



Grade 6 Math Circles

February 15, 2012

Math Puzzles

Problem Solving Tips

- 1) Read and re-read the question.
- 2) Highlight or underline the important information.
- 3) Draw a picture, table, or graph to help visualize the problem.
- 4) Write out what you know.

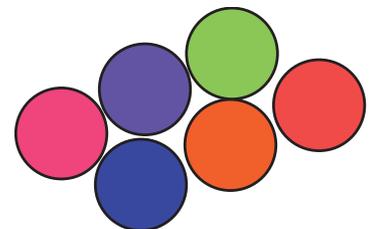
Logic Puzzles

A logic puzzle is a type of mathematical problem that uses reasoning to determine the answer.

Example:

Lindsey is making a necklace out of a variety of different coloured glass beads. She has six beads in total: one red, one blue, one purple, one pink, one green, and one orange. Determine the order that the beads are placed onto the string by using the following clues:

- 1) The first bead is not purple.
- 2) The last bead is orange.
- 3) The red bead is used before the blue bead with exactly one bead in between.
- 4) The third bead is neither red nor blue.
- 5) There is at least one bead in between the purple bead and the orange bead.
- 6) The green bead is used first.



Strategy:

- 1) Draw a table with the colour and placement possibilities.
- 2) Use the clues to eliminate possibilities by marking an X in the table. Use a \checkmark to mark the correct position of each bead in the table.

Solution:

- First we should start by drawing a table that shows all the possible positions for each colour of bead.

		Bead Placement					
		1	2	3	4	5	6
Bead Colour	Red						
	Blue						
	Purple						
	Pink						
	Green						
	Orange						

- From the first clue, we can place an X in the box that represents purple being the first bead.
- The second clue tells us that the last bead is orange. This means that we can mark that square with a \checkmark and the rest of the boxes in the 6th bead placement column with an X (since no two beads can be placed on the string at the same time).

		Bead Placement					
		1	2	3	4	5	6
Bead Colour	Red						\times
	Blue						\times
	Purple						\times
	Pink						\times
	Green						\times
	Orange	\times	\times	\times	\times	\times	\checkmark

- From the third clue we have three possibilities for the placement of the red bead and the blue bead. Either the red bead will be placed first and the blue bead third, or the red bead will be placed second and the blue bead fourth, or the red bead will be placed third and the blue bead fifth.
- Since the third bead is neither red nor blue, that narrows down the three possibilities that we had after reading the third clue, leaving us with just one possibility. The red bead must be placed second and the blue bead placed fourth.

		Bead Placement					
		1	2	3	4	5	6
Bead Colour	Red	✗	✓	✗	✗	✗	✗
	Blue	✗	✗	✗	✓	✗	✗
	Purple		✗		✗		✗
	Pink		✗		✗		✗
	Green		✗		✗		✗
	Orange	✗	✗	✗	✗	✗	✓

- The fifth clue gives us two possibilities for the placement of the purple bead. Since there is atleast one bead in between the purple bead and the orange bead, this means that the placement of the purple bead is either first or third.
- This sixth clue tells us that the first bead is green. This allows us to narrow down the possibilities for the placement of the purple bead, determining that the purple bead will be placed third. Thus, this leaves the pink bead to be placed fifth.

		Bead Placement					
		1	2	3	4	5	6
Bead Colour	Red	✗	✓	✗	✗	✗	✗
	Blue	✗	✗	✗	✓	✗	✗
	Purple	✗	✗	✓	✗	✗	✗
	Pink	✗	✗	✗	✗	✓	✗
	Green	✓	✗	✗	✗	✗	✗
	Orange	✗	✗	✗	✗	✗	✓

Therefore, the order that the beads are placed onto the string is: green, red, purple, blue, pink, orange.

Exercises:

1) Wendy was on a train from Toronto to Calgary when she spotted a sign saying how many kilometers until the train reached their destination. Unfortunately, she couldn't quite read the number. She does remember that it was a 4-digit number and that:

- a) There was a 1 in the number.
- b) The number in the one's digit was 6 times larger than the number in the ten's digit.
- c) The number in the hundred's digit was 3.
- d) The number in the thousand's digit was $\frac{1}{3}$ the number in the one's place.

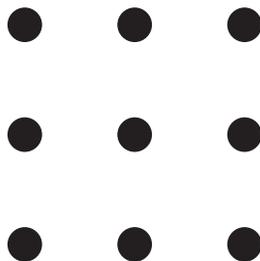
2) Harry, Ron, Hermione, and Ginny are trying to fly from Hogwarts castle to the Weasley's house but they only have one broom. The broom can only hold one of Harry and Ron or both (or one) of Hermione and Ginny. What is the minimum number of trips between Hogwarts and the Weasley's house needed to move all four people from Hogwarts to the Weasley's house?

3) Three friends James, Scott, and Harris each ate a different dessert. One ate cookies, one ate cake, and the other ate pie. The one who ate the cake always lies, the one who ate the cookies always tells the truth, and the one who ate the pie can either lie or tell the truth. Determine who ate which dessert based on these clues:

- a) James says "Harris ate the cake"
- b) Scott says: "James ate the cookies."
- c) Harris says: "I ate the pie"

4) Sally needs 5 cups of water for her recipe. She only has one measuring cup that holds 7 cups and one that holds 4 cups. Neither of the measuring cups has any other markings on the side. How can she measure 5 cups?

