



Grade 7/8 Math Circles

Winter 2018 - March 27/28/29

Word Problems

Warm-up: The River Crossing Game

A family consisting of a mom, a dad, two boys and two girls, a policeman and a thief are on one side of a river and have only one boat to cross the river. Your goal is to help all 8 people cross the river safely while following these constraints:

1. The boat can carry no more than 2 people.
2. Only the parents or the policeman can drive the boat.
3. The dad can not be with the girls without the mom being there.
4. The mom can not be with the boys without the dad being there.
5. The thief can not be alone with any of the family members without the policeman being there.

Is it possible? If so, how many crossings will it take?



Retrieved from: <https://play.google.com/store/apps/details?id=zl.puzzle.riveriq>

Today we are going to work on word problems. These problems can often be solved in different ways. They will test your logic skills!

Tips and Tricks

To solve word problems, here is a step-by-step process you may find helpful for some scenarios, especially when you want to solve your equation algebraically!

1. Represent the unknown quantity with a variable.
2. Use the information given in the problem to set up an equation with the variable.
3. Solve the equation.
4. Write a conclusion.

Off to the races!



You have 25 horses and a track that can race 5 horses at once.

You are given no stopwatch and asked to find the 3 fastest horses.

You can assume that all the horses travel at different speeds and each horse travels at the same speed each race.

What is the minimum number of races required to determine the 3 fastest horses?

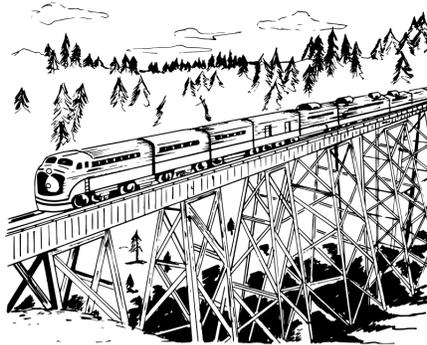
Watch out for that train!

A man is three eighths of the way across a bridge when he hears a train coming from behind. If he runs as fast as possible back toward the train, he will get off the bridge just in time to avoid a collision.

Also, if he runs as fast as possible away from the train, he will get off the bridge (on the other side) just in time to avoid a collision.

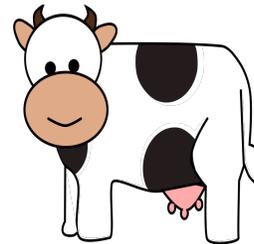
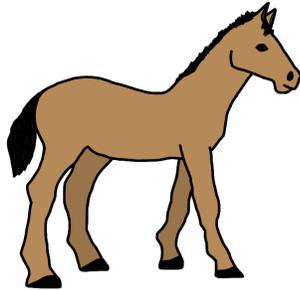
The train is traveling at 40 kilometres per hour.

How fast does the man run?



Cow Many?

(CTMC 2016 Team problem number 20)



A group of cows and horses are randomly divided into two equal rows. (The animals are well-trained and stand very still.) Each animal in one row is directly opposite an animal in the other row. If 75 of the animals are horses and the number of cows opposite cows is 10 more than the number of horses opposite horses, determine the total number of animals in the group.

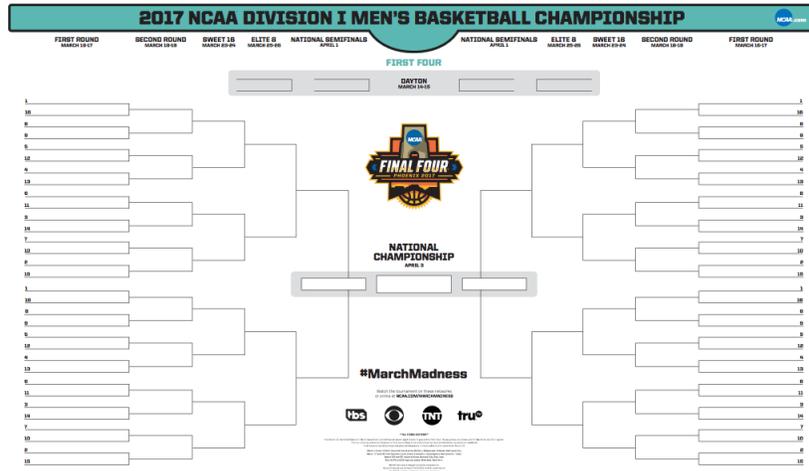
The Birthday Problem

In a group of 23 students, what is the probability that at least two people share the same birthday?

