**The King’s Orders Make for One Hell of a Brain Teaser**

*(Difficulty: Easy)*

King Nupe of the kingdom Catan dotes on his two daughters so much that he decides the kingdom would be better off with more girls than boys, and he makes the following decree: All child-bearing couples must continue to bear children until they have a daughter!

But to avoid overpopulation, he makes an additional decree: All child-bearing couples will *stop* having children once they have a daughter! His subjects immediately begin following his orders.

After many years, what’s the expected ratio of girls to boys in Catan?

**Hint**

The likelihood of each baby born being a girl is, of course, 50 percent.

**How Many Eggs Does This Hen Lay?**

(Difficulty: Easy)

This problem is in honor of my dad, Harold Feiveson. It’s due to him that I love math puzzles, and this is one of the first problems (of many) that he gave me when I was growing up.

A hen and a half lays an egg and a half in a day and a half. How many eggs does one hen lay in one day?

**The Gold Chain Math Problem Is Deceptively Simple**

*(Difficulty: Moderate)*

You’re rummaging around your great grandmother’s attic when you find five short chains each made of four gold links. It occurs to you that if you combined them all into one big loop of 20 links, you’d have an incredible necklace. So you bring it into a jeweler, who tells you the cost of making the necklace will be $10 for each gold link that she has to break and then reseal.

**How much will it cost?**

**Try to Solve This Pickleball Puzzle**

*(Difficulty: 🚨HARD🚨)*

Kenny, Abby, and Ned got together for a round-robin pickleball tournament, where, as usual, the winner stays on after each game to play the person who sat out that game. At the end of their pickleball afternoon, Abby is exhausted, having played the last seven straight games. Kenny, who is less winded, tallies up the games played:

Kenny played **eight**games

Abby played **12**games

Ned played **14** games

**Who won the fourth game against whom?**

**Hint**

How many total games were played?

**Our Circuit Breaker Riddle Is Pure Evil. Sorry.**

*(Difficulty: 🚨HARD🚨)*

The circuit breaker box in your new house is in an inconvenient corner of your basement. To your chagrin, you discover none of the 100 circuit breakers is labeled, and you face the daunting prospect of matching each circuit breaker to its respective light. (Suppose each circuit breaker maps to only one light.)

To start with, you switch all 100 lights in the house to “on,” and then you head down to your basement to begin the onerous mapping process. On every trip to your basement, you can switch any number of circuit breakers on or off. You can then roam the hallways of your house to discover which lights are on and which are off.

**What is the minimum number of trips you need to make to the basement to map every circuit breaker to every light?**

**Hint**

The solution does*not*involve either switching on or off the light switches in your house or feeling how hot the lightbulbs are. You might want to try solving for the case of 10 unlabeled circuit breakers first.

**Two Trains. Two Grandmas. Can You Solve This Tricky Math Riddle?**

*(Difficulty: Moderate)*

Jesse’s two grandmothers want to see him every weekend, but they live on opposite sides of town. As a compromise, he tells them that every Sunday, he’ll head to the subway station nearest to his apartment at a random time of the day and will hop on the next train that arrives.

If it happens to be the train traveling north, he’ll visit his Grandma Erica uptown, and if it happens to be the train traveling south, he’ll visit his Grandma Cara downtown. Both of his grandmothers are okay with this plan, since they know both the northbound and southbound trains run every 20 minutes.

But after a few months of doing this, Grandma Cara complains that she sees him only one out of five Sundays. Jesse promises he’s indeed heading to the station at a random time each day. **How can this be?**

**Hint**

The trains always arrive at their scheduled times.

**Here's a Really Hard Math Problem About Ants**

*(Difficulty: 🚨HARD🚨)*

Max and Rose are ant siblings. They love to race each other, but always tie, since they actually crawl at the exact same speed. So they decide to create a race where one of them (hopefully) will win.

