

EOCEP Data Review Report: Spring 2017

Algebra 1

In November 2017 the South Carolina Department of Education convened panels of experts to review item data on the Algebra 1 EOCEP test. The panels looked at items with a high percentage of students answering correctly and items with a low percentage of students answering correctly. The discussions of that panel yielded the recommendations that follow. The panel recognizes the hard work of SC educators and offers the following as suggestions for ways to improve student success on the Algebra 1 EOCEP test.

Algebra 1 General Suggestions:

The following are general suggestions for multiple items or are not directly tied to a standard.

- Use proper academic vocabulary. Use the word “intercepts” and other grade level appropriate academic vocabulary. Saying “the place where the graph crosses an axis” is ok for scaffolding, but must be phased out quickly. Mathematics is a language. The committee suggested using the Frayer model for teaching new mathematical vocabulary. Another suggestion was to use anchor charts as a review of vocabulary and to leave them posted for reference in subsequent units. One teacher noted, “I speak mathematically to my students, and I expect the same in return.”
- Have mathematical discussions with your students. This is an opportunity to hear how your students are experiencing the math. Have students explain their reasoning and provide thoughtful responses to the reasoning of others.
- Students should know they must read and answer the question being asked. During a mathematical discussion give students a story item without the question. Then ask students to provide questions to complete the item. This allows student to see a traditional item with multiple questions. The hope is when the students get to the test they will not see a traditional item and think they automatically know the question.
- Use graph paper as scratch paper. This is useful for some students to keep numbers lined up when performing operations. Others may find it useful in recreating diagrams, tables, or graphs on the test.
- Practice multi-step items. Many students are stopping after one step of a multi-step item.
- Practice the Online Tools Training (OTT). The OTT is there to minimize test day stress. The OTT familiarizes students with the mechanics of the test and the tools that are there to help them.
- Teaching procedures or shortcuts and not conceptual understanding will hurt students eventually. It is clear that students are fluent in certain procedures, but do not understand the basic underlying principle. For instance, a conceptual understanding of graphing involves knowing that the graph is the set of all the ordered pairs that make the corresponding equation true. Starting at the y-intercept and then applying the slope is one way to get a graph, not the definition of a graphing.
- Being efficient does not mean blindly doing the same procedure really fast. Rather, efficiency is taking the time to first choose an appropriate or best strategy. For instance, graphing is not the most efficient way to solve this system of equations:

$$\begin{cases} y = x \\ 4 = 2x + 2y \end{cases}$$

- Items on the EOCEP Algebra 1 test are not grouped by key concept or standard. In fact, we tend to not group items from the same/similar standards together. Students should practice a test that is likewise ungrouped before the EOCEP Algebra 1 test.
- Students should be encouraged to fully read story items before putting pencil to paper. Students may need a strategy for organizing the information they read and should always note what the item is asking them to find.
- When discussing zeros, roots, and x-intercepts the committee recognizes that there are subtle differences in when you may want to use each term. However, from the student perspective these three concepts are essentially the same. Those words should be used interchangeably and invoke the same conceptual recognition.
- Students need continued practice with fractions.
- Students tend to do well on what the committee considered the typical Algebra 1 items. However, when the items were a bit more challenging or assessed primarily conceptual understanding students tended to experience more trouble.
- The committee encourages teachers to vary the way in which questions are phrased. There are very few items whose only direction is to “solve” on the EOCEP Algebra 1 test. Teachers should be sure to include story items as much as possible or at least a sentence. In addition, many items have rather friendly numbers, but test a higher level of understanding.

Suggestions that are standard specific:

Creating Equations (ACE)

- A1.ACE.2 – Students need practice with translating from verbal expressions to symbolic expressions. In particular students missed “there are ‘a’ times as many Xs as Ys,” where ‘a’ is a number and X and Y are objects. Students should continue to practice careful reading and alternate phrasing. Students should continue to practice this standard into systems of equations as well.

