSE.A.2 | |
| **7.6 Solving Quadratic Equations by Factoring (25)**  Use the zero factor theorem  Solve quadratic equations by factoring  Solve equations with degree greater than 2 by factoring | A-SSE.A.1a  A-SSE.A.2  A-SSE.B.3a  A-APR.B.3  A-REI.B.4b | |
| **7.7 Solving Quadratic Equations and Problem Solving (26)**  Solve problems that can be modeled by quadratic equations | A-CED.A.1  A-REI.B.4b | |
| **CHAPTER 9: Roots, Radicals, and Trigonometric Ratios** | **No data** | |
| **9.2 and 9.4 Simplifying Square Roots and Rationalizing Denominators (21)**  Use the product rule to simplify square roots  Use the quotient rule to simplify square roots  Rationalize denominators |  | |
| **CHAPTER 10: Quadratic Equations** | **No data** | |
| **10.1 Solving Quadratic Equations by the Square Root Property (27)**  Use the square root property to solve quadratic equations  Solve problems modeled by quadratic equations | A-REI.B.4b  A-SSE.A.2 | |
| **10.2 Solving Quadratic Equations by Completing the Square (13)**  Write perfect square trinomials  Solve quadratic equations of the form  by completing the square  Solve quadratic equations of the form  by completing the square | A-SSE.B.3b  A-REI.B.4 | |
| **10.3 Solving Quadratic Equations by the Quadratic Formula (26)**  Use the quadratic formula to solve quadratic equations  Approximate solutions to quadratic equations  Determine the number of solutions of a quadratic equation using the discriminant  Solve geometric problems modeled by quadratic equations | A-REI.4b  A-CED.A.3 | |
| **10.4 Quadratic Functions and Their Graphs (49)**  Graph quadratic functions of the form  Write quadratic functions in the form  Use the vertex formula to help graph quadratic functions of the form | A-SSE.B.3b  F-IF.B.4  F-IF.C.7a  F-IF.C.8a  F-BF.B.3 | |

LMS for Algebra I that are not reflected in *MyMathLab* course exercises:

| **LMS #** | **Standard Description** |
| --- | --- |
| N-RN.B.3 | Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. |
| N-Q.A.2 | Define appropriate quantities for the purpose of descriptive modeling. |
| N-Q.A.3 | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. |
| A-REI.C.5 | Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. |
| A-REI.D.11 | Explain why the x-coordinates of the points where the graphs of the equations and intersect are the solutions of the equation ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  and/or  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. |
| F-IF.C.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. |
| F-LE.A.1a | Distinguish between situations that can be modeled with linear functions and with exponential functions.  a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. |
| F-LE.A.3 | Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. |
| S-ID.B.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. |
| S-ID.B.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 and quadratic models.  b. Informally assess the fit of a function by plotting and analyzing residuals.  c. Fit a linear function for a scatter plot that suggests a linear association. |
| S-ID.C.8 | Compute (using technology) and interpret the correlation coefficient of a linear fit. |
| S-ID.C.9 | Distinguish between correlation and causation. |

**LSU College Readiness Program for Math**

**MML Algebra I Supplemental Activities**

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| --- | --- |
| **Standard # and Description** | N-RN.B.3  Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. |
| **Source** | Illustrative Mathematics  https://www.illustrativemathematics.org/content-standards/HSN/RN/B |

**Operations with Rational and Irrational Numbers**

Experiment with sums and products of two numbers from the following list to answer the questions that follow:



Based on the above information, conjecture which of the statements is ALWAYS true, which is SOMETIMES true, and which is NEVER true?

1. The sum of a rational number and a rational number is rational.
2. The sum of a rational number and an irrational number is irrational.
3. The sum of an irrational number and an irrational number is irrational.
4. The product of a rational number and a rational number is rational.
5. The product of a rational number and an irrational number is irrational.
6. The product of an irrational number and an irrational number is irrational.

**Rational or Irrational?**

In each of the following problems, a number is given. If possible, determine whether the given number is rational or irrational. In some cases, it may be impossible to determine whether the given number is rational or irrational. Justify your answers.

