

Definition Set C

Definition I

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Problem Solving

Problem solving means engaging in a task for which the solution method is not known in advance. In order to find a solution, students must draw on their knowledge, and through this process, they will often develop new mathematical understandings. Solving problems is not only a goal of learning mathematics but also a major means of doing so. Students should have frequent opportunities to formulate, grapple with, and solve complex problems that require a significant amount of effort and should then be encouraged to reflect on their thinking.

By learning problem solving in mathematics, students should acquire ways of thinking, habits of persistence and curiosity, and confidence in unfamiliar situations that will serve them well outside the mathematics classroom. In everyday life and in the workplace, being a good problem solver can lead to great advantages.

Problem solving is an integral part of all mathematics learning, and so it should not be an isolated part of the mathematics program. Problem solving in mathematics should involve all the five content areas described in these Standards. The contexts of the problems can vary from familiar experiences involving students' lives or the school day to applications involving the sciences or the world of work. Good problems will integrate multiple topics and will involve significant mathematics.

Definition II

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Problem Solving Standard for Grades 6 – 8

Through problem solving, students can experience the power and utility of mathematics. Problem solving is central to inquiry and application and should be interwoven throughout the mathematics curriculum to provide a context for learning and applying mathematical ideas. Middle-grades students whose curriculum is based on the Standards in this document will benefit from frequent opportunities for both independent and collaborative problem-solving experiences. They will engage profitably in complex

investigations, perhaps occasionally working for several days on a single problem and its extensions.

Problem solving in grades 6-8 should promote mathematical learning. Students can learn about, and deepen their understanding of, mathematical concepts by working through carefully selected problems that allow applications of mathematics to other contexts. Many interesting problems can be suggested by everyday experiences, such as reading literature or using cellular telephones, in-line skates, kites, and paper airplanes.

Instruction in grades 6-8 should take advantage of the expanding mathematical capabilities of students to include more-complex problems that integrate such topics as probability, statistics, geometry, and rational numbers. Situations and approaches should build on and extend the mathematical understanding, skills, and language that students have acquired.

Definition VII

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What is a problem?

All of us have problems of various types. Typical problems in our daily lives include: trying to figure out a way to pay the orthodontist's bill; finding that you not only have a flat tire but also a flat spare; forgetting the name of an acquaintance you are about to introduce to a friend. So, we all know when we have problems. However, the situation is complicated by the fact that what is a problem for one person may not be a problem for someone else. Consequently, it isn't always easy to recognize when a task will be a problem for students. The following definition provides some guidelines for deciding whether a task really is a problem for students.

DEFINITION: A *problem* is a task for which:

1. The person confronting it *wants or needs to find a solution*.
2. The person has *no readily available procedure* for finding the solution.
3. The person must *make an attempt* to find a solution.

This definition emphasizes three crucial components of a problem: (a) a desire or need on the part of the problem solver to attain a goal, (b) the fact that the goal cannot be reached directly or immediately, and (c) the fact that a conscious effort is made to reach the goal. These three components have special implications for mathematics instruction.

The first component requires that teachers present the problems they want their students to solve in a way that is sufficiently attractive so that the students *want* to solve them. It does no good to pose the cleverest problems if the students are not interested in attempting to solve them. The second component requires initial failure in the sense that direct recall of facts or the application of an algorithm does not give the student a method

for solving the problem. (The exercise 9842/27 is *not* a problem for a person with a calculator or one who knows how to perform a division algorithm.) The third component requires an attempt at a solution.

Teachers must know a lot about their students to coordinate a real problem-solving situation. Students must not be able to get the solution immediately, but the solution must be within grasp. Too often students believe that if a task cannot be done quickly and with little difficulty, it cannot be done at all. Nothing could be further from the truth! Teachers who intend to make problem solving a real part of their instruction must pay heed to the unique relationship that exists between the task and the individual or the group. They must remember that what is a problem for one person may not be a problem for another because of differences in knowledge, experience, ability, interest, or other factors.

Definition VIII

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What Is Problem Solving?

Problem solving has been defined as what to do when you don't know what to do. In previous math classes, you have often had specific examples to follow on most exercises. An *exercise* essentially asks you to repeat back a method you have learned on a similar example. A *problem* is much more difficult, as you don't usually have a preconceived notion as to how to solve it.