Learning Progression with Modeling

Algebra I

Ellensburg High School

February 2014

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This learning progression is for a high school algebra 1 class. The purpose of this learning progression is to align a textbook to the Common Core. In addition, one of the standards will be taught via modeling.

Textbook: Boswell, Larson, Kanold & Stiff. (2004). *Algebra 1.* Evanston, IL: McDougal Littell.

This learning progression focuses on the "Creating Equations" domain. This domain only has one cluster, and it covers a total of four standards. They are as follows:

- CCSS.Math.Content.HSA-CED.A.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*.
- CCSS.Math.Content.HSA-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- CCSS.Math.Content.HSA-CED.A.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 nutritional and cost constraints on combinations of different foods*.
- CCSS.Math.Content.HSA-CED.A.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*.

These four standards will be taught as a unit in the order they are listed above. This learning progression will span 3 class periods/days. The first two standards will be taught on Days 1 and 2 respectively. The last two standards will be taught together. All of the standards will have corresponding activities and benchmark assessments. These will be explained in detail on the following pages; however, below is a brief outlook of the learning progression.

Standard	Class Activity	Benchmark Assessment
HSA-CED.A.1	A lecture will be given to the students providing them with the info they need in order to achieve the standard.	Homework from the aligned textbook will be used for assessment. Ch. 1 Sec. 4 pg. 27, #14-24 even, Sec. 5 pg. 35, #23-28. In addition, a worksheet will be made in order to supplement. It will include quadratics, rational, and exponential functions.
HSA-CED.A.2	A lecture will be given.	Homework from the textbook will be used. Ch.1 Sec. 5, pg. 36, #39-48. A worksheet will be created to supplement as well.
HSA-CED.A.3 HSA-CED.A.4	A modeling activity will be used.	An investigation packet will be created and given to the students, which will be used for assessment of the standards.

Standard HSA-CED.A.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.*

Activity

As a whole class, we will have a discussion on the definitions, such as equation, inequality, variable, linear, quadratic, rational, and exponential functions. The students will take notes throughout the discussion in order to use them as study aids to prepare for the benchmark assessment. In addition to the definitions, students will also be taught how to solve these types of functions (linear, quadratic, rational, and quadratic) in one variable. It is important to note that depending on the class, this standard may need to be taught over many class days. However, for my particular class, I know that they have at least been exposed to these types of functions before and at least have an idea of how to solve them in one variable. So this activity is more of a comprehensive review for my students. Students will be given a worksheet in order to practice this standard (Figure 1-1).

Benchmark Assessment

Selected homework problems from the aligned textbook will be used for the benchmark assessment (Figure 1-2) and well as a worksheet to supplement. It will be graded and based on the class distribution, I will be able to tell whether or not the students understand and have obtained mastery of this standard.

Figure 1-1

Name_____

Date_____

Class Period_____

Worksheet

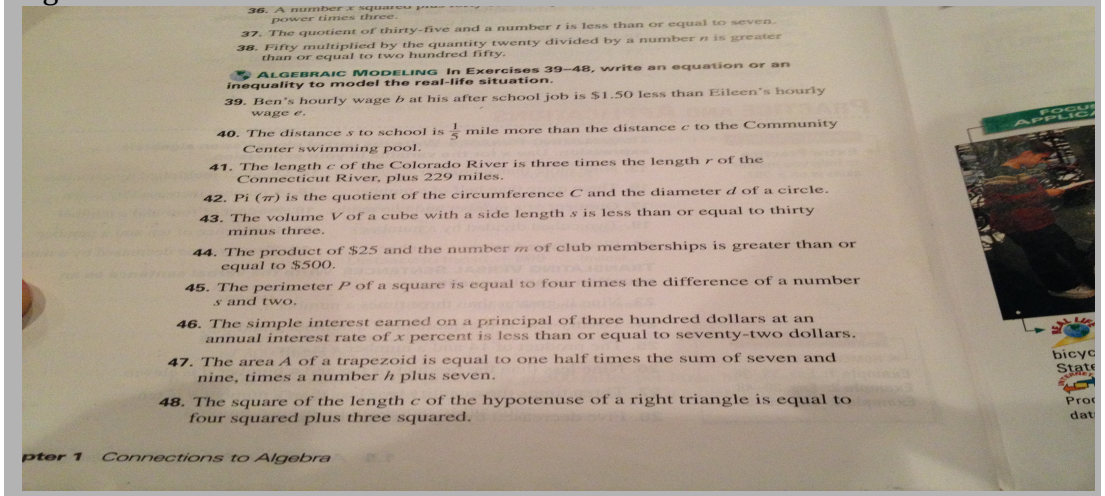
Standard: HSA-CED.A.1

1. Solve y = 3x + 9

2. Write an equation that depicts the third power of 8 is 2.

3. Solve y = x^2 – 16.

Figure 1-2



36. A number x squared plus [illegible] power times three.

37. The quotient of thirty-five and a number t is less than or equal to seven.

38. Fifty multiplied by the quantity twenty divided by a number n is greater than or equal to two hundred fifty.

ALGEBRAIC MODELING In Exercises 39–48, write an equation or an inequality to model the real-life situation.

