Algebra 1

Using Sample Questions
To Improve Problem Solving Skills

Focus: Formative Assessment Feedback

Students miss many questions on mathematics tests due to lack of experience and skill with problem solving. These pages provide feedback strategies for Algebra 1 sample questions available on the Test Development web site. Feedback from formative assessment, using the **Sample Items** and the **Problem Solving Strategy,** can be a great help to student learning.

Descriptive feedback is an important part of formative assessment and it contrasts with the right/wrong feedback that grading often provides. Descriptive feedback is especially useful for development of higher level thinking, which is needed for mathematics problem solving.

Problem solving. Students who are experienced at using problem solving strategies will be more successful on the Algebra 1 End-of-Course Test and on subsequent standardized mathematics tests such as the SAT or ACT. To provide a framework for descriptive feedback, please use the one page **Problem Solving Strategy**

Accessing sample Algebra 1 Sample Questions. The examples below show suggestions linked to the Extended Set of Sample Items for Algebra 1 on the Test Development web pages: http://www.ncpublicschools.org/accountability/testing/eoc/algebra1/alg1scs2003extset

First Step: Introduction

1) Introduce students to the one page sheet: "Problem Solving Strategy." Go over the bulleted items. Point out that these are tools and tactics which are important for math success . One doesn't use all of the items for each problem. Nor do good problem solvers need to use the items in sequence.

2) Explain that the target is to become competent problem solvers who can successfully make and execute a plan to solve both easy and complex math problems. Tell students that they will practice using many tools, including drawing a figure, making a table, solving a simpler problem, and checking the answer for reasonableness. Remind them that making a drawing, sketch, or graph is one of the most useful skills for test taking to understand each problem and to avoid unreasonable answers.

3) Work through a problem (suggestion: Goal 4, Number 1) as a class exercise. The purpose of this exercise is for students to learn how to apply tools from the problem solving strategy sheet in a specific situation. As an example, discussion points for Goal 4, Number 1 are on the attached page.

4) Tell students that they will give and receive descriptive feedback as they go through sample test questions. Explain that the primary purpose is to learn from their successes and mistakes how to be great problem solvers.

Second Step: First Assignments and Non-Graded Assessment

5) Assign one or a few of the sample problems. Tell students that it is fine to go slowly until they get comfortable using the tools and tactics. Explain that for the assignment they should have something for each of the four major steps, using as an example the work from Goal 4, Number 1.

6) Collect and review the student efforts. There is no need to grade other than to note whether students made an effort and understood the instructions. After you return the assignment, model giving descriptive feedback, based on what you saw as common positive approaches and common errors. The feedback should be linked to specific items on the sheet: Problem Solving Strategy.

Third Step: Working through the Sample Questions

7) Peer assessment should be used as students are assigned regular sets of sample items, perhaps weekly. Students acquire more ownership of their learning when they can assess others' work and their own. Assessment is used to provide descriptive feedback on problem solving strategies, but grades are not given. (Even though students do not get graded for correct or incorrect on these activities, they need to know that effort here will have a big impact on their performance on teacher tests and standardized tests.) From time to time, teachers collect, review, and provide feedback in class discussion on the comments students have made on each others' problems.

8) Self assessment. After students become better with peer assessment, introduce them to self assessment. A different mixture of self- peer- and teacher assessment will suit each class and teacher.

Graded work.

9) On your own regular tests, be sure to include some questions which demand problem solving skills. When reviewing results with the class, point out common errors and how those errors link to points in the Problem Solving Strategies. Also, point out examples of success using problem solving. Help students make the connection between their improvement through non-graded feedback and their success on graded tests, particularly as preparation for the End-of-Course Test.

References

A.H. Schoenfeld, *Status of Research on Teaching Problem Solving*, Mathematics Education, 5 June 2007.

P.Black and D. Wiliam, *Assessment and Classroom Learning*, Assessment in Education, Vol.5, No.1, 1998.

Class Exercise

Algebra I, Goal 4, Problem 1. (from Extended Sample Set)

This is an example of applying the points from the problem solving strategy.

Denisha bought a car for $15,000 and its value depreciated linearly. After 3 years the value was $11,250. What is the amount of yearly depreciation?
A) $2,000 B) $1,500 C) $1,250 D) $750

Step 1. Understand the problem.

What are we looking for? **The Amount of Yearly depreciation**.
What does "yearly depreciation" mean? **The amount that the value of the car decreases each year.**
What are the requirements or conditions? **The car's value depreciated linearly.**
What does "depreciated linearly" mean? **The graph of the value of the car versus number of years after purchase will be a straight line.**

Make a rough sketch of the graph.
The x-axis would have the years 0 through 3 and the y-axis would be scaled from 0 through 15,000. Put in the points (0, 15000) and (3, 11,250). Connect the points with a straight line.

Make a table.

Years after purchase	Value of Car	Yearly Depreciation
0	$15,000	
1		Unknown
2		Unknown
3	$11,250	Unknown

Use the table to help understand the problem by using a simple guess for the amount of yearly depreciation, say $1,000.
If the yearly depreciation is $1,000, what is the value of the car after 1 year? **$14,000**. After 2 years? **$13,000**. After 3 years? **$12,000**.
Is the answer that we need for yearly depreciation bigger or smaller than $1,000 and why? **Bigger, because we must get to a value lower than $12,000 after 3 years.** Does that rule out any answer choices? **Yes, it rules out choice D, $750, because that is even lower than $1,000.**

Step 2. Make a Plan.

First subtract the value after 3 years from the original value to obtain the depreciation in 3 years.
Then divide the total depreciation by 3 to get the depreciation per year.

Step 3. Execute the Plan

First, 15,000 minus 11,250 equals 3,750
Then 3,750 divided by 3 equals 1,250.
That is answer choice C.

Step 4. Look Back

Did we answer the question that was asked? **Yes**

Was more than one question asked? **No**

Is the answer reasonable? **Yes, because, from our work in Step 1, we know that the yearly depreciation must be more than $1,000. (We might try $2,000 also to find an upper limit.)**

Is there an easier (or another) way to solve the problem? **We could find the equation of the line in the graph we sketched in Step 1.**

So …. $y = mx + b$, where y is the value of the car after x years.

How do we interpret the constants in the equation of the line?

"b" is the value of y when x is zero, 15,000

"m" is the change in y per unit change in x, 1,250