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 CheckUse the commutative and associative propertiesUse the distributive propertyName 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 termsUse the distributive property to remove parenthesesWrite word phrases as algebraic expressionsName the properties illustrated by the statements | A-APR.A.1A-SSE.A.1a6.EE.A.26.EE.A.37.EE.A.1 |
| **2.2 and 2.3 Properties of Equality (35)**Use the addition property of equality to solve linear equationsSimplify an equation and then use the addition property of equalityUse the multiplication property of equality to solve linear equationsUse addition and multiplication properties of equality to solve linear equations | A-REI.A.1A-REI.B.3 |
| **2.4 Solving Linear Equations (39)**Apply a general strategy for solving a linear equationSolve equations containing fractions | A.REI.A.1A-REI.B.38.EE.C.7a |
| **2.5 Introduction to Problem Solving (28)** Solve problems involving direct translationsSolve problems involving relationships among unknown quantitiesSolve problems involving consecutive integers | A-REI.B.3A-CED.A.1 |
| **2.6 Formulas and Problem Solving (35)**Substitute values into a formula and solve for the unknown variableSolve a formula for one of its variablesUse formulas to solve problems | N-Q.A.1A-CED.A.1A-CED.A.4A-REI.B.3 |
| **2.8 Mixture and Distance Problem Solving (17)**Solve mixture problemsSolve uniform motion problems | N-Q.A.1A-CED.A.1A-CED.A.3A-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 numbersGraph paired data to create a scatter diagramDetermine whether an ordered pair is a solution of an equation in two variablesFind missing coordinate of an ordered pair solution given one coordinate of the pairInterpret information given in a scatter plot | S-ID.C.78.SP.A.16.EE.B.5A-REI.D.10 |
| **3.2 Graphing Linear Equations (32)**Identify linear equationsGraph an equation by finding and plotting ordered pair solutionsSolve application problems | A-REI.D.10F-IF.C.7a  |
| **3.3 Intercepts (28)**Identify intercepts of a graphGraph a linear equation by finding and plotting interceptsIdentify and graph vertical and horizontal lines | A-REI.D.10F-IF.C.7a |
| **3.4 Slope and Rate of Change (34)**Find the slope of a line given points on the lineFind the slopes of horizontal and vertical linesFind the slope of a line given its equationSlope as a rate of change | F-IF.B.6F-LE.B.5S-ID.C.7A-REI.D.10 |
| **3.5 Equations of a Line (34)**Use the slope-intercept form to write an equation of a lineUse the slope-intercept form to graph a linear equationUse the point-slope form to find equation of line given slope and a point on the lineUse the point-slope form to find an equation of a line given two points on the lineUse the point-slope form to solve problemsFind equations of vertical and horizontal lines | A-CED.A.2F-LE.A.1bF-LE.A.2F-LE.B.5 |
| **3.6 Functions (31)**Identify relations, domains, and rangesIdentify functionsUse the vertical line testUse function notation | F-IF.A.1F-IF.A.2F-IF.B.5 |
| **3.7 Graphing Linear Functions (18)**Graph linear functionsGraph linear functions by finding interceptsGraph vertical and horizontal linesDecide whether a situation describes a linear function | F-IF.C.7a |
| **3.8 Graphing Piecewise Defined Functions; Shifting/Reflecting Graphs (18)**Graph piecewise-defined functionsUse vertical and horizontal shifts to graph a functionUse function notationGraph nonlinear equationsVertical and horizontal shifts | F-IF.A.2F-IF.C.7abF-BF.A.1aF-BF.B.3A-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 linesSolve inequalitiesSolve inequality applications | A-CED.A.1A-REI.B.3 |
| **4.2 Compound Inequalities (33)**Solve compound inequalities involving orSolve 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 variablesGraph 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 variablesSolve 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 conditionsWrite a system of equations to describe a situationUse a system of equations to solve problems | A-REI.C.6A-CED.A.2A-CED.A.3 |
| **5.5 Systems of Linear Inequalities (16)**Solve systems of linear inequalitiesUse mathematical models involving linear inequalities | A-REI.C.6A-CED.A.3 |
| **5.7 Mean, Median, and Mode (17)**Calculate mean, median, and modeDetermine effects of linear transformations of dataWork with box plotsUse box plots to discuss and compare data setsDetermine the median, first and third quartiles, and interquartile range of a data setWork with measures of central tendency | S-ID.A.1S-ID.A.2S-ID.A.3 |
| **CHAPTER 6: Exponents and Polynomials** | **No data** |
| **6.1 Exponents (39)**Evaluate exponential expressionsUse the product rule for exponentsUse the power rules for products and quotientsUse the quotient rule for exponents, and define a number raised to the 0 powerDecide which rule(s) to use to simplify an expression | 8.EE.A.1 |