1. 
2. 
3. 
4. 
5. , where *a* is a positive integer
6.  , where *x* and *y* are irrational numbers

|  |  |
| --- | --- |
| **Standard # and Description** | N-Q.A.2  Define appropriate quantities for the purpose of descriptive modeling.  N-Q.A.3  Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. |
| **Source** | Illustrative Mathematics  https://www.illustrativemathematics.org/content-standards/HSN/Q/A/2 |

**Weed Killer**

A liquid weed-killer comes in four different bottles, all with the same active ingredient. The accompanying table gives information about the concentration of active ingredient in the bottles, the size of the bottles, and the price of the bottles. Each bottle’s contents is made up of active ingredient and water.

| **Concentration** | **Amount in Bottle** | **Price of Bottle** |
| --- | --- | --- |
| A: 1.04% | 64 fl oz | $12.99 |
| B: 18.00% | 32 fl oz | $22.99 |
| C: 41.00% | 32 fl oz | $39.99 |
| D: 1.04% | 24 fl oz | $5.99 |

1. You need to apply a 1% solution of the weed killer to your lawn. Rank the four bottles in order of best to worst buy. How did you decide what made a bottle a better buy than another?
2. The size of your lawn requires a total of 14 fl oz of active ingredient. Approximately how much would you need t spend if you bought only the A bottles? Only the B bottles? Only the C bottles? Only the D bottles? If you can only buy one type of bottle, which type should you buy so that the total cost to you is the least for this particular application?

|  |  |
| --- | --- |
| **Standard # and Description** | A-REI.C.5  Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. |
| **Source** | Louisiana Student Standards: Companion Document for Teachers (Algebra I)  https://www.louisianabelieves.com/docs/default-source/teacher-toolbox-resources/algebra-i---teachers-companion-document-pdf |

Use the system  to explore what happens graphically with different combinations of the linear equations.

1. Graph the original system of linear equations. Describe the solution of the system and how it relates to the solutions of each individual equation.
2. Add the two linear equations together and graph the resulting equation. Describe the solutions to the new equation and how they relate to the system’s solution.
3. Explore what happens with other combinations such as
4. Multiply the first equation by 2 and add to the second equation.
5. Multiply the second equation by  and add to the first equation.
6. Multiply the second equation by  and add to the first equation.
7. Multiply the first equation by  and add to the second equation.
8. Are there any combinations that are more informative than others?
9. Make a conjecture about the solution to a system and any combination of the equations.

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| **Standard # and Description** | A-REI.D.11  Explain why the x-coordinates of the points where the graphs of the equations and intersect are the solutions of the equation ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  and/or  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. |
| **Source** | Louisiana Student Standards: Companion Document for Teachers (Algebra I)  https://www.louisianabelieves.com/docs/default-source/teacher-toolbox-resources/algebra-i---teachers-companion-document-pdf |

1. The functions  and  give the lengths of two different springs in centimeters, as mass is added in grams, *m*, to each separately.
2. Graph each equation on the same set of axes.
3. What mass makes the springs the same length?
4. What is the length at that mass?
5. Write a sentence comparing the two springs.
6. Find the approximate solution(s) to each equation by graphing. Give your answers to the nearest tenth if necessary.
7. 
8. 
9. Given the following equations determine the 𝑥-value(s) that result in an equal output for both functions.



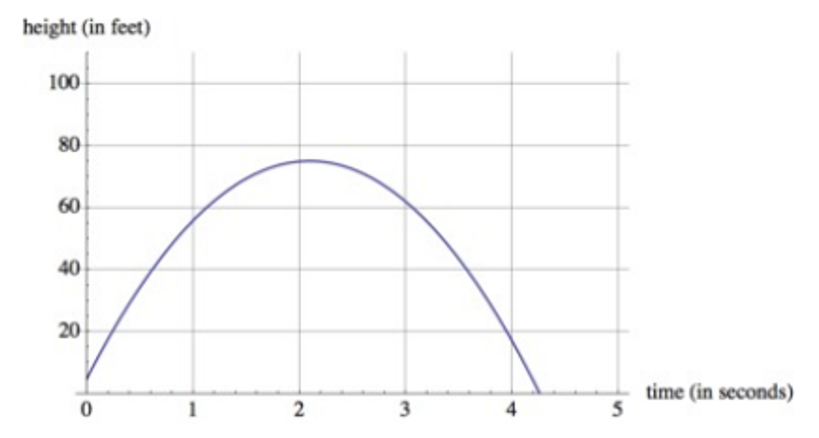
1. Graph the functions f and g using a graphing utility and approximate the solution(s) to the equation (𝑥)=𝑔(𝑥).



