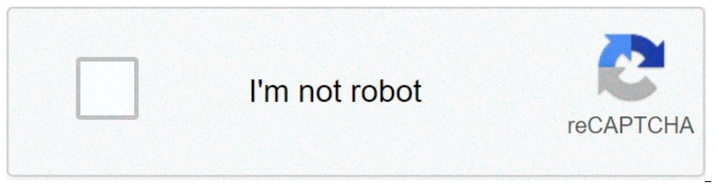

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Math logic problems with answers

arrow_back Back to Home I absolutely adore a good maths puzzle or a logic puzzle. This page is a collection of some of my favourites that I have complied over the years. Some you will know, but hopefully some you will not. Many come from the outstanding Numberplay Blog from the New York Times. The puzzles are not arranged by topic (as that might give away some of the secrets to solving them) or by age or difficulty, because that depends very much on the puzzle solver themselves. Please do not email me for any of the answers, as am afraid I do not have time to reply. Anyway, that would spoil the fun. But I guess for relatively large sums of money, I may be tempted to divulge some information. And if you have a favorite puzzle that you think would fit well into this collection, please let me know via Twitter Contents There are one hundred people standing in a circle. They count off beginning at one and ending at one hundred. Since they are in a circle, ONE is next to TWO and ONE HUNDRED. ONE has a sword and kills TWO. He passes the sword to THREE who kills FOUR. And so forth. NINETY-NINE kills ONE HUNDRED and passes the sword to ONE. Then ONE kills THREE and passes the sword to FIVE. This goes on until only one person is left standing. Which number is he? 2. The 4 Coins Problemkeyboard_arrow_up Back to Top You're creating a new coin system for your country. You must use only four coin values and you must be able to create the values 1 through 10 using one coin at a minimum and two coins maximum. What 4 coins do you choose, and can you think of a second set of 4 coins that achieves the same goal? 3. The Wedding Ringkeyboard_arrow_up Back to Top In certain parts of rural Russia, a would-be bride would gather six long pieces of straw or grass and grasp them in her hand. She then would randomly tie pairs of knots on the top and the bottom. Since there are six blades of grass sticking out above and below the hand, she will tie three knots on the top and three knots on the bottom. The story goes, that if she formed one big ring, she would get married soon. What is the probability that she will get married? 4. The Averages Problemkeyboard_arrow_up Back to Top Consider a list of all the ways you could take four distinct digits from 1 to 9 and arrange them to make the sum of two 2-digit numbers. Some numbers might appear several times: 134, for example, is 93 + 41, and also 91 + 43. What are the mean, median and mode of all the numbers on this list? (Mean is the sum of all the numbers divided by the number of numbers, median is the middle value in a sorted list of the numbers, and the mode is the number that appears most often.) 5. Avoiding the Trollkeyboard_arrow_up Back to Top Every day you make a trip from A to B, 2 miles away. But your trip is unpredictable. On 50% of the days, you can walk between A and B without any obstruction. The other 50% of the time, a troll appears at the halfway point, blocking your trip. The troll also activates an invisible barrier that blocks 1 mile perpendicularly in both directions, forcing you to walk around it to complete your trip. You cannot see the troll or the barrier until you are halfway from A to B, so you cannot plan in advance whether you need to walk around the barrier. You do know the troll appears randomly 50% of the time. If you can walk in straight lines to any points between A and B, what is your best strategy so you walk the least distance on average? What is that distance? Ali Baba found a cave full of gold and diamonds. A bag full of gold weighs 200 kilograms, a bag full of diamonds weighs 40 kilograms. Ali Baba can carry only 100 kilograms at a time. A kilogram of gold costs $20, and a kilogram of diamonds costs $60. What is the greatest amount of money Ali Baba can earn for the gold and diamonds he can carry out at once (in one attempt in one bag)? 7. Drinking Game Puzzlekeyboard_arrow_up Back to Top The game starts with 6 empty glasses in a row numbered 1 to 6. You roll a standard die. If the number for the glass is empty, then the glass is filled up. If the number for the glass is full, then you drink that glass so it becomes empty. There is a special rule when 5 glasses are full. If you roll the number for the lone empty glass, then the final glass gets filled and you have to drink all 6 glasses. At this point the game ends. From the start of the game, what is the average number of rolls until the game ends? 8. The Raja's Pearlskeyboard_arrow_up Back to Top A rajah, in his will, left his daughters a certain number of pearls with the instructions to divide them as follows: The oldest daughter was to receive 1 pearl plus 1/7 of what was left. The next eldest daughter was to receive 2 pearls plus 1/7 of those left. The next eldest daughter was to receive 3 pearls plus 1/7 