39. Ben's hourly wage b at his after school job is $1.50 less than Eileen's hourly wage e.

40. The distance s to school is $\frac{1}{5}$ mile more than the distance c to the Community Center swimming pool.

41. The length c of the Colorado River is three times the length r of the Connecticut River, plus 229 miles.

42. Pi (π) is the quotient of the circumference C and the diameter d of a circle.

43. The volume V of a cube with a side length s is less than or equal to thirty minus three.

44. The product of $25 and the number m of club memberships is greater than or equal to $500.

45. The perimeter P of a square is equal to four times the difference of a number s and two.

46. The simple interest earned on a principal of three hundred dollars at an annual interest rate of x percent is less than or equal to seventy-two dollars.

47. The area A of a trapezoid is equal to one half times the sum of seven and nine, times a number h plus seven.

48. The square of the length c of the hypotenuse of a right triangle is equal to four squared plus three squared.

pter 1 Connections to Algebra

Standard HSA-CED.A.2

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

Activity

As a class, we will have a discussion on what this standard is and what they will have to learn in order to be successful. Students will be exposed to writing equations and inequalities with two or more variables. In addition, students will know how to graph equations on a coordinate plane with the correct labels and scales. Students will be given a worksheet (Figure 2-1) in order to practice this standard.

Benchmark Assessment

Selected homework problems (Figure 2-2) from the aligned textbook as well as a supplemented worksheet will be used for a benchmark assessment. From this I will be able to tell if the students have mastered the standard.

Figure 2-1

Name_____

Date_____

Class Period_____

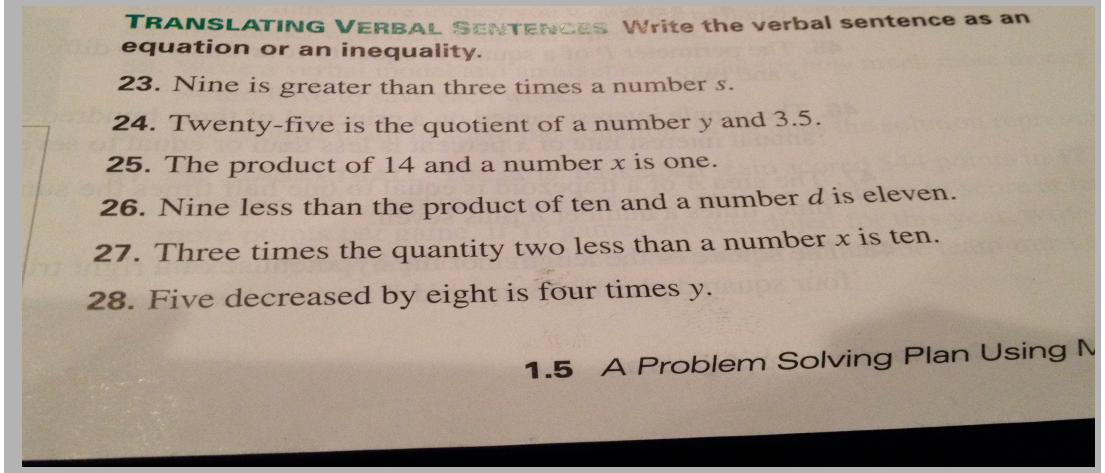
Worksheet

Standard: HSA-CED.A.2

1. If a rental car costs $2.35 per mile driven and $12 per day, write an equation to model this scenario.

2. Graph the equation, y = 4x + 5.

Figure 2-2



TRANSLATING VERBAL SENTENCES Write the verbal sentence as an equation or an inequality.

23. Nine is greater than three times a number s.

24. Twenty-five is the quotient of a number y and 3.5.

25. The product of 14 and a number x is one.

26. Nine less than the product of ten and a number d is eleven.

27. Three times the quantity two less than a number x is ten.

28. Five decreased by eight is four times y.

1.5 A Problem Solving Plan Using N

Standard HSA-CED.3 & HSA.CED.4

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 nutritional and cost constraints on combinations of different foods.*