|  |  |
| --- | --- |
| **Standard # and Description** | F-IF.C.9  Compare properties of two functions (linear, quadratic, piecewise linear (to include absolute value) or exponential) 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*. |
| **Source** | Illustrative Mathematics  https://www.illustrativemathematics.org/content-standards/HSF/IF/C/9/tasks/1279 |

**Throwing Baseballs**

Suppose Brett and Andre each throw a baseball into the air. The height of Brett’s baseball is given by , where *h* is in feet and *t* is in seconds. The height of Andre’s baseball is given by the graph below:



Brett claims that his baseball went higher than Andre’s and Andre says that his baseball went higher.

1. Who is right?
2. How long is each baseball airborne?
3. Construct a graph of the height of Brett’s throw (if not done already), and explain how this can confirm your claims to parts (a) and (b).

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| **Standard # and Description** | F-LE.A.1a  Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. |
| **Source** | Illustrative Mathematics  https://www.illustrativemathematics.org/HSF-LE.A.1 |

**Equal Differences over Equal Intervals 1**

1. Complete the table. In the third column, show your work as demonstrated. What do you notice about the third column?

| ***x*** | ***y* = 2*x* + 5** | **Δ*y*** |
| --- | --- | --- |
| 1 | *y* = 2(1) + 5 = 7 | --- |
| 2 | *y* = 2(2) + 5 = 9 | 9 – 7 = 2 |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |

1. Complete the table, showing your work as above. What do you notice about the third column? What is the graphical interpretation of this?

| ***x*** | ***y* = a*x* + b** | **Δ*y*** |
| --- | --- | --- |
| 1 | *y* = a(1) + b = a + b | --- |
| 2 | *y* = a(2) + b = 2a + b | 2a + b – (a + b) = a |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |

1. Let *y* = a*x* + b. Let *x*0 be any particular *x*-value. Show that if *x*0 is increased by 1, the corresponding Δ*y* is a constant that does not depend on *x*0. What is this constant?
2. Does (1) serve as an example of the result in (3)? Explain.

**Equal Factors over Equal Intervals**

1. Complete the table below. Is Δ*x* a constant? If so, what constant is it? What do you notice about the third column of the table?

| ***x*** |  | **Successive quotients** |
| --- | --- | --- |
| 0 |  | --- |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

1. Complete the table below. Is Δ*x* a constant? If so, what constant is it? What do you notice about the third column of the table?

| ***x*** |  | **Successive quotients** |
| --- | --- | --- |
| 0 |  | --- |
| 2 |  |  |
| 4 |  |  |
| 6 |  |  |
| 8 |  |  |

1. Let . Let *x*0 be any particular x-value. Show that if *x*0 is increased by a constant, Δ*x*, the successive quotient  is always the same no matter what *x*0 is.
2. Is (2) an example of the result of (3)? Explain.

|  |  |
| --- | --- |
| **Standard # and Description** | F-LE.A.3  Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. |
| **Source** | Louisiana Student Standards: Companion Document for Teachers (Algebra I)  https://www.louisianabelieves.com/docs/default-source/teacher-toolbox-resources/algebra-i---teachers-companion-document-pdf |

1. Compare the values of the functions ,  , and for 𝑥 ≥ 0.
2. Kevin and Joseph each decide to invest $100. Kevin decides to invest in an account that will earn $5 every month. Joseph decided to invest in an account that will earn 3% interest every month.
3. Whose account will have more money in it after two years?
4. After how many months will the accounts have the same amount of money in them?
5. Describe what happens as the money is left in the accounts for longer periods of time.