For this race, each of them will start at the bottom corner of a cuboid, and then crawl as fast as they can to reach a crumb at the opposite corner. The measurements of their cuboids are as pictured:



If they both take the shortest possible route to reach their crumb, **who will reach their crumb first?** (Don’t forget they’re ants, so of course they can climb anywhere on the edges or surface of the cuboid.)

**Hint**

Remember: Think outside the box.

**This Peppermint Patty Riddle Is Practically Impossible**

*(Difficulty: 🚨HARD🚨)*

You’re facing your friend, Caryn, in a “candy-off,” which works as follows: There’s a pile of 100 caramels and one peppermint patty. You and Caryn will go back and forth taking at least one and no more than five caramels from the candy pile in each turn. The person who removes the last caramel will also get the peppermint patty. And you *love* peppermint patties.

Suppose Caryn lets you decide who goes first. **Who should you choose in order to make sure you win the peppermint patty?**

**Hint**

First, solve for a pile of 10 caramels.

**Can You Solve the Great American Rail-Trail Riddle?**

*(Difficulty: Moderate)*

*This problem was suggested by the physicist P. Jeffrey Ungar.*

Finally, the [Great American Rail-Trail](https://www.railstotrails.org/greatamericanrailtrail/) across the whole country is complete! Go ahead, pat yourself on the back—you’ve just installed the longest handrail in the history of the world, with 4,000 miles from beginning to end. But just after the opening ceremony, your assistant reminds you that the metal you used for the handrail expands slightly in summer, so that its length will increase by one inch in total.

“Ha!” you say, “One inch in a 4,000 mile handrail? That’s nothing!” But … are you right?

Let’s suppose when the handrail expands, it buckles upward at its weakest point, which is in the center. How much higher will pedestrians in the middle of the country have to reach in summer to grab the handrail? That is, in the figure below, **what is *h***? (For the purposes of this question, ignore the curvature of the Earth and assume the trail is a straight line.)



**Hint**

[Pythagoras](https://en.wikipedia.org/wiki/Pythagoras) is a fascinating historical figure.

**This Riddle Is Like an Especially Cruel SAT Problem. Can You Find the Answer?**

*(Difficulty: Moderate)*

Amanda lives with her teenage son, Matt, in the countryside—a car ride away from Matt’s school. Every afternoon, Amanda leaves the house at the same time, drives to the school at a constant speed, picks Matt up exactly when his chess club ends at 5 p.m., and then they immediately return home together at the same constant speed. But one day, Matt isn’t feeling well, so he leaves chess practice early and starts to head home on his portable scooter.

After Matt has been scooting for an hour, Amanda comes across him in her car (on her usual route to pick him up), and they return together, arriving home 40 minutes earlier than they usually do. How much chess practice did Matt miss?

**Hint**

Consider the case where Amanda meets Matt exactly as she’s leaving their house.

**Can You Get These 3 Movie Stars Across the River?**

*(Difficulty: Moderate)*

Three movie stars, Chloe, Lexa, and Jon, are filming a movie in the Amazon. They’re very famous and very high-maintenance, so their agents are always with them. One day, after filming a scene deep in the rainforest, the three actors and their agents decide to head back to home base by foot. Suddenly, they come to a large river.

On the riverbank, they find a small rowboat, but it’s only big enough to hold two of them at one time. The catch? None of the agents are comfortable leaving their movie star with any other agents if they’re not there as well. They don’t trust that the other agents won’t try to poach their star.

For example, Chloe’s agent is okay if Chloe and Lexa are alone in the boat or on one of the riverbanks, but definitely *not*okay if Lexa’s agent is also with them. **So how can they all get across the river?**

**Hint**

There isn’t just one way to solve this problem.

**This Ludicrously Hard Riddle Is Our Tribute to a Late Math Genius. Can You Figure It Out?**

*(Difficulty: 🚨HARD🚨)*

Carol was creating a family tree, but had trouble tracking down her mother’s birthdate. The only clue she found was a letter written from her grandfather to her grandmother on the day her mother was born. Unfortunately, some of the characters were smudged out, represented here with a **“\_\_\_”**. (The length of the line does not reflect the number of smudged characters.)