of what was left, and so on in the same manner. The youngest daughter received what was left after all the other divisions. At first, the youngest daughter thought the distribution was unfair, but after careful calculations she concluded that all daughters would receive the same number of pearls. How many pearls and how many daughters were there in all? 9. The St Petersburg Lotterykeyboard_arrow_up Back to Top Suppose we play the following game. I toss a coin repeatedly until it comes up heads. If heads appears on the first throw, I pay you $2. If it appears on the second throw, I give you $4; if on the third, I pay $8 and so on, doubling each time. How much would you be willing to pay me to play this game? 10. Cheryl's Birthdaykeyboard_arrow_up Back to Top Albert and Bernard just became friends with Cheryl, and they want to know when her birthday is. Cheryl gives them a list of 10 possible dates. May 15 May 16 May 19 June 17 June 18 July 14. July 16 August 14. August 15. August 17 Cheryl then tells Bernard and Albert separately the month and the day of her birthday respectively. Albert: I don't know when Cheryl's birthday is, but I know that Bernard does not know too. Bernard: At first I don't know when Cheryl's birthday is, but I know now. Albert: Then I also know when Cheryl's birthday is. When is Cheryl's birthday? 2 mathematicians meet on the street and one says to the other, "I bet you can't guess the ages of my 3 children" (all integer ages). The 2nd mathematician says, "I'll take your bet but only if you give me enough information to solve it." The 1st agrees, and says, "The product of my 3 children's age is 36." "That is not enough information." "Right you are!" he looks around, spies an address on a building and says, "The sum of my children's age is the same as the address over there." Thinking a little bit; "That still isn't enough information." "Right you are again! My eldest son has red hair." After some thinking the 2nd mathematician won the bet. 12. Band around the earthkeyboard_arrow_up Back to Top Imagine there is a steel band around the equator of the Earth, nice and snug (~25,000 mi). If you then add one foot of steel to this band, how much is the band raised off the ground? High enough to slip a hair under it? Your hand? High enough to walk under it? 13. The School Lockerskeyboard_arrow_up Back to Top There is a school with 1,000 students and 1,000 lockers. On the first day of term the headteacher asks the first student to go along and open every single locker, he asks the second to go to every second locker and close it, the third to go to every third locker and close it if it is open or open it if it is closed, the fourth to go to the fourth locker and so on. The process is completed with the thousandth student. How many lockers are open at the end? 14. The Devil's Wagerkeyboard_arrow_up Back to Top You die and the devil says he'll let you go to heaven if you beat him in a game. He sits you down at a round table. He divides a large pile of quarters in two so you both have the same amount of quarters in your own pile. He says, "O.K., we'll take turns putting quarters down, no overlapping allowed, and the quarters must rest on the table surface. The first guy who can't put a quarter down loses. You cannot shift or try to squeeze any quarter into a space that moves another quarter." The devil says he wants to go first. You realize if the devil goes first, he probably has a strategy to win. You haven't had time to think this through yet, so you ask for some time to consider your options. He grants you 15 minutes. At that end of that time you know how to beat him … but you also know you must go first for your strategy to win. You convince him to let you go first, saying you really didn't have enough time to consider a strategy so you should at least go first. What is your winning strategy? 15. Half an Eggkeyboard_arrow_up Back to Top A peasant woman came to a market to sell some eggs. A first buyer took half her eggs plus 1/2 an egg. The same happened with the remaining eggs: a second buyer buyer took half her eggs plus 1/2 an egg. A third only bought what was left over: 1 egg. How many eggs were there initially? You can only use two maths symbols (including factorials and square roots) to make 6 0 0 0 = 6 1 1 1 = 6 2 2 2 = 6 3 3 3 = 6 4 4 4 = 6 5 5 5 = 6 6 6 6 = 6 7 7 7 = 6 8 8 8 = 6 9 9 9 = 6 17. Three Liars Tossing a Coinkeyboard_arrow_up Back to Top Three people each have a tendency to lie 1/3 of the time. There is a coin flip that they all see. They all say it's Heads. What's the probability it is actually Heads? 