Problem Solving Exercises

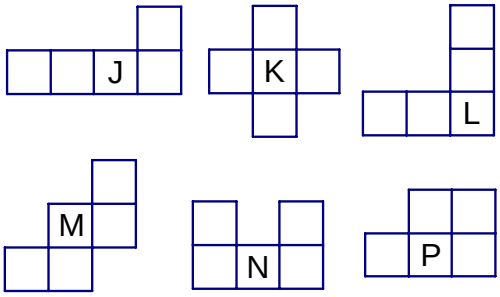
Describe at least one situation that does not have one right answer. Your discussion should include all the potentially correct responses. For example, what route do you travel to get to school? Many paths will lead to the same conclusion!

You are giving a party. You are not a guest.

First doorbell ring brings one guest.
Second doorbell ring brings 3 new guests.
Third doorbell ring brings 5 new guests.
Etc. Each new doorbell ring brings 2 more new guests than last one.

How many guests enter on the 20th ring?
What is the grand total number of guests after the 20th ring?
Are generalizations possible?

List at least five questions a student could generate using these shapes.

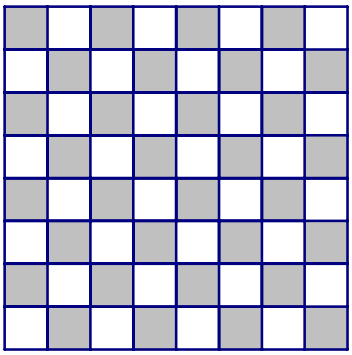


Use another geometric shape to develop questions along the line of thinking developed with the example of five congruent squares.

Describe how nine blocks, where eight are known to weigh the same and one is heavy, require two weighings to identify the heavyweight. Can this be done more than one way?

The Tower monk story makes a wonderful mathematics problem. Use a set of six disks and do the puzzle in 63 moves. Then try to do the puzzle in 63 or fewer seconds. How did you do?

How many squares are on a checkerboard?



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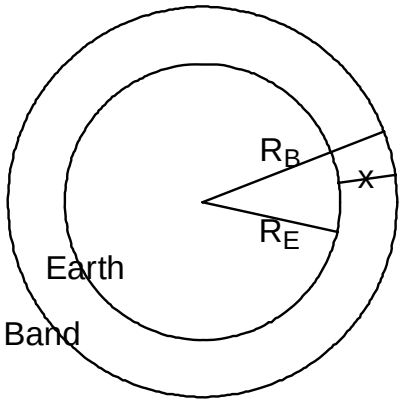
Suppose the earth is a sphere and the circumference at the equator is 25,000 miles. A band is placed around the earth, concentric with the equator. The circumference of the band is 25,000 miles + 10 feet. A standard sheet of 8.5 - by 11-inch notebook paper is about 0.003 inches thick. Would that paper fit between the band and the equator in any of its three configurations (thickness, width, length)? What is the thickest thing that could fit between the band and the equator?



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A mile-long, horizontal bridge is built with no expansion joints. Neither end will move. The bridge expands to a length of 1 mile + 2 feet due to temperature changes. The expansion causes the bridge to bow up in the middle. What is the distance between the center of the bridge in its normal and in its expanded state? The value of this question is suspect because, in the real world, bridge design must allow for expansion and contraction. However, the answer is so surprising that it is worthy of consideration.

A school has a hall with 1,000 lockers, all of which are closed. A thousand students start down the hall. The first student opens every locker. The second student closes all lockers that are multiples of two. The third student changes (closes an open locker or opens a closed one) all multiples of three. The fourth student changes all multiples of four. And so on. After all students have entered the school, how many lockers are closed and which ones?

Folklore describes a young man and a king's daughter. They were very much in love and wanted to marry. The king did not want the wedding to occur because the young man was not of the appropriate breeding, and besides, the young man did not possess the wealth to provide the lifestyle to which the girl had become accustomed. The young man was a clever fellow and offered the king an opportunity that was too good to pass up. The boy offered to go away if the king would be willing to give him some grain. The king would place one kernel of grain on a square of a checkerboard. The second square would contain two kernels of grain, the third four, and so on, until all 64 unit squares on the checkerboard were used. The total of the kernels of grain would be the young man's wealth and with it, he would leave, unless the king deemed otherwise. The king accepted the challenge. Do you think the young man married the king's daughter?

A sheet of paper is folded in half, and then in half again, and again, and so on, until a total of 50 folds is made. The question is, "How high is the stack of paper?" The assumption here is that the 50 folds can be made.
Typical paper is 0.003 inches thick.

What is the largest number you can write using only three digits? The digits may be repeated.

A customer enters a 7-11 convenience store and selects four items. The clerk informs the customer that the total cost of the four items is $7.11 (excluding tax). The customer was amazed that the cost of the items was the same as the store name. The clerk informed the customer that the price of each item was multiplied to arrive at the total. The customer calmly informed the clerk that the prices should be added, not multiplied. The clerk obliged and the sum was $7.11 for the same four items. What was the exact cost of each item (no rounding is necessary to obtain the exact values)?

How many different routes can be taken to go from the bottom left corner of a checkerboard to the upper right corner when you may move only up or to the right along the existing segments between the squares?

Your job is to write numerals on pages in a book. You are paid by the number of digits you write. You wrote 642 digits. How many pages did you number?

Resources

Brumbaugh, D. K., Ortiz, E., Gresham, G. (2006). *Teaching Middle School Mathematics*. Mahwah, NJ: Lawrence Erlbaum Associates.

Brumbaugh, D., Rock, D. (2001). *Scratch Your Brain C1*. Pacific Grove, CA: Critical Thinking Books and Software.