“Dear Virginia,

Little did I know when I headed to work this Monday morning, that by evening we would have a beautiful baby girl. And on our wedding anniversary, no less! It makes me think back to that incredible weekend day, **J\_\_\_ 27th, 19\_\_\_**, when we first shared our vow to create a family together, and, well, here we are! Happy eighth anniversary, my love.

Love, Edwin”

**The question: When was Carol’s mother born?**

**Hint**

This problem is inspired by Conway’s [Doomsday Rule](https://en.wikipedia.org/wiki/Doomsday_rule).

**To Solve This Twisty Math Riddle, You Just Need One Belt and One Earth**

*(Difficulty: Moderate)*

Imagine you have a very long belt. Well, extremely long, really … in fact, it’s just long enough that it can wrap snugly around the circumference of our entire planet. (For the sake of simplicity, let’s suppose Earth is perfectly round, with no mountains, oceans, or other barriers in the way of the belt.)

Naturally, you’re very proud of your belt. But then your brother, Peter, shows up—and to your disgruntlement, he produces a belt that’s *just* a bit longer than yours. He brags his belt is longer by exactly his height: 6 feet.

**If Peter were also to wrap his belt around the circumference of Earth, how far above the surface could he suspend the belt if he pulled it tautly and uniformly?**

**Hint**

Earth’s circumference is about 25,000 miles, or 130 million feet … but you don’t need to know that to solve this problem.

**This Elbow Tapping Riddle Is Diabolical. Good Luck Solving It.**

*(Difficulty: 🚨HARD🚨)*

In some future time, when the shelter-in-place bans are lifted, a married couple, Florian and Julia, head over to a bar to celebrate their newfound freedom.

They find four other couples there who had the same idea.

Eager for social contact, every person in the five couples enthusiastically taps elbows (the new handshake) with each person they haven’t yet met.

It actually turns out many of the people had known each other prior, so when Julia asks everyone how many elbows they each tapped, she remarkably gets nine different answers!

**The question: How many elbows did Florian tap?**

**Hint**

What nine answers did Julia hear?

**You'll Need a Drink After Trying to Solve This Whisky Riddle**

*(Difficulty: Easy)*

Alan and Claire live by the old Scottish saying, “Never have whisky without water, nor water without whisky!” So one day, when Alan has in front of him a glass of whisky, and Claire has in front of her a same-sized glass of water, Alan takes a spoonful of his whisky and puts it in Claire’s water.

Claire stirs her whisky-tinted water, and then puts a spoonful of this mixture back into Alan’s whisky to make sure they have exactly the same amount to drink.

**So: Is there more water in Alan’s whisky, or more whisky in Claire’s water?** **And does it matter how well Claire stirred?**

**Hint**

The size of the spoon does *not* matter.

**The Doodle Problem Is a Lot Harder Than It Looks. Can You Solve It?**

*(Difficulty: Moderate)*

This week’s riddle is relatively simple—but sinister all the same.

The question: Can you make 100 by interspersing any number of pluses and minuses within the string of digits 9 8 7 6 5 4 3 2 1? You *can’t* change the order of the digits! **So what’s the *least*number of pluses and minuses needed to make 100?**



For instance, 98 - 7 - 6 + 54 - 32 shows one way of interspersing pluses and minuses, but since it equals 107, it’s not a solution.

I call this a “doodle problem”: one that’s best worked on during meetings where you might be doodling otherwise.

**Hint**

You might want to start looking for solutions that use a total of **seven pluses and minuses** (although there are ways to use fewer).

This Math Puzzle Stumped Every Scientist but One. Think You Can Crack It?

*(Difficulty: HARD)*

In honor of Freeman Dyson, the [renowned physicist who died last month](https://www.popularmechanics.com/space/deep-space/a11098/dyson-sphere/), here’s a legendary tale demonstrating his quick wit and incredible brain power.