18. Free the Prisonerskeyboard_arrow_up Back to Top The warden meets with 23 new prisoners when they arrive. He tells them, "You may meet today and plan a strategy. But after today, you will be in isolated cells and will have no communication with one another. "In the prison is a switch room, which contains two light switches labeled 1 and 2, each of which can be in either up or the down position. I am not telling you their present positions. The switches are not connected to anything. "After today, from time to time whenever I feel so inclined, I will select one prisoner at random and escort him to the switch room. This prisoner will select one of the two switches and reverse its position. He must flip one switch when he visits the switch room, and may only flip one of the switches. Then he'll be led back to his cell. "No one else will be allowed to alter the switches until I lead the next prisoner into the switch room. I'm going to choose prisoners at random. I may choose the same guy three times in a row, or I may jump around and come back. I will not touch the switches, if I wanted you dead you would already be dead. "Given enough time, everyone will eventually visit the switch room the same number of times as everyone else. At any time, anyone may declare to me, 'We have all visited the switch room.' "If it is true, then you will all be set free. If it is false, and somebody has not yet visited the switch room, you will all die horribly. You will be carefully monitored, and any attempt to break any of these rules will result in instant death to all of you" What is the strategy they come up with so that they can be free? 19. Burning Ropes to Measure Timekeyboard_arrow_up Back to Top Warm-up: You are given a box of matches and a piece of rope. The rope burns at the rate of one rope per hour, but it may not burn uniformly. For example, if you light the rope at one end, it will take exactly 60 minutes before the entire rope has burnt up, but it may be that the first 1/10 of the rope takes 50 minutes to burn and that the remaining 9/10 of the rope takes only 10 minutes to burn. How can you measure a period of exactly 30 minutes? You can choose the starting time. More precisely, given the matches and the rope, you are to say the words "start" and "done" exactly 30 minutes apart. The actual problem: Given a box of matches and two such ropes, not necessarily identical, measure a period of 15 minutes. 20. Minimum Number of Aircraftkeyboard_arrow_up Back to Top On Bagshot Island, there is an airport. The airport is the homebase of an unlimited number of identical airplanes. Each airplane has a fuel capacity to allow it to fly exactly 1/2 way around the world, along a great circle. The planes have the ability to refuel in flight without loss of speed or spillage of fuel. Though the fuel is unlimited, the island is the only source of fuel. What is the fewest number of aircraft necessary to get one plane all the way around the world assuming that all of the aircraft must return safely to the airport? How did you get to your answer? Notes: (a) Each airplane must depart and return to the same airport, and that is the only airport they can land and refuel on ground. (b) Each airplane must have enough fuel to return to airport. (c) The time and fuel consumption of refueling can be ignored. (so we can also assume that one airplane can refuel more than one airplanes in air at the same time.) (d) The amount of fuel airplanes carrying can be zero as long as the other airplane is refueling these airplanes. What is the fewest number of airplanes and number of tanks of fuel needed to accomplish this work? (we only need airplane to go around the world) A wholesale merchant came to me one day and posed this problem. Every day in his business he has to weigh amounts from one pound to one hundred and twenty-one pounds, to the nearest pound. To do this, what is the minimum number of weights he needs and how heavy should each weight be? 22. Relatively Prime Betkeyboard_arrow_up Back to Top There is a box in which distinct numbered balls have been kept. You have to pick two balls randomly from the lot. If someone is offering you a 2 to 1 odds that the numbers will be relatively prime, for example If the balls you picked had the numbers 6 and 13, you lose $1. If the balls you picked had the numbers 5 and 25, you win $2. Will you accept that bet? 23. Crossing the Bridgekeyboard_arrow_up Back to Top Four people need to cross a rickety bridge at night. Unfortunately, they have only one torch and the bridge is too dangerous to cross without one. The bridge is only strong enough to support two people at a time. Not all people take the same time to cross the bridge. Times for each person: 1 min, 2 mins, 7 mins and 10 mins. What is the shortest time needed for all four of them to cross the bridge? 24. 25 Horses, 5 Trackskeyboard_arrow_up Back to Top Mr John has 25 horses, and he wants to pick the fastest 3 horses out of those 25. He has only 5 tracks, which means only 5 horses can run at a time. He doesn't even have a stop watch . What is the minimum number of races required to find the 3 fastest horses? 