5) Determine how to connect 9 dots placed in three straight rows of three dots using four straight lines and without lifting the pencil off the page.



Magic Squares:

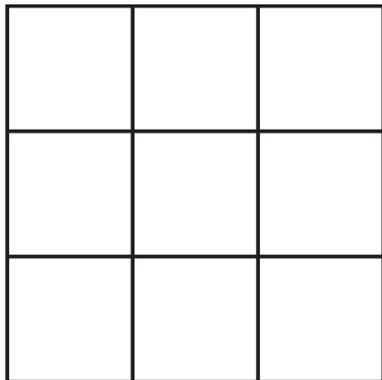
A magic square is a mathematical puzzle such that the entries in each row, column, and main diagonal add up to the same value or "magic number."

Strategies:

- 1) Write out the ways to sum up to the magic number.
- 2) Look for the numbers that appear most often. These numbers will most likely be somewhere near the middle of the square where they are used in multiple sums.
- 3) Use the numbers already in the magic square (if any) and the magic number to find possibilities for the missing numbers.

Example:

- 1) Place the numbers 1 to 9 in the squares such that each vertical, horizontal, and main diagonal add up to 15.



Step 1: Write out all the ways to use three numbers from 1 to 9 to add up to 15.

$$1 + 9 + 5 = 15$$

$$2 + 8 + 5 = 15$$

$$3 + 7 + 5 = 15$$

$$4 + 6 + 5 = 15$$

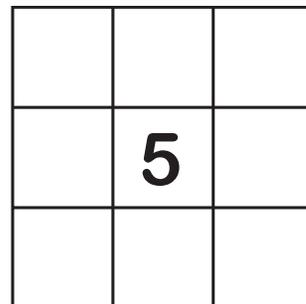
$$2 + 9 + 4 = 15$$

$$2 + 7 + 6 = 15$$

$$3 + 4 + 8 = 15$$

$$1 + 6 + 8 = 15$$

Step 2: Looking at the equations from step 1, we notice that the number 5 appears four times (the most appearances of any number). This means that the number 5 is involved in four row, column, or diagonal summations. In the 3x3 magic square, this is only possible if the number 5 is in the center square.



2		4
	5	
6		8

Step 3: Looking again at the equations from step 1, we notice that the numbers 2,4,6, and 8 appear three times in the equations (the second most number of appearances). In the 3x3 magic square, this is only possible if the numbers 2,4,6, and 8 are in the corners of the magic square.

Step 4: The last step is to use the equations and the numbers already in the square to determine the locations of the remaining numbers by process of elimination.

2	9	4
7	5	3
6	1	8

Sudoku:

A Sudoku puzzle is a logic puzzle made up of a 9 x 9 grid which has been divided into 9 larger boxes. The objective of a Sudoku puzzle is to place the numbers 1 to 9 in the grid so that each column, row, and larger box contains all of the numbers 1 to 9 without having any duplicates.

Strategies:

- 1) Use the numbers that are already in the puzzle to cross reference the rows, columns and larger boxes.
- 2) Use process of elimination to help you determine where the numbers go.

Example:

Sudoku 9x9 - Medium (136526672)

	8		5		4		2	
	9	7				5	3	
3								1
		1	2	8	7	4		
		9	3	1	5	6		
6								7
	1	2				9	8	
	5		7		1		4	

www.sudoku-puzzles.net

Exercises:

- 1) Solve the following 4x4 magic square by entering the remaining numbers from 1 to 16 such that each row, column, and main diagonal sums to 34.

1	4		15
	16		
12		7	
	5	11	

2) Solve the following 5x5 magic square by entering the remaining numbers from 1 to 25 such that each row, column, and main diagonal sums to 65.

17			8	15
	5	7		
4		13	20	22
10	12			3
11		25		9

3) Use the numbers 5, 6, 7, 8, 9, 10, 11, 12, 13 to complete the Magic Square. What is the magic number?

4) Use the numbers 10, 11, 12, 13, 14, 15, 16, 17, 18 to complete the Magic Square. What is the magic number?

5) Solve each of the following Sudoku puzzles:

Sudoku 9x9 - Hard (131280151)

		6				3		
		8	2		1	5		
1				8				6
	8	4	7		6	2	1	
	7	3	5		2	8	9	
8				5				2
		5	8		7	1		
		7				9		

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Sudoku 9x9 - Very hard (132006347)

6		9		8	4			1
	4		9					8
	7		2				4	
7							6	
		5	4		3	1		
	1							3
	8				9		2	
9					2		7	
3			6	5		9		

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6) A Samurai Sudoku puzzle is made up of 5 individual Sudoku puzzles with one of the Sudoku puzzles overlapping one large box of the other four Sudoku puzzles. Solve the following Samurai Sudoku puzzle.

Samurai - Medium (162569122)

8			9			6			5		1	7					
				1	8							3			4		
1	9				6				9	7			8			3	
		2												6			
	6					2	9									2	1
		5								9		1	4	5			
		3					1	9		8					9		4
				5		3			5				8			3	
			6		4			5	3			1					8
							9	7			2						
								8					7	4			
											1						
5	3		2							3				8			
	8			9													
	4									5					9		2
			3	8												1	4
			9			6	8				6			3			7
		3			1												2
		1	6				5				4	5	6		7		
			1	2				4				9				6	
		5															
											3			2	8		9