|  |  |
| --- | --- |
| **Standard # and Description** | S-ID.B.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. |
| **Source** | Illustrative Mathematics  https://www.illustrativemathematics.org/content-standards/HSS/ID/B/5/tasks/2044 |

**Support for a Longer School Day?**

Each student in a random sample of students at a local high school was categorized according to gender (male or female) and whether they supported a proposal to increase the length of the school day by 30 minutes (oppose, support, or no opinion). The following table summarizes the data for this sample.

| **Gender** | **Oppose** | **Support** | **No Opinion** | **Total** |
| --- | --- | --- | --- | --- |
| **Male** | 50 | 40 | 20 | 110 |
| **Female** | 40 | 40 | 10 | 90 |
| **Total** | 90 | 80 | 30 | 200 |

1. What proportion of the students in this sample are male?
2. What proportion of the students in this sample support the proposal?
3. What proportion of the males in this sample support the proposal?
4. What proportion of the students in this sample who support this proposal are male?
5. Interpret the following joint relative frequency in the context of this problem: 10/200
6. Interpret the following marginal relative frequency in the context of this problem: 30/200
7. Interpret the following conditional frequency in the context of this problem: 50/110
8. Interpret the following conditional frequency in the context of this problem: 20/110
9. Interpret the following conditional frequency in the context of this problem: 20/30

|  |  |
| --- | --- |
| **Standard # and Description** | S-ID.B.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 and quadratic models.  b. Informally assess the fit of a function by plotting and analyzing residuals.  c. Fit a linear function for a scatter plot that suggests a linear association |
| **Source** | Illustrative Mathematics  http://tasks.illustrativemathematics.org/content-standards/HSS/ID/B/6/tasks/941 |

Jane wants to sell her Subaru Forester but doesn’t know what the listing price should be. She checks on craigslist.com and finds 22 Subarus listed. The table below shows age (in years), mileage (in miles), and listed price (in dollars) for these 22 Subarus. (Collected on June 6th, 2012 for the San Francisco Bay Area.)

|  |  |  |
| --- | --- | --- |
| **Age** | **Mileage** | **Price** |
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1. Make appropriate plots with well-labeled axes that would allow you to see if there is a relationship between price and age and between price and mileage. Describe the direction, strength and form of the relationships that you observe. Does either mileage or age seem to be a good predictor of price?
2. If appropriate, describe the strength of each relationship using the correlation coefficient. Do the values of the correlation coefficients agree with what you see in the plots?
3. Pick the stronger relationship and use the data to find an equation that describes this relationship. Make a residual plot and determine if the model you chose is a good one. Write a few sentences explaining why (or why not) the model you chose is appropriate.
4. If Jane’s car is 9 years old with 95000 miles on it, what listing price would you suggest? Explain how you arrived at this price.

|  |  |
| --- | --- |
| **Standard # and Description** | S-ID.B.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 and quadratic models.  b. Informally assess the fit of a function by plotting and analyzing residuals.  c. Fit a linear function for a scatter plot that suggests a linear association. |
| **Source** | Louisiana Student Standards: Companion Document for Teachers (Algebra I)  https://www.louisianabelieves.com/docs/default-source/teacher-toolbox-resources/algebra-i---teachers-companion-document-pdf |

A study was done to compare the speed (in miles per hour) with the mileage (in miles per gallon) of an automobile. The results are shown in the table.

(source: Federal Highway Administration)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Speed,  ( |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Mileage,  ( |  |  |  |  |  |  |  |  |  |  |  |  |  |

1. Use your calculator to make a scatter plot of the data.
2. Use the regression feature to find a model that best fits the data.
3. Approximate the speed at which the mileage is the greatest.