One day, in a gathering of top scientists, one of them wondered out loud whether there exists an integer that you could exactly double by moving its last digit to its front. For instance, 265 would satisfy this *if*526 were its exact double—which it isn’t.

After [apparently just five seconds](https://www.nytimes.com/2009/03/29/magazine/29Dyson-t.html?_r=1&scp=1&sq=Freeman%20dyson%20table%20integer&st=cse), Dyson responded, “Of course there is, but the smallest such number has 18 digits.”

This left some of the smartest scientists in the world puzzling over how he could have figured this out so quickly.

So given Dyson’s hint, **what is the smallest such number?**

**Hint**

My second grader has recently learned how to add a 3-digit number to itself using the classic vertical method:



18-digit numbers, of course, can be added in the same way.

**Figure Out What’s on Her Forehead**

*(Difficulty: Moderate)*

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Cecilia loves testing the logic of her very logical friends Jaya, Julian, and Levi, so she announces:

*“I’ll write a positive number on each of your foreheads. None of the numbers are the same, and two of the numbers add up to the third.”*

She scribbles the numbers on their heads, then turns to Jaya and asks her what her number is. Jaya sees Julian has 20 on his forehead, and Levi has 30 on his. She thinks for a moment and then says, “I don’t know what my number is.” Julian pipes in, “I also don’t know my number,” and then Levi exclaims, “Me neither!” Cecilia gleefully says, “I’ve finally stumped you guys!”

“Not so fast!” Jaya says. “Now I know my number!”

**What is Jaya’s number?**

**Hint**

Jaya could be one of two numbers, but only one of those numbers would lead to Julian and Levi both not knowing their numbers. Why?

**Can You Get Keanu Reeves Elected As President?**

*(Difficulty: Moderate)*

It’s 2024, and there are five candidates running in the democratic primary: Taylor Swift, Oprah Winfrey, Mark Cuban, Keanu Reeves, and Dwayne Johnson. (Hey, it could happen.) As usual, the first primary is in Iowa.

In an effort to overcome its embarrassment after the [2020 caucus debacle](https://www.popularmechanics.com/science/math/a30810883/iowa-caucuses-math-errors/), the Iowa Democratic Party has just announced a new, foolproof way of finding the best candidate: there will be four consecutive elections.

First, candidate 1 will run against candidate 2. Next, the winner of that will run against candidate 3, then that winner will run against candidate 4, and finally the winner of that election will run against the final candidate. By the transitive property, the winner of this last election must be the best candidate ... so says the Iowa Democratic Party.

Candidate Keanu has been feeling pretty low, as he knows he is ranked near the bottom by most voters, and at the top by none. In fact, he knows the Iowa population is divided into five equal groups, and that their preferences are as follows:



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Keanu is childhood friends with Bill S. Preston, Esq., the new head of the Iowa Democratic Party. Preston, confident that the order of the candidates doesn’t matter for the outcome, tells Keanu he can choose the voting order of the candidates.

**So what order should Keanu choose?**

**Hint**

How would Keanu fare in one-to-one races against each candidate?

**Who Opened All These Damn Lockers?**

*(Difficulty: Moderate)*

There are 100 lockers that line the main hallway of Chelm High School. Every night, the school principal makes sure all the lockers are closed so that there will be an orderly start to the next day. One day, 100 mischievous students decide that they will play a prank.

The students all meet before school starts and line up. The first student then walks down the hallway, and opens every locker. The next student follows by closing every other locker (starting at the second locker). Student 3 then goes to every third locker (starting with the third) and opens it if it’s closed, and closes it if it’s open. Student 4 follows by opening every fourth locker if it’s closed and closing it if it’s open. This goes on and on until Student 100 finally goes to the hundredth locker. **When the principal arrives later in the morning, which lockers does she find open?**

**Hint**

Make sure you pay attention to all of the factors.