| **6.2 Adding and Subtracting Polynomials (45)**Vocabulary and Readiness CheckDefine polynomial, monomial, binomial, trinomial, and degreeFind the value of a polynomial given replacement values for the variablesSimplify a polynomial by combining like termsAdd and subtract polynomials | A-SSE.A.1aA-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 binomialMultiply the sum and difference of two terms | A-APR.A.1A-SSE.A.2 |
| **6.5 Negative Exponents (32)**Simplify expressions containing negative exponentsUse all the rules and definitions for exponents to simplify exponential expressions | 8.EE.A.18.EE.A.4 |
| **6.6 Graphing Exponential Functions and Using the Compound Interest Formula (30)**Graph exponential functionsGraph transformations of exponential functionsUse the compound interest formula | F-BF.B.3F-LE.A.2F-IF-C.7eA-SSE.B.3c |
| **6.7 Exponential Growth and Decay Functions (10)**Model exponential growthModel exponential decayModel exponential decay with half-life | F-LE.A.1cA-SSE.A.1b |
| **A.F Arithmetic and Geometric Sequences (27)**Identify arithmetic sequences and their common differencesIdentify geometric sequences and their common ratiosDetermine if a sequence is arithmetic or geometric | F-IF.A.3F-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 integersFactor out the greatest common factor from a polynomialFactor a polynomial by grouping | A-SSE.A.1A-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.1aA-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 1Factor 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.1aA-SSE.A.2 |
| **7.5 Factoring Binomials (24)**Factor the difference of two squaresFactor other binomials | A-SSE.A.2 |
| **7.6 Solving Quadratic Equations by Factoring (25)**Use the zero factor theoremSolve quadratic equations by factoringSolve equations with degree greater than 2 by factoring | A-SSE.A.1aA-SSE.A.2A-SSE.B.3aA-APR.B.3A-REI.B.4b  |
| **7.7 Solving Quadratic Equations and Problem Solving (26)**Solve problems that can be modeled by quadratic equations | A-CED.A.1A-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 rootsUse the quotient rule to simplify square rootsRationalize 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 equationsSolve problems modeled by quadratic equations | A-REI.B.4bA-SSE.A.2 |
| **10.2 Solving Quadratic Equations by Completing the Square (13)**Write perfect square trinomialsSolve quadratic equations of the form  by completing the squareSolve quadratic equations of the form  by completing the square | A-SSE.B.3bA-REI.B.4 |
| **10.3 Solving Quadratic Equations by the Quadratic Formula (26)**Use the quadratic formula to solve quadratic equationsApproximate solutions to quadratic equationsDetermine the number of solutions of a quadratic equation using the discriminantSolve geometric problems modeled by quadratic equations | A-REI.4bA-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.3bF-IF.B.4F-IF.C.7aF-IF.C.8aF-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.3Explain 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

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| **Standard # and Description** | N-Q.A.2Define appropriate quantities for the purpose of descriptive modeling.N-Q.A.3Choose 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?

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| **Standard # and Description** | A-REI.C.5Prove 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.11Explain 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).



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| --- | --- |
| **Standard # and Description** | F-IF.C.9Compare 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 Mathematicshttps://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.1aProve that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. |
| **Source** | Illustrative Mathematicshttps://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.

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| --- | --- |
| **Standard # and Description** | F-LE.A.3Observe 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.

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| **Standard # and Description** | S-ID.B.5Summarize 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 Mathematicshttps://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

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| **Standard # and Description** | S-ID.B.6Represent 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 Mathematicshttp://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.

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| **Standard # and Description** | S-ID.B.6Represent 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.6Represent 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.8Compute (using technology) and interpret the correlation coefficient of a linear fit.S-ID.C.9Distinguish between correlation and causation. |
| **Source** | Illustrative Mathematicshttps://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 |