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.*

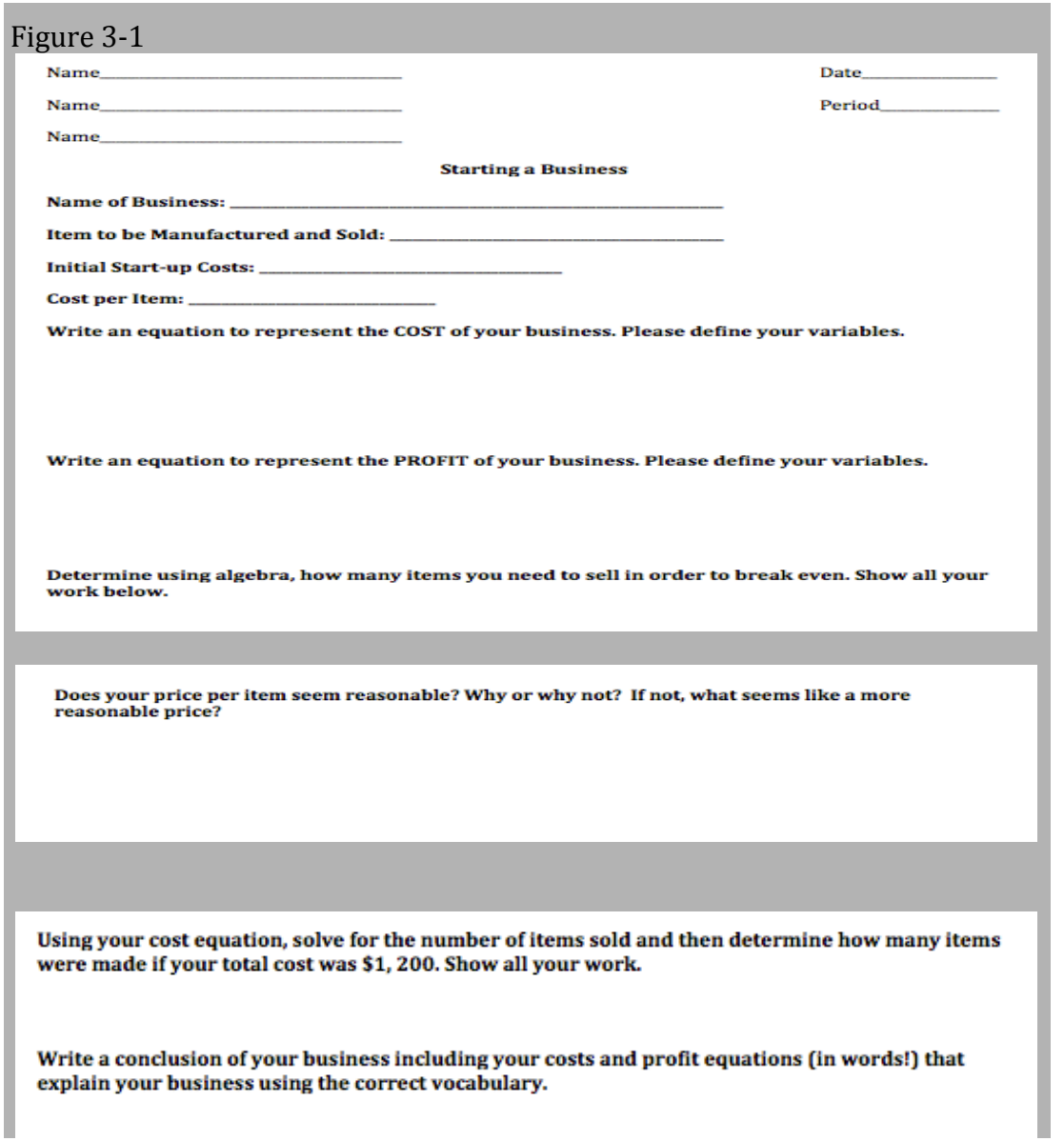
Activity

For these standards, students will not be getting a lecture or discussion. Instead, the students will be given an investigation packet (Figure 3-1). The students will work in pairs or small groups in order to start their own business. Students will have to create a system of equations in order to model their business and come to conclusions about it.

Benchmark Assessment

The investigation packet will be used for the benchmark assessment. From its completion and grading, I will be able to interpret if the students know these two standards or not.

Figure 3-1



Name_____ Date_____

Name_____ Period_____

Name_____

Starting a Business

Name of Business: _____

Item to be Manufactured and Sold: _____

Initial Start-up Costs: _____

Cost per Item: _____

Write an equation to represent the COST of your business. Please define your variables.

Write an equation to represent the PROFIT of your business. Please define your variables.

Determine using algebra, how many items you need to sell in order to break even. Show all your work below.

Does your price per item seem reasonable? Why or why not? If not, what seems like a more reasonable price?

Using your cost equation, solve for the number of items sold and then determine how many items were made if your total cost was $1, 200. Show all your work.

Write a conclusion of your business including your costs and profit equations (in words!) that explain your business using the correct vocabulary.

Formative assessment for this learning progression will be a variety of different methods. However most of the benchmark assessments are in the form of homework questions, except for the last two standards, which will be assessed with the investigation packet. The final formative assessment, in a form of an exam covering all of the four standards, will be accurate because they are aligned with the Common Core Standards. The questions will consist of ones similar to the figures displayed in the learning progression. For this final exam, students will receive a review of the material and a day in class to ask whatever questions they would like. Adjustments will be made for those students who need it for various reasons such as IEPs or student disabilities. Each question on the final exam will be graded using a four-point scale (table below). Students will receive a four if the answer is correct and all work is shown, or fully understands. Depending on the amount of errors or limited shown work, which would mean that they do not fully understand, points will be deducted. From the score distribution of the class, I will be able to see if the class has mastered the standards or if we need to go back and review.

	Fully Understands	Mostly Understands	Almost there	Little Understanding	No Understanding
Standard 1 _____	5	4	3	2	1
Standard 2 _____	5	4	3	2	1
Standard 3 _____	5	4	3	2	1