

Building a Strong Mathematical Mind – Strand 3: Problem Solving

## The Secret to Math Problem Solving

“Problem Solving” Oh, those words! So many people shy away from me when I suggest that they do some math problems. Others are encouraged that there is a program that actually incorporates proper, intense problem solving, but are afraid of tackling the problems themselves. What makes them so uncomfortable?

Problem solving in math is not just putting words to a basic math question. A good math problem will test the conceptual understanding of an idea or topic, or encourage a student to think outside the box and read carefully.

Here are some examples of questions that challenge students to think differently.

**Question #1:** Grade 1

*Below are two shapes. One of them is not a rectangle; what is the other one?*



*Common wrong answer: circle. Correct answer: rectangle.*

A large part of being able to do math problems is in the language. One must determine what the question is asking, then to logically organize the material to create a strategy to answer the question. This “other one” question does just that. Students, (and many of their parents), will want to automatically say the other one is the circle, without thinking about the problem. Students are given a chance to come up with a strategy to solve this, and

most of them realize fairly quickly that if you point to the shape that is not the rectangle, (the circle), then the other one is a rectangle.

**Question #2:** Grade 3

*Brian Bunny is reading a book called How to Grow Your Own Carrots. If he starts reading at the top of page 8 and he reads to the bottom of page 20, how many pages will he have read in all?*

*Common wrong answer:  $20 - 8 = 12$ . Correct answer:  $20 - 7 = 13$ .*

The key to this question is what is not stated in the question. What was missing in the question, but implied, is the number of pages **not** read. If Brian read all 20 pages, except the first 7, then he read 13 pages. In many cases, it is not what is written in the question, but rather that information which is not written that is the key to the question. Good problem solvers are able to see this. You want your child to look for a complete picture of the problem, and not just to always look for a solution that includes only that information given in the question.

**Question #3:** Grade 7

*How many numbers are there in the following arithmetic series?  $8 + 9 + 10 + \dots + 19 + 20$*

Notice the similarity to question #2. Instead of pages in a book (a concrete concept), this question has numbers. Again, the answer is (20 numbers) – (7 numbers that are not in the series) = 13. This uses the same concept as in question #2, but it just looks different.

**Question #4:** Grade 4

*It takes 30 seconds for a clock to strike 6 o'clock. How long does it take the same clock to strike 11 o'clock? (Assume the strikes are instantaneous)*

*Common wrong answer: 55 seconds. Correct answer: 60 seconds.*

Again, we want students to think about what is really happening. If the strikes are instantaneous, then the time period, or interval, between each strike is what is important. If there are 6 strikes, then there will be 5 intervals. The complete time for the intervals is 30 seconds. Each interval therefore takes  $30 \div 5 = 6$  seconds. When the clock strikes 11 o'clock, there are 10 intervals, each taking 6 seconds, for a total of 60 seconds. There are several processes that have to happen in a student's mind to come up with this answer. Often we

encourage students to draw out a picture illustrating what is happening so that there is a proper understanding.

One last note: Stay away from introducing algebra until students learn how to think divergently with these types of problems! Many parents have come to me, very proudly announcing that their child has learned algebra at a very young age. I strongly urge you to be careful: once students learn the linear thinking required for algebra, it is very difficult to get them to think divergently. Algebra is relatively easy to learn, compared to the thinking required for problem solving.

In every grade in Spirit of Math there are at least 400 problems that students must answer each year. The problems are presented to students as the Problem of the Day (POW) for the younger students, and progress to larger assignments. These assignments provide for research and experimentation with numbers, but are largely aimed at developing both problem solving and relationship skills. In various ways, students are encouraged to share their insights and understandings without just giving away answers.

For more information regarding a Spirit of Math after-school school campus near to you, please visit <https://spiritofmath.com>.

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