Reasoning with Equations and Inequalities (AREI)

- A1.AREI.4a – Students need to practice transforming equations and showing each step. Students should be encouraged to have mathematical discussions to analyze a solved item. Students need to be able to justify their steps in solving.
- A1.AREI.6b – Students should understand that solving systems of equations by linear combinations is really finding a different set of equations that have better arithmetic and the same solution as the original pair. Students should practice finding and highlighting the intermediate steps. Students should critique other student work, either real or made up. Ask the students what is correct or what went wrong in the work of another student.
- A1.AREI.10 – Students need practice working with discrete and continuous data. Students should be asking if they are graphing every solution to a function or only certain ones based on a given context. In relation to this standard, students were not certain that a continuous graph showed all of the solutions.

- A1.AREI.11 – Be sure to tell students that to find “the solution” of $f(x) = g(x)$, “the solution” is the x-value, not the ordered pair or the y-value. The standard explicitly states that the x-value is the answer. The two functions intersect at point(s), but the solution(s) in this case is/are the x-value(s). A teacher on the committee suggested using a table to help understand the graph. Set up the table as $x|y_1|y_2$ and then when $y_1 = y_2$, the x-value is the solution. This is also a good time to contrast this with finding the solution to a system of equations.

Structure and Expressions (ASE)

- A1.ASE.3 – When explaining properties of a quantity students need a strong command of mathematical vocabulary. Students need practice seeing the words “real numbers” and understanding that is describing a number system. In addition, students must understand abstractly what happens when working within a number system.

Interpreting Functions (FIF)

- A1.FIF.1 – Be careful when teaching the definition of a function. Some students hear that a function does not have repeated x-values. Allow students to see functions with repeated ordered pairs as an example of when x-values may be repeated.
- A1.FIF.5 – Students should be exposed to a variety of story items where they need to find a rate. Some items should be constant and others discrete. Some suggestions were to have students create a table for items that are discrete and then plot the points to avoid having them draw the line. Students need help when the item says something happens at a constant rate. For instance, a person at regular intervals consumes A objects every B hours. Ask students to plot or find a graph that has only the points that show when objects are consumed. Students will have to be careful that there are A evenly spaced points every B hours.
- A1.FIF.8 – Students need practice with quadratic equations in different forms to highlight different properties of functions. For instance, a form that most readily shows the zeros vs a form that shows the y-intercept. This standard is about translating for a purpose not finding solutions.
- A1.FIF.8a – Teachers should remind students that this standard asks them to find critical points of a quadratic, not just the solutions. In addition, students should understand that the axis of symmetry is a line of symmetry for quadratics.
- A1.FIF.9 – Students need experience comparing functions in different forms. This standard allows for a comparison of two different functions in two different representations or two different functions in the same representation. Students should practice both types of comparison.

Linear, Quadratic, and Exponential (FLQE)

- A1.FLQE.1 – Students need more practice with exponential functions and how they are different from quadratic functions. Be careful that students do not perceive any function with an exponent as an exponential function.

Real Number System (NRNS)

- A1.NRNS.1 – Teachers should know that this standard includes items where students are asked to simplify expressions involving rational exponents. Students should practice dividing exponents when the item is written as a fraction.
- A1.NRNS.2 – Students should practice simplifying and translating a radical of a radical. Rewriting a radical of a radical can be done in multiple ways. Students should be exposed to different ways of thinking about the simplification process. This is a good place for mathematical discussions or reflecting on the reasoning of others.
- A1.NRNS.3 – Teachers need to stress number systems. Students should see the words “real numbers, integers, rational numbers, etc.” and understand they refer to a system of numbers. Students tend to read over the words naming a number system and miss how that limits possible results or inputs for a function. Students need practice with this vocabulary in the abstract. For instance, have students practice reasoning through items with all variables defined on number systems, i.e., let, a , b , c , and d be integers. Then ask students what is true when we add, subtract, multiply, or divide them.

SC students are generally doing well when:

- solving quadratic equations for zeros.
- finding the solution to a system of linear equations when the solution is a point.
- solving linear equations in one variable.
- identifying parts of an equation in terms of a context.
- working with linear equations.
- finding a constant rate of change.
- reading scatter plots.
- working with literal equations.