March Madness!

Assuming there are 64 teams playing in the NCAA Basketball March Madness tournament and each team is equally likely to win any game (this part isn't true but otherwise the question will be much too hard!), what is the probability of filling out a perfect bracket?

A perfect bracket means that you guess the winner of all games correctly.



Retrieved from: <http://www.nbcports.com/washington/ncaa/ncaa-tournament-2017-printable-march-madness-bracket>

Swimming in Logic!

What stroke is being practiced by which swimmer from which country in which lane?

		Styles				Lanes				Countries			
		Backstroke	Butterfly	Dolphin	Freestyle	#1	#2	#3	#4	Australia	Canada	UK	USA
Names	Betty												
	Carol												
	Daisy												
	Emily												
Countries	Australia												
	Canada												
	UK												
	USA												
Lanes	#1												
	#2												
	#3												
	#4												

Clues

Answer

- Betty is swimming next to the athlete from the UK. Neither of them is swimming Butterfly.
- Among Emily and the Backstroker, one is from the UK and the other is in the fourth lane.
- Carol is not swimming Backstroke nor Dolphin. She is not Australian, and she is not swimming in lanes #2 nor #4.
- The Freestyler is next to both Daisy and the American swimmer.
- The American swimmer is next to Carol.
- Daisy is not swimming in lane #2.

Retrieved from: <https://www.brainzilla.com/logic/logic-grid/swimming-pool/>

The Monty Hall Problem

You are a contestant on a game show where the prize is a new car.

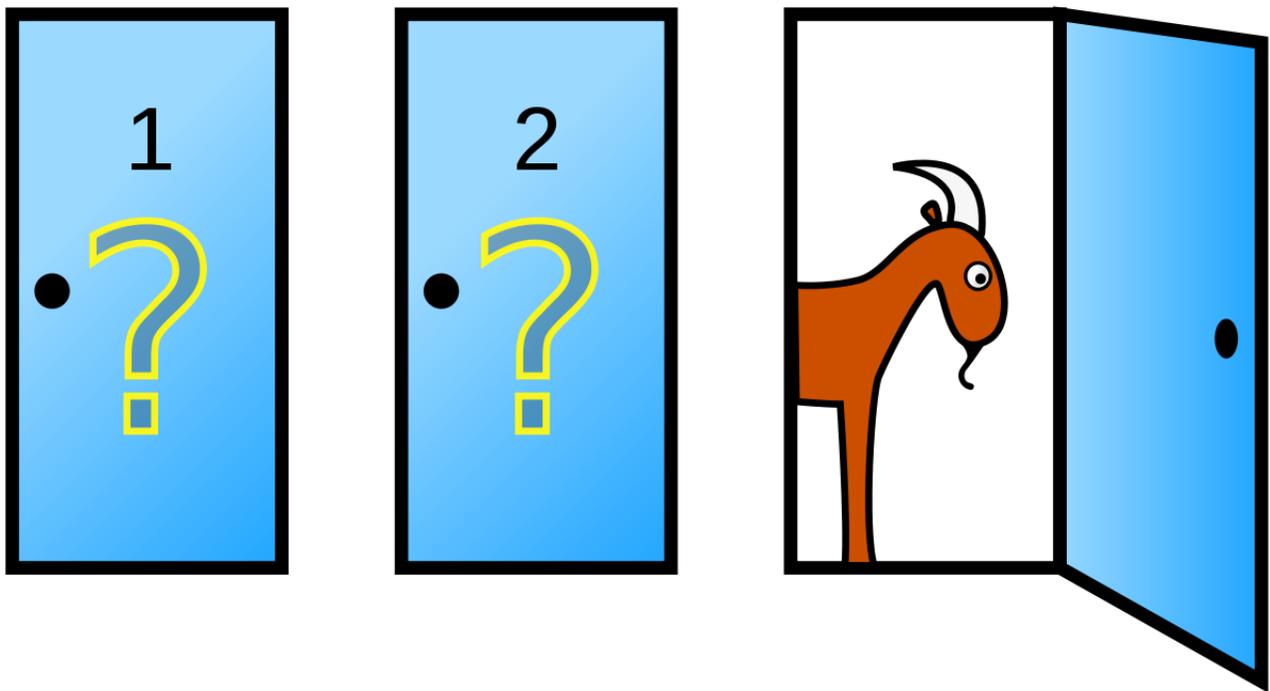
There are 3 doors. Behind two doors, there is a goat. Behind one door, there is a car.