25. Flipping Coins Puzzlekeyboard_arrow_up Back to Top There are are twenty coins sitting on the table, ten are currently heads and tens are currently tails. You are sitting at the table with a blindfold and gloves on. You are able to feel where the coins are, but are unable to see or feel if they heads or tails. You must create two sets of coins. Each set must have the same number of heads and tails as the other group. You can only move or flip the coins, you are unable to determine their current state. How do you create two even groups of coins with the same number of heads and tails in each group? People are waiting in line to board a 100-seat airplane. Steve is the first person in the line. He gets on the plane but suddenly can't remember what his seat number is, so he picks a seat at random. After that, each person who gets on the plane sits in their assigned seat if it's available, otherwise they will choose an open seat at random to sit in. The flight is full and you are last in line. What is the probability that you get to sit in your assigned seat? 27. Proportion of Girls and Boyskeyboard_arrow_up Back to Top In a country where everyone wants a boy, each family continues having babies till they have a boy. After some time, what is the proportion of boys to girls in the country? (Assuming probability of having a boy or a girl is the same) 28. The Hats and the Monsterkeyboard_arrow_up Back to Top There is an island with 10 inhabitants. One day a monster comes and says that he intends to eat every one of them but will give them a chance to survive in the following way: In the morning, the monster will line up all the people - single file so that the last person sees the remaining 9, the next person sees the remaining 8, and so on until the first person that obviously sees no one in front of himself. The monster will then place black or white hats on their heads randomly (they can be all white, all black or any combination thereof). The monster will offer each person starting with the last one (who sees everyone else's hats) to guess the color of his/her own hat. The answer can only be one word: "white" or "black". The monster will eat all ten hostages as soon as a second captive answers incorrectly. All the remaining people will hear the guess but not the outcome of the guess. The monster will then go on to the next to last person (who only sees 8 people), and so on until the end. The monster gives them the whole night to think. The Task: Devise a strategy that guarentees all captive's survival. Assumptions: 1) All the 10 people can easily understand your strategy, and will execute it with perfect precision. 2) If the monster suspects that any of the people are giving away information to any of the remaining team members by intonation of words when answering, or any other signs, or by touch, he will eat everyone. 3) The only allowed response is a short, unemotional "white" or "black". 29. Eggs from a Buildingkeyboard_arrow_up Back to Top Suppose that there is a building with 100 floors. You are given 2 identical eggs. The most interesting property of the eggs is that every egg has it's own "threshold" floor. Let's call that floor N. What this means is that the egg will not break when dropped from any floor below floor N, but the egg will definitely break from any floor above floor N, including floor N itself. For example, if the property of the eggs is that N equals 15, those eggs will always break on any floor higher than or equal to the 15th floor, but those eggs will never break on any floor below floor 15. The same holds true for the other egg since they are identical. These are very strong eggs, because they can be dropped multiple times without breaking as long as they are dropped from floors below their "threshold" floor, floor N. But once an egg is dropped from a floor above it's threshold floor Here is the puzzle: What strategy should be taken in order to minimize the number of egg drops used to find floor N (the threshold floor) for the egg? Also, what is the minimum number of drops for the worst case using this strategy? Remember that you are given 2 identical eggs which both have the same exact threshold floor. 30. 5 Pirates, 100 Gold Coinskeyboard_arrow_up Back to Top Five ship's pirates have obtained 100 gold coins and have to divide up the loot. The pirates are all extremely intelligent, treacherous and selfish (especially the captain). The captain always proposes a distribution of the loot. All pirates vote on the proposal, and if half the crew or more go "Aye", the loot is divided as proposed, as no pirate would be willing to take on the captain without superior force on their side. If the captain fails to obtain support of at least half his crew (which includes himself), he faces a mutiny, and all pirates will turn against him and make him walk the plank. The pirates start over again with the next senior pirate as captain. What is the maximum number of coins the captain can keep without risking his life?