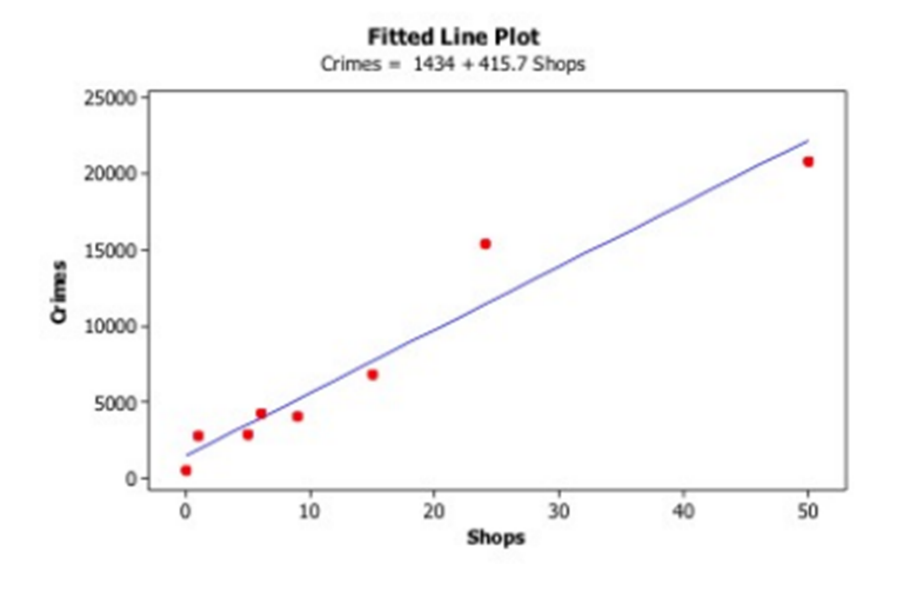
|  |  |
| --- | --- |
| **Standard # and Description** | S-ID.B.6  Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.  a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and quadratic models.  b. Informally assess the fit of a function by plotting and analyzing residuals.  c. Fit a linear function for a scatter plot that suggests a linear association.  S-ID.C.8  Compute (using technology) and interpret the correlation coefficient of a linear fit.  S-ID.C.9  Distinguish between correlation and causation. |
| **Source** | Illustrative Mathematics  https://www.illustrativemathematics.org/content-standards/HSS/ID/C/8/tasks/1307 |

**Coffee and Crime**

Many counties in the United States are governed by a county council. At public county council meetings, county residents are usually allowed to bring up issues of concern. At a recent public county council meeting, one resident expressed concern that 3 new coffee shops from a popular coffee shop chain were planning to open in the county, and the resident believed that this would create an increase in property crimes in the county. (Property crimes include burglary, larceny-theft, motor vehicle theft, and arson according to information from 2010 found at [www.fbi.gov](http://www.fbi.gov).)

To support this claim, the resident presented the following data and scatterplot (with the least squares line shown) for 8 counties in the state:

| **County** | **Number of Coffee “Shops”** | **Number of “Crimes”** |
| --- | --- | --- |
| A | 9 | 4000 |
| B | 1 | 2700 |
| C | 0 | 500 |
| D | 6 | 4200 |
| E | 15 | 6800 |
| F | 50 | 20800 |
| G | 5 | 2800 |
| H | 24 | 15400 |



The scatterplot shows a positive linear relationship between “Shops” (the number of coffee shops of this particular chain in the county) and “Crimes” (the number of annual property crimes for the county). In other words, counties with more of these coffee shops tend to have more property crimes annually.

1. Does the relationship between Shops and Crimes appear to be linear? Would you consider the relationship between Shops and Crimes to be strong, moderate, or weak?
2. Compute the correlation coefficient. Does the value of the correlation coefficient support your choice in part (a)? Explain.
3. The equation of the least-squares line for this data is

**Predicted Crimes = 1434 + 415.7(Shops)**

Based on this line, what is the estimated number of additional annual property crimes for a given county that has 3 more coffee shops than another county?

1. Does this data support the claim that building 3 additional coffee shops will necessarily *cause* an increase in property crimes? What other variables might explain the positive relationship between the number of coffee shops for this coffee shop chain and the number of annual property crimes for these counties?
2. If the following two counties were added to the data set would you still consider using a line to model the relationship? If not, what other types (forms) of model would you consider?

| **County** | **Number of Coffee “Shops”** | **Number of “Crimes”** |
| --- | --- | --- |
| I | 25 | 36900 |
| J | 27 | 24100 |