You pick Door 1 but don't get to see what's behind any of the doors yet.

The host opens Door 3. There is a goat in this door!

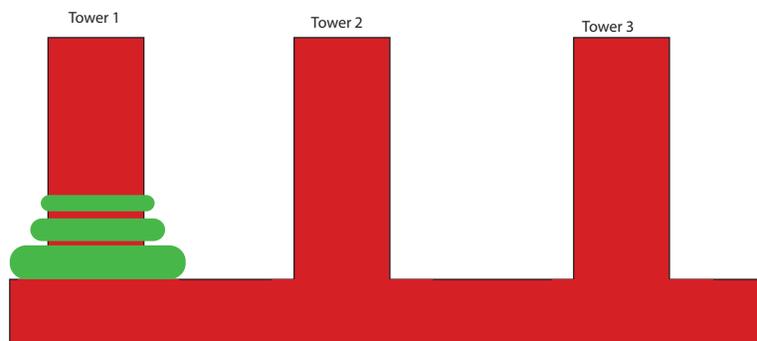
Now, the host asks you whether you want to stick with Door 1 or switch to Door 2.

Which door do you choose?



Problems

1. A large box of chocolates and a small box of chocolates together costs \$15. If the large box costs twice as much as the small box, what are the individual prices of the two boxes? (Gauss 2007).
2. The sum of three consecutive odd numbers is 57. What is the product of these three numbers? (Gauss 2014)
3. Four basketball teams from the Waterloo, Laurier, Queens and Toronto compete in the University March Madness Basketball Tournament. The tournament is single elimination with the first round match ups Waterloo vs. Laurier and Queens vs. Toronto. If someone was to randomly guess the winners for the entire tournament, what is the probability they would guess correctly?
4. In football, the player who kicks the ball is referred to as the punter. During a recent football game, the punter, Khan Kickit, kicked the ball five times. His longest kick was 44 yards and he averaged 35 yards per kick. Each of his kicks was a different positive integer length.
Determine the minimum possible length of Khan's shortest kick.
5. The Tower of Hanoi is a game with three towers, and a certain amount of rings. The object of the game is to move all of the rings from the first tower to the third tower in the same order (largest at the bottom to smallest at the top). The catch: You can only move one peg at a time, and a ring can never have a larger ring on top of it.



What is the minimum number of moves for 3 rings? 5 rings?

6. Three counters, labelled X, Y, and Z are placed in the positions shown on the board. Two players alternate turns. A turn consists of moving any one of the three counters any number of squares to the left, but the counter may not land on top of, or move past any of the other counters. The winner of the game is the player who makes the last legal move. What is the winning strategy? Is the player going first or the player going second guaranteed to win with this strategy?



7. A census taker approaches a woman leaning on her gate and asks about her children. She says, "I have three children and the product of their ages is thirty-six. The sum of their ages is the number on this gate." The census taker does some calculation and claims not to have enough information. The woman enters her house, but before slamming the door tells the census taker, "I have to see to my eldest child who is in bed with measles." The census taker departs, satisfied.

What are the ages of the three children?

8. Five sisters all have their birthday in a different month and each on a different day of the week. Using the clues below and the grid, determine the month and day of the week each sister's birthday falls.

1. Paula was born in March but not on Saturday. Abigail's birthday was not on Friday or Wednesday.
2. The girl whose birthday is on Monday was born earlier in the year than Brenda and Mary.
3. Tara wasn't born in February and her birthday was on the weekend.
4. Mary was not born in December nor was her birthday on a weekday. The girl whose birthday was in June was born on Sunday.
5. Tara was born before Brenda, whose birthday wasn't on Friday. Mary wasn't born in July.

(Source: puzzlersparadise.com)

	February	March	June	July	December	Sunday	Monday	Wednesday	Friday	Saturday
Abigail										
Brenda										
Mary										
Paula										
Tara										
Sunday										
Monday										
Wednesday										
Friday										
Saturday										

9. At Cornthwaite H.S., many students enroll in an after-school arts program. The program offers a drama class and a music class. Each student enrolled in the program is in one class or both classes. In 2014, a total of 80 students enrolled in the program. Let x represent the number of students in both classes. If there were five fewer than thrice x students in the drama class, and thirteen greater than six times x students in the music class, how many students were in both classes?

10. A ladybug wishes to travel from B to A on the surface of a wooden block with dimensions $2 \times 4 \times 8$ as shown in the diagram. Determine the shortest distance for